

**ISCOs**  
International Scientific Congresses



Co-sponsored by  
**World Health  
Organization**  
International Scientific Congresses



# 49th ISCoS 10th SCS 9th ASCoN Annual Scientific Meeting

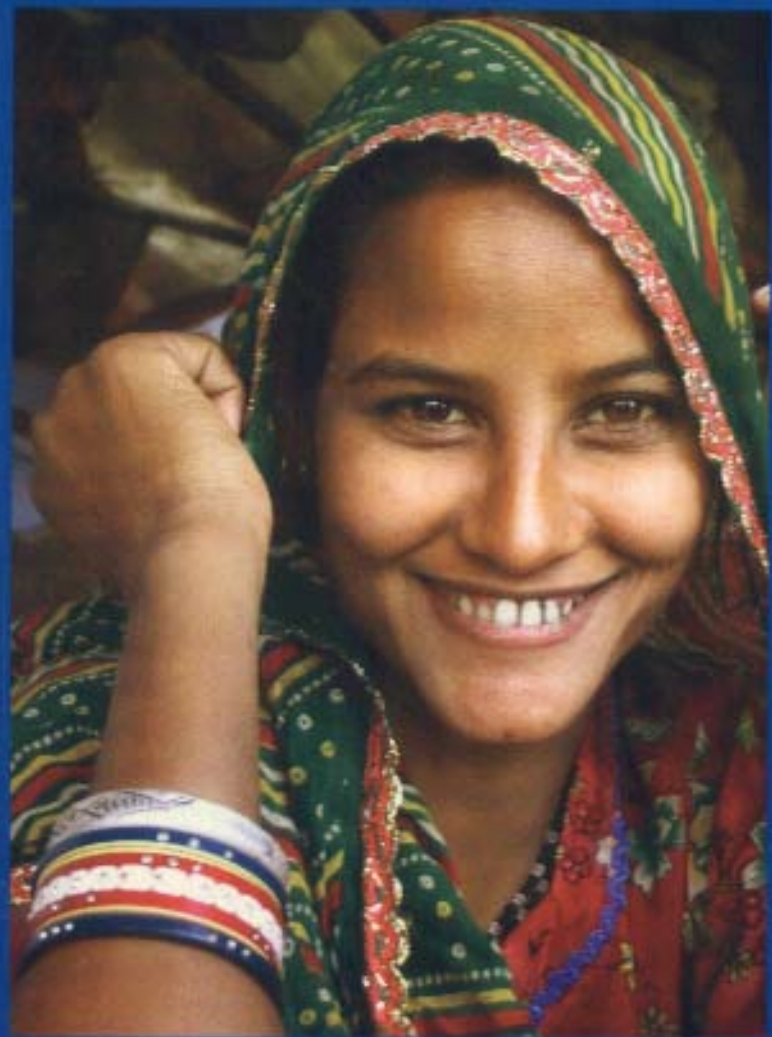
October 29 - 31, 2010

# Souvenir

# india

Venue: Le Meridien, New Delhi

[www.iscos2010.org](http://www.iscos2010.org)



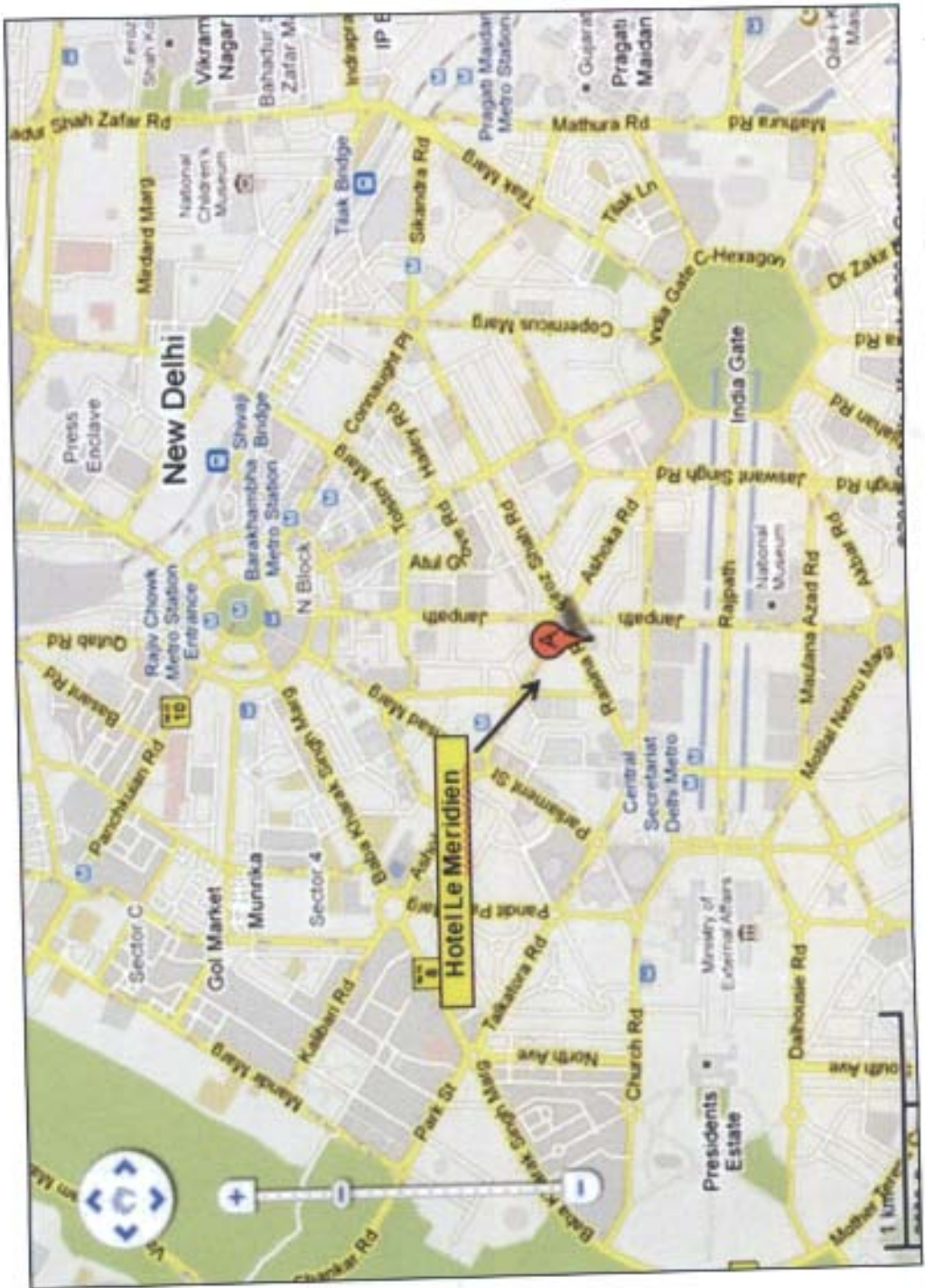
atithi devo  
bhava  
(guests are like God)



# Contents

Messages	i
Programme layout	ix
ISCoS Executives & Committee	1
Local Organizing Committee	7
ISCoS society medal holders	9
Indian Faculty	11
International Faculty	12
Abstracts	13
Master Plan Le Meridean	315
Important Events & Date	316
Important Numbers	317
Editorial Committee	318

# Central Delhi Map



## Message



**Sheila Dikshit**  
Chief Minister

Govt. of National Capital  
Territory of Delhi

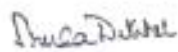
Delhi Secretariat,  
I.P. Estate  
New Delhi - 110002

I am happy to learn that the Indian Spinal Injuries Centre and Spinal Cord Society are hosting the International Spinal Cord Society's Annual International Conference in New Delhi in October 2010.

India is fast emerging as the global hub of technology. The healthcare industry has undergone remarkable development and is at par with leading nations of the world. On behalf of the Government and people of Delhi, I extend a warm welcome to all of you to participate in the conference. As the capital, New Delhi will not only give you an insight into our advanced technology and medical knowledge but also give you the opportunity to experienced the much talked about Indian hospitality.

I am sure that deliberations would go a long way in dissemination of latest information on treatment of spinal disease.

My sincere and best wishes for success of the International Conference.

  
Sheila Dikshit

## Message



**Major HPS Ahluwalia**  
Padmabhushan,  
Padmashri and  
Arjuna Award

Chairman  
Indian Spinal Injuries  
Centre  
New Delhi

I, along with the entire family of Indian Spinal Injuries Centre extend a very warm welcome to all delegates from India and abroad. It is with immense pleasure and privilege that we are able to host the Annual Scientific Meeting yet again for ISCoS in 2010.

We have all come a long way since ISCoS held its meeting in India for the very first time in 1995. We take great pride in our hardwork and diligence of celebrating our triumph over hurdles and difficulties in these past 15 years. This would not have been possible without the dedication of our sincere team of professionals at the Indian Spinal Injuries Centre.

We are grateful to our friends and associates worldwide, who have believed in us and shown their continued support through all our endeavours.

On behalf of the Spinal Cord Society and the Organising Committee I wish you all a successful conference and a pleasant stay in New Delhi.

Major H.P.S. Ahluwalia  
Chairman  
Indian Spinal Injuries Centre

## Message



**W S EL MASRY FRCS,**  
President, ISCOS

Dear Friends & Colleagues

It is my pleasure to welcome members of ISCOS, the Spinal Cord Society, the Asian Spinal Cord Network and all delegates to the 49th Annual Scientific Meeting of the International Spinal Cord Society in New Delhi, India.

Having personally attended a number of conferences on average one every two years organised by Major HPS Ahluwalia, Dr A K Mukherjee, Air Marshal A S Chahal, Dr H S Chhabra and their team, I can assure you that the organisation of this Annual Scientific Meeting will be second to none.

We are guaranteed a meeting of clinical and scientific excellence which will enrich our practice further and expand our knowledge for the benefit of improving the lives of our patients.

We will undoubtedly enjoy the renowned warm Indian hospitality, the vibrance of both Old and New Delhi and the exceptional international camaraderie and fraternity we have been accustomed to in our Annual Scientific Meetings.

I am looking forward to seeing you all in October in Delhi

Very best wishes,

**W S EL MASRY FRCS,**  
President, ISCOS

## Message



Prof. Finn Biering-Sørensen  
President elect of ISCoS

Dear friends, colleagues, delegates

It is a pleasure to welcome you all to New Delhi, India for the Joint 49th International Spinal Cord Society (ISCoS), 9th Asian Spinal Cord Network (ASCoN) and 10th Spinal Cord Society (SCS) Meeting. I am sure you will professionally profit from the various sessions, symposia, and workshops you attend during the meeting as well as the pre and post conference arrangements. It is also a great pleasure that the World Health Organisation (WHO) is sponsoring the meeting including a workshop on the Causes of Spinal Cord Injury (SCI). The topics of the conference include Management of Vertebral Lesion of SCI, Cost Effective Management of SCI, Human and Animal Trials Including Neuronal Regeneration and Ethical Considerations, Management of Neurogenic Bladder in Developing Countries, and Pott's Spine. Several other themes will be highlighted, including Prevention of SCI, and the International Perspectives in SCI (IPSCI) – a joint project between WHO and ISCoS. Furthermore there will be a Consumer Group Workshop. Beside the scientific programme I am sure you will appreciate the social programme and the opportunities for exploring the surroundings in and around New Delhi as well as India in general.

Looking forward seeing you around



## Message



**Dr. A. K. Mukherjee**  
Organizing Chairman –  
ISCoS - 2010

Director General,  
ISIC, New Delhi

It is a privilege to welcome all Delegates coming for combined Annual Scientific Meeting of International Spinal Cord Society (ISCoS), Asian Spinal Cord Network (ASCoN) & Spinal Cord Society along with Indian Spinal Injuries Centre to be held on 29<sup>th</sup> to 31<sup>st</sup> October 2010 in Le Meridien, New Delhi. Professionals from all over the world are joining together to solve the complex issues of spinal cord injury management.

Let us build together a movement for the welfare of persons with disabilities.

(Dr. A. K. Mukherjee)  
Organizing Chairman – ISCoS - 2010  
Director General, ISIC, New Delhi

## Message



**Shinsuke Katoh**  
Honorary secretary  
ISCoS

Welcome to the 49<sup>th</sup> Annual Scientific Meeting of the International Spinal Cord Society (ISCoS) combined with the 10<sup>th</sup> Spinal Cord Society (SCS) and 9<sup>th</sup> Asian Spinal Cord Network (ASCoN) annual meetings. This is the second ISCoS general meeting held in the south Asia.

Many of the old members must clearly remember the previous meeting in **1995** which was successfully organized by Air Marshal Amar Chahal and his co-workers, and we saw the start of the Indian Spinal Injuries Centre.

After the meeting, SCS and ASCoN were established and they have played a pivotal role in the spread of the comprehensive management of the spinal cord injuries in the south Asia, which is one of the important missions of our society. In this meeting, you will witness the development of the circumstances of the spinal cord injured and the society in India.

We must thank the local organizers, especially Dr. H.S. Chhabra, for their effort to make this meeting fruitful.

I cordially ask you to enjoy the meeting, the educational courses and your visit to this fascinating country.

Shinsuke Katoh  
Honorary secretary  
ISCoS

## Message



**Susan Charlifue, PhD**  
Chair,  
ISCoS Scientific  
Committee

Dear Colleagues,

On behalf of the members of the Scientific Committee of the International Spinal Cord Society, we are delighted to welcome you to the 2010 Annual Scientific Meeting. The Scientific Committee had the privilege of reviewing excellent abstracts in the areas of spinal cord injury research, acute and rehabilitative care and long-term follow-up. We hope you will agree that the program is going to be thought-provoking, educational and enriching.

There are several presentations being given simultaneously and we invite you to take advantage of as many of these outstanding presentations and posters as possible.

Sincerely,

A handwritten signature in black ink that reads "Susan Charlifue". The script is cursive and elegant.

Susan Charlifue, PhD  
Chair, ISCoS Scientific Committee

## Message



**Dr H S Chhabra**  
Organizing Secretary –  
ISCoS 2010

Asian countries together constitute 60% of the population of the world. They are also fast emerging as the global hub of technology. The recently concluded Common Wealth Games has also put India on the focus around the globe. Hence it is most appropriate that New Delhi is hosting the Combined 49<sup>th</sup> International Spinal Cord Society (ISCoS), 9<sup>th</sup> Asian Spinal Cord Network (ASCoN) and 10<sup>th</sup> Spinal Cord Society Annual Scientific Meeting at Hotel Le Meridian from 29<sup>th</sup> to 31<sup>st</sup> October 2010.

The Scientific program has shaped up well. With 18 workshops and 13 sessions, 74 international faculties and 50 Indian faculties, the conference promises to be an academic feast. We hope that the social and cultural events will help in establishing bondages and linkages amongst the fraternity.

Delhi is a tourist's paradise with many heritage sites. The climate in October – November is very pleasant. The hospitality of the city is well known and I am sure that you will surely witness it while participating in the conference.

We are grateful to ISCoS and ASCoN for giving us an opportunity to host the conference. We extend a warm welcome to all of you. We assure you that we will strive to live up to your expectations.

Dr H S Chhabra  
Organizing Secretary – ISCoS 2010

ISCoS



Co-sponsored by  
**World Health  
Organization**  
Prevention & Rehabilitation Branch



**49th ISCoS**  
**10th SCS 9th ASCoN**  
Annual Scientific Meeting

**PROGRAMME**



india

Hosted by Indian Spinal Injuries Centre

## PRE-CONFERENCE SCHEDULE

October 28, 2010

### WORKSHOP I

- 06-- Management of Vertebral Lesion  
Auditorium, ISIC  
0800 hrs to 1730 hrs

### WORKSHOP II

- 09-- Data collection SCI injury  
Conference Hall, ISIC  
0800 hrs to 1200 hrs

### WORKSHOP III

- 11-- Causes of Spinal Cord Injury  
Conference Hall, ISIC  
1300 hrs - 1730 hrs

## WORKSHOP I

### Management of Vertebral Lesion Auditorium, ISIC 0800 hrs to 1730 hrs

Chairpersons: Dr. Peter Wing & Dr. Wee Fu Tan

- 08:00 - 08:10 Introduction  
- Dr. Peter Wing
- 08:10 - 08:40 Defining instability after spinal trauma and the radiological evaluation protocols needed to determine it.  
**W 1**  
- Dr. Scott Paquette
- 08:40 - 09:00 Thoracolumbar fracture classification systems and their role in determining treatment.  
**W 2**  
- Dr. Rajasekaran
- 09:00 - 10:00 How I would classify this fracture?  
Classification of various representative cases by Panelists  
**Moderator:**  
- Dr. Patrick Kluger  
**Panelists:**  
- Dr. Peter Wing/ Dr. Wee Fu Tan/ Mr. WS El Masry  
Dr. Hans Joseph Ertl  
Dr. S. Rajasekaran/ Dr. Scott Paquette
- 10:00 - 10:30 Break

Chairpersons: Dr. W. Donovan & Dr. Ruth Marshall

- 10:30 - 11:30 **Debate - Thoracolumbar Burst Fractures - How will I manage it?**  
Conservative  
- Mr. W S EL Masry  
Surgical  
- Dr. S. Rajasekaran  
This debate will cover broadly the following issues:
- Does canal clearance affect neurological outcome
  - Correlation of post traumatic kyphotic deformities with eventual outcome
  - Is Hospital stay shorter in patients managed surgically
  - Incidence of complications in patients managed surgically
- 11:30 - 12:30 **Panel Discussion:**  
Unresolved issues in Thoracolumbar Fracture Management (viz. Timing of surgery, timing of mobilization (conservative or surgical), Indication and duration of bracing, anterior vs posterior surgery)  
**Moderator:**  
- Dr. H.S.Chhabra  
**Panelists:**  
- Prof Bernhard Meyer/ Dr. S. Rajasekaran/ Dr. Naresh Kumar/ Dr. Shankar Acharya/ Dr. H.N. Bajaj/ Dr. Ruth Marshall/  
Dr. U. Singh

12:30 - 13:30 Break

**Chairpersons - Dr Patrick Kluger & Dr. Rana Patir**

13:30 - 13:45  
**W 3** Cervical fracture classification systems and their role in determining treatment

- Dr. Sagun Tull

13:45 - 14:45 **Panel Discussion:**  
Management of Flexion Distraction Cervical Spine Injuries

**Moderator**

- Dr. P Sarat Chandra

**Panelists**

- Dr. Patrick Kluger/ Dr.

Wee Fu Tan/ Dr. Sagun

Tull/ Dr. A.K. Singh/ Dr.

Yash Gulati/ Dr. Sunil

Katoch/ Dr. Anand Nene

14:45 - 15:15 Break

**Chairpersons: Dr. Hans Joseph Erli & Dr. A.K. Singh**

15:15 - 16:15 **Panel discussion:**  
Management of Extension Distraction Cervical Spine Injuries

**Moderator**

- Dr. Rajendra Prasad

**Panelists**

- Dr. Scott Paquette/Dr.

Sagun Tull / Dr. Naresh

Kumar / Dr. Rana Patir

16:15 - 17:30

Dr. P. Sarat Chandra / H. N.

Bajaj / Dr. W. Donovan

**Panel & Open House**

**Discussion - Protocol for Management of Vertebral Lesion in Spinal Cord Injury**

**Moderator:**

- Dr. H.S. Chhabra

**Panelists:**

- Dr. Patrick Kluger/ Dr.

Scott Paquette/ Dr. Hans

Joseph Erli/ Dr. Naresh

Kumar/ Mr. WS El Masry

## WORKSHOP II

Data collection SCI injury

Conference Hall, ISIC

0800 hrs to 1200 hrs

**Chairpersons - Dr. U. Singh and Dr. D. Brown**

08:00 - 10:00

**Lectures**

08:00 - 08:10

Objectives and purposes of data collection training workshop

- Mr Eric Weerts

08:10 - 08:30

The Asian Spinal Cord Network data collection experiences in Vietnam

- Mr Eric Weerts

08:30 - 10:00

Practical Demonstration on SCI injury data collection can be done pathways for



registration using ASCON -  
ICECI database using visual  
SCI accidents enactments  
- Mr. Ray Cripps/  
Dr. Bonne Lee

10:00 - 10:30 Break

10:30 - 12:00 Lectures

**Chairpersons - Peter Wing and Bonne Lee**

10:30 - 11:15 Exercises of Data collection  
on ICECI registry, encoding  
of narratives, comments  
and golden standards for  
SCI injuries registration  
- Mr. Ray Cripps/  
Ms Nguyen Thi Thao

11:15 - 11:45 Data analysis, visualization,  
graphics for reporting on  
with data collection tool  
- Eric Weerts

11:45 - 12:00 Closure session/Q and A on  
creating a network for data  
collectors and feed  
international networks with  
standardized information on  
SCI prevalence and  
occurrence.  
- Eric Weerts/Bonne Lee /  
Peter Wing

12:00 End of workshop

## WORKSHOP III

### Causes of Spinal Cord Injury ISIC Conference Hall 1300 hrs - 1730 hrs

**Chairpersons - Mr. W. El Masry & Dr. S Charlifue**

13:00 - 15:00 Lectures

13:00 - 13:30 Global Mapping of SCI -  
Incidence and Prevalence

- Dr. Peter Wing

13:30 - 14:00 Australian SCI Register

- Dr. Bonne Lee

14:00 - 14:30 Causes of SCI in Africa

- Dr. Mike Fitzharris

14:30 - 15:00 Causes of SCI in India -

Experience of the Indian Spinal  
Injuries Centre, Delhi

- Dr. Harvinder Chhabra

15:00 - 15:30 Break

**Chairpersons - Dr. Fin Biering Sorenson &  
Prof. U Singh**

15:30 - 17:30 Lectures

15:30 - 15:50 Causes of SCI in Vietnam  
- Mr. Eric Weerts

15:50 - 16:10 Causes of SCI in Malaysia  
- Dr. Nazirah

16:10 - 16:30 Causes of SCI in Thailand  
- Dr. Apichana Kovindha

16:30 - 16:50 Prevention of SCI in China  
- Dr. Dajue Wang

16:50 - 17:20 SCI from Diving - Are they really  
Preventable

- Dr. Herndon Murray

17:20 - 17:30 Summing Up

## MAIN CONFERENCE SCHEDULE

October 29 - 31, 2010

Friday, October 29, 2010

### Hall - A

- 08- Session I: Management of Vertebral Lesion  
0800 hrs to 1000 hrs
- 09- Session III: Free Papers  
1030 hrs to 1130 hrs
- 10- Session IV: Presidential & ISRT Lecture  
1130 hrs to 1230 hrs
- 11- Session V: Management of Neurogenic Bladder in Developing Countries  
1330 hrs to 1630 hrs
- 12- Session VII - Joint Session of WHO, DAR and Swiss Paraplegic Research  
1630 hrs to 1730 hrs

### Hall - B

- 13- Workshop IV: Practical Neurogenic Bladder Management Worldwide  
0800 hrs to 1130 hrs
- 14- Workshop VI: Pott's Spine  
1330 hrs to 1630 hrs

### Hall - C

- 15- Session II: Free Papers  
0800 hrs to 1000 hrs
- 17- Workshop V - Advances in Surgical Management of Spinal Ailments - I  
1030 hrs to 1130 hrs

- 18- Workshop VII: Consumer Group Workshop: "Considering the benefits of a Global SCI Consumer Organisation"  
1330 hrs - 1500 hrs
- 19- Session VI: Free Papers  
1530 hrs to 1630 hrs
- 20- Workshop VIII - Advances in Surgical Management of Spinal Ailments - II  
1630 hrs to 1730 hrs

Saturday, October 30, 2010

### Hall - A

- 21- Session - VIII: Prevention of SCI  
0800 hrs to 1230 hrs
- 22- Session IX: Human and Animal Trials including Neuronal Regeneration and Ethical Considerations  
1330 hrs to 1500 hrs
- 23- Session X: Pott's Spine  
1530 hrs to 1730 hrs

### Hall - B

- 25- Spinal Cord Society Annual Scientific Meeting  
0800 hrs to 1230 hrs
- 27- Workshop X: Urinary Tract Infections  
1330 hrs to 1730 hrs

## PROGRAMME SCHEDULE

October 29 - 31, 2010

Saturday, October 30, 2010

Hall - C

- 29- Workshop IX : Ethical and Scientific Challenges in the Translation of Discoveries to Human Treatments for Spinal Cord Injury and Related Neurological Disorders  
0800 hrs to 1230 hrs
- 30- Workshop XI : Advances in Surgical Management of Spinal Trauma  
1330 hrs to 1500 hrs
- 31- Workshop XII : Maintaining Passion in Medicine: International Perspectives  
1530 hrs to 1730 hrs

Sunday, October 31, 2010

Hall - A

- 33- Session XI: Cost Effective Management of Spinal Cord Injury  
0800 hrs - 1230 hrs
- 35- Hall - A1  
Session XII: Free Papers  
1330 hrs to 1520 hrs
- 37- Hall - A2  
Session XIII: Free Papers  
1330 hrs to 1520 hrs

Hall - B

- 38- ASCoN Annual Scientific Meeting  
0800 hrs to 1230 hrs

- 42- IGASS Symposium: "Prevention and Management of Neurological Complications during Spine Surgery"  
1330 hrs to 1800 hrs

Hall - C

- 45- Workshop XIII: From Cells to Bedside to Community: An ICORD Update  
0800 hrs to 1000 hrs
- 46- Workshop XIV: Because SCI Shouldn't Paralyze the Caregivers: A Cross-Cultural & Interactive Workshop on Family Response & Psychosocial Adjustment Following an SCI  
1030 hrs to 1230 hrs
- 47- Workshop XV: It will happen again: Disaster Preparation Response for Spinal Cord Injuries. Lessons from the Haitian Earthquake  
1330 hrs to 1520 hrs
- 49- Workshop XVI (ASCoN Workshop): "Workshop to demonstrate the Beijing Peer Counseling & Education Network Model using IT as the Means of Communication"  
1600 hrs to 1800 hrs

Friday, October 29, 2010

**Session I : Management of Vertebral Lesion**

0800 hrs to 1000 hrs

**Chairpersons** M Mc Clelland & Dr. S. Katoh

08:00 – 09:15 **Keynote Lectures**

08:00 – 08:15 Mythology about the current management of Traumatic Spinal Injuries and concerns about the interpretation of outcomes of future interventions—**Mr. W El Masry**

**S 01**

08:15 – 08:25 Consensus statement of workshop on protocol of management of vertebral lesion – **Dr. H S Chhabra**

08:25 – 08:43 Surgical management of thoracolumbar fractures: Current strategies – **Dr. Patrick Kluger**

**S 02**

08:43 – 09:01 Current trends for surgical management of lower cervical spine fractures – **Dr. Brian Kwon**

**S 03**

09:01 – 09:15 Discussion

09:15 – 10:00 Free Papers

09:15 – 09:27 Acute outcomes of cervical spine injuries in the elderly (146) – **Dr. Vivek Mittal**

**O 01**

09:27 – 09:39 A prospective randomised study on the outcome of three different surgical methods of management in thoracolumbar burst fractures with neurological deficit (70) – **Dr. Amrithlal Mascarenhas**

**O 03**

09:39 – 09:51 Spinal epidural abscess: experience from a regional spinal injuries centre (102) – **Dr. Ramaswamy P Hariharan**

**O 03**

09:51 – 10:00 Discussion

10:00 – 10:30 Break

fractures with neurological deficit (70)

– **Dr. Amrithlal Mascarenhas**

Spinal epidural abscess: experience from a regional spinal injuries centre (102)

– **Dr. Ramaswamy P Hariharan**

– **Dr. Ramaswamy P Hariharan**

– **Dr. Ramaswamy P Hariharan**

09:51 – 10:00 Discussion

10:00 – 10:30 Break

**Session III : Free Papers**

1030 hrs to 1130 hrs

**Chairpersons** Dr. Lawrence Vogel & Dr. Nalli Uvraj

10:30 – 10:38 Diagnostic criteria for the traumatic central cord syndrome. A questionnaire survey of spine specialists and a systematic review of clinical descriptors and scores (138) – **Mr. Martin Pour**

**O 16**

10:38 – 10:46 Emptying the bowel in SQ patients by pharmacotherapeutic activation of lumbo-sacral defecation centres: proof of principle (236) – **John B Furness**

**O 17**

10:46 – 10:54 Reliability and repeatability of the Hoffman sign (89) – **Dr. Thiru Annaswamy**

**O 18**

10:54 – 11:02 Evaluating self-reported pressure ulcer prevention measures in SQ with the revised skin management

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

– **Dr. Thiru Annaswamy**

## Friday, October 29, 2010

needs assessment checklist:  
psychometric properties  
(187)

– Mr. Anthony Gelis

11:07 – 11:10

O 20

Wheelchair and upright  
physical activity after SCI  
(40) – Ms. Elaine Coulter

11:10 – 11:18

O 21

Performance of persons with  
SCI on a new training device  
providing standardized  
upper body exercise (215)  
– Mrs. Anna Bjerkefors

11:18 – 11:30

Discussion

### Session IV : Presidential & ISRT Lecture 1130 hrs to 1230 hrs

Chairpersons Dr. Fin Biering Sorensen  
& Dr. Susan Charlifue

11:30 – 12:00

Presidential Lecture:  
Current strategies for  
conservative  
management of vertebral  
fractures

– Mr. WS El Masry

12:00 – 12:30

International Spinal  
Research Trust (ISRT)  
Lecture: Putting myelin  
back on axons: from  
biology to therapy  
– Professor Robin  
Franklin

12:30 – 13:30

Break

### Session V : Management of Neurogenic Bladder in Developing Countries 1330 hrs to 1630 hrs

Chairpersons

Prof. Helmut Madersbacher &  
Dr. Dinesh Suman

13:30 – 15:00

Keynote Lectures

13:30 – 13:54

S 04

Challenges in Management of  
Neurogenic Bladder in  
Developing Countries  
– Dr. J.J. Wyndaele

13:54 – 14:18

S 05

Innovative Techniques for cost  
effective management of  
neurogenic bladder in  
developing countries  
– Mr. Gurpreet Singh

14:18 – 14:42

S 06

Complications of neurogenic  
bladder in developing  
countries – Incidence,  
peculiarities & Management  
strategies  
– Dr. Inder Perakash

14:42 – 15:00

Discussion

15:00 – 15:30

Break

15:30 – 16:30

Free Papers

Chairpersons

Dr. Gurpreet Singh &  
Dr. Manfred Stohrer

15:30 – 15:42

O 23

Training children in clean  
intermittent catheterization  
using playing cards: a real  
advantage in different social  
cultural scenarios and with  
different languages:  
preliminary experience (210)  
– Mr. Giovanni Mosiello

Friday, October 29, 2010

15:42 – 15:54  
O 24 Detrusorial injections of botulinum toxin in overactive bladder due to multiple sclerosis: a 10 year experience (124)

– Dr. Elena Andretta

15:54 – 16:06  
O 25 The role of autonomic bladder dysfunction in the development of periparticular ossification in acute tetraplegic patients: a predictor for autonomic dysreflexia? (175)

– Dr. Cornelia Putz

16:06 – 16:18  
O 26 Urological follow-up in adult meningomyelocele patients: an algorithm to use by the rehabilitation physician (159)

– Mrs. Charlotte Vandendriessche

16:18 – 16:30 Discussion

**Session VII - Joint Session of WHO, DAR and Swiss Paraplegic Research  
1630 hrs to 1730 hrs**

**\*World Report on Disability and International Perspectives on SCI  
S 23**

– Alena Officer & Jerome Bickenbach

**Workshop IV - Practical Neurogenic Bladder Management Worldwide  
0800 hrs to 1130 hrs**

Chairperson  
08:00 – 08:10 Dr. JJ Wyndaele  
Welcome

– Dr. JJ Wyndaele

08:10 – 08:29  
W 14 Neurogenic bladder after spinal cord injury:

Pathophysiology and epidemiology

– Dr. G Del Popolo

08:29 – 08:48

W 15

Diagnosis

– Dr. JJ Wyndaele

08:48 – 08:58

W 16

Discussion

Behavioural and drug treatment

– Dr. A Kovindha

09:17 – 09:36

W 17

Trick of trade of catheters

– Dr. H Madersbacher

09:36 – 09:46

W 18

Discussion

Case Presentation

– Dr. G Del Popolo

Panel Discussion

Moderator

– Dr. J Wyndaele

10:00 – 10:30

W 18

Break

Surgical treatment

– Dr. M Stohrer

10:50 – 10:55

W 18

Discussion

Case Presentation

– Dr. H Madersbacher

## Friday, October 29, 2010

- 11:10 – 11:25  
 Panel Discussion:  
 Moderator  
 – Dr. J Wyndaele  
 Case Presentation  
 – Dr. A Kovindha (5 min)  
 Panel Discussion:  
 Moderator  
 – Dr. J Wyndaele

### Workshop VI : Pott's Spine 1330 hrs to 1630 hrs

- Chairpersons (13:30 – 15:00)  
 13:30 – 13:46  
 W 22  
 Dr. Anil Jain & Dr. Shankar Acharya  
 Pott's Spine  
 Diagnostic dilemmas and strategies in TB spine  
 – Dr. Gautam Zaveri
- 13:46 – 13:51  
 Discussion
- 13:51 – 14:07  
 W 23  
 Current antitubercular regimens and recommendations  
 – Dr. Sudhir Kapoor
- 14:07 – 14:12  
 Discussion
- 14:12 – 14:28  
 W 24  
 When to operate: indications and approaches  
 – Dr. Shekhar Bhojraj
- 14:28 – 14:33  
 Discussion
- 14:33 – 14:49  
 W 25  
 Recent advances in surgical management of Pott's Spine  
 – Dr. Sajan Hegde
- 14:49 – 15:00  
 Discussion

- 15:00 – 15:30  
 Break
- Chairpersons  
 Dr. Matthew Verghese & Dr. Naresh Kumar
- 15:30 – 15:46  
 W 26  
 MDR - Tb and XDR - TB; diagnosing and management strategies  
 – Dr. Anil Jain
- 15:46 – 16:02  
 W 27  
 Prevention and management of post tubercular deformities  
 – Dr. Shankar Acharya
- 16:02 – 16:18  
 W 28  
 Management of TB of CV junction  
 – Dr. Rana Patir
- 16:18 – 16:30  
 Discussion

### Session II : Free Papers 0800 hrs to 1000 hrs

- Chairpersons  
 Dr. Anand Nene & Dr. Lisa Harvey
- 08:00 – 08:08  
 O 51  
 Impact of customised wheelchair and seating on the functional ability among people with spinal cord injuries (243)  
 – Mr. Nekram Upadhyay
- 08:08 – 08:16  
 O 05  
 Electrical stimulation combined with progressive resistance training increases strength in people with SCI (57)  
 – Prof. Lisa Harvey
- 08:16 – 08:24  
 O 06  
 Non linear formulas for the

Friday, October 29, 2010

- 08:24 – 08:32  
**O 07** spinal cord injury ability realization measurements index (SCI-ARMI) (49)  
– Prof. Amiram Catz  
To walk or not to walk? Introduction of a validated clinical prediction rule and grading system for independent ambulation outcomes in traumatic SCI: a European multicenter study (107) – Mr. Joost J. van Middendorp
- 08:32 – 08:40  
**O 08** Comparing contents and quantity of therapy for patients with a SCI in postacute rehabilitation in Australia, Norway and the Netherlands (251)  
– Mrs. Sacha van Langeveld
- 08:40 – 08:48  
**O 09** SCI in children injured at five years of age and younger (50)  
– Dr. Lawrence Vogel
- 08:48 – 09:00  
Discussion
- 09:00 – 09:08  
**O 10** Neurological recovery after traumatic cervical SCI (104)  
– Mr. Ralph Marino
- 09:08 – 09:16  
**O 11** Study of septic arthritis of hip joint in spinal injury patients as a complication of bed sore (126)  
– Dr. Gururaj Sangondimath
- 09:16 – 09:24  
**O 12** Thoracic myelopathy due to ossification of ligamentum

- 09:24 – 09:32  
**O 13** flavum: predictors of surgical outcome (77)  
– Dr. Amish Sanghvi  
Racial/ethnic disparities in mortality and causes of death in persons with SCI (214) – Dr. Yuying Chen  
Related factors with post-traumatic syringomyelia (116) – Dr. Hyun-Yoon Ko  
When to discuss future walking ability of persons with acute SCI - the patient's perspectives (100)
- 09:48 – 10:00  
– Prof. Hyung-Ik Shin
- 10:00 – 10:30  
Discussion

### Workshop V - Advances in Surgical Management of Spinal Ailments - I 1030 hrs to 1130 hrs

- Chairpersons Dr. Patrick Kluger & Dr. H.N. Bajaj
- 10:30 – 10:45  
**W 19** Role of Ceramics in Degenerative spine surgeries  
– Dr. Nobert Passuti
- 10:45 – 11:00  
**W 20** Non-fusion technologies: Current status and evidence base. Where do we stand today  
– Prof Bernhard Meyer
- 11:00 – 11:15  
**W 21** \*Management of severe deformity of the immature spine with



Friday, October 29, 2010

preservation of growth<sup>†</sup>  
Prof. Cody Bunker

11:15 – 11:30 Discussion

**Workshop VII : Consumer Group  
Workshop - "Considering the benefits  
of a Global SCI Consumer  
Organisation"**

1330 hrs to 1500 hrs

Chairperson : Jane Horsewell

**Panel Discussion  
W29**

Panel Members:

Fin Biering-Sørensen, ISCoS

Apichana Kovindha, ASCoS

Dajue Wang and Mr.Wen, consumer  
organizations China

Ketna Mehta, Nina Foundation for People  
with Spinal Cord Injury, India

**Session VI : Free Papers**

Chairpersons

Dr. Thomas Oxland &  
Dr. Fazlul Hoque

15:30 - 15:38  
O 27

Analyzing the cause of injury  
to develop the prevention  
strategies of pediatric-onset  
SCI in Korea (39)  
- Dr. Bum-Suk Lee

15:38 - 15:46

The comparison of the results

O 28

of observational gait analysis  
and 3D gait analysis when  
using functional electrical  
stimulation: A case report  
(230) - Mr. Prit Eelmae

15:46 - 15:56

O 29

Health of people with SCI in  
Singapore: Implications for  
rehab planning and  
implementation (52)  
- Ms. Joy Teo

15:56 - 16:04

O 30

Satisfaction with long term  
care of Dutch persons with  
SCI living in the community  
(139) - Dr. Marcel Post

16:04 - 16:12

O 31

Exclusive neck and trunk  
control scale for SCI patients:  
A step towards independent  
living (223)

- Mr. Anshul Sharma

16:12 - 16:20

O 32

Outcomes in SCI patients  
requiring ventilatory  
assistance: a 5 year review  
(178)

- Mr. Pradeep Thumbikat

16:20 - 16:30

Discussion

**Workshop VIII - Advances in Surgical  
Management of Spinal Ailments - II  
1630 hrs to 1730 hrs**

Chairpersons

Dr. Rainer Abel & Dr. V S  
Madan

16:30 - 16:45  
W 30

Advances in Cervical Total  
Disc Replacement Surgery  
- Dr. Wee Fu Tan

Friday, October 29, 2010

Saturday, October 30, 2010

16:45 – 17:00 Advances in treatment of  
W 31 cervical myelopathy

– Dr. Naresh Kumar

17:00 – 17:15 XLIF procedure for Discitis

W 32 – Dr. Jake Timothy

17:15 – 17:30 Discussion

## Hall – A

### Session - VIII : Prevention of SCI

0800 hrs to 1230 hrs

Chairperson Prof Douglas Brown &

08:00 – 10:00 Asso. Prof. Gita Handa

08:00 – 08:30 Road Traffic Accidents-Indian  
S 07 Policy Issues

– Dr A.K. Mukherjee

08:30 – 09:00 The problem: Overview of RTC  
S 08 in South Asia with reference to  
SCI

– Dr Mike Fitzharris

09:00 – 09:20 RTC in India: Prevention  
S 09 strategies

– Prof. Dinesh Mohan

09:20 – 09:40 SCI due to RTC in South India  
S 10 and strategies for prevention

– Dr Abhishek Srivastava

09:40 – 10:00 Questions of speakers and  
discussion of the problems to  
suggest solutions and  
strategies for prevention  
– Panellists and Delegates

10:00 – 10:30 Break

Chairpersons Prof. U Singh & Prof. Sergio  
Aito

10:30 – 10:50 Things Falling from a height on  
S 11 people

– Dr George Tharion

10:50 – 11:10 Low falls and SCI: Aspects of  
S 12 prevention

– Dr Rajendra Sharma

11:10 – 11:30 Falls from a height

S 13 – Dr Mrinal Joshi

## Saturday, October 30, 2010

- 11:30 – 11:45  
**S 14** Falls in the "informal" construction sector in Vietnam  
– Mr Eric Weerts
- 11:45 – 12:00  
**S 15** Falls while carrying a load on the head: A problem in Bangladesh  
– Dr Fazlul Hoque
- 12:00 – 12:15  
**S 16** Wheelbarrow Program: An alternative load transport to the head  
– Reshma Parvin Nuri
- 12:15 – 12:30 Questions of speakers and discussion of the problems to suggest solutions and strategies for prevention  
– Panelists and Delegates

12:30 – 13:30 Break

### Session IX : Human and Animal Trials including Neuronal Regeneration and Ethical Considerations 1330 hrs to 1500 hrs

- Chairpersons Dr. Ralph Marino & Dr. Andrei Krassioukov
- 13:30 – 14:30  
**S 17** Keynote Lectures  
Overview of Current Research holding promise for the management of Human SCI – Dr Sergio Aito
- 13:50 – 14:10 Stem cell therapy for human SCI – fact or fiction  
– Dr. John Steeves

- 14:10 – 14:30 Discussion
- 14:30 – 15:00 Free Papers
- 14:30 – 14:42  
**O 33** Does physical therapy effect outcomes in chronic SCI subjects undergoing cellular therapy? (239)  
– Mr. Mohit Arora
- 14:42 – 14:54  
**O 34** Improvement of locomotor performance following transplantation of autologous Schwann cells in a non-human primate with chronic spinal cord injury (252)  
– Dr. James D. Guest

14:54 – 15:00 Discussion

15:00 – 15:30 Break

### Session X : Pott's Spine 1530 hrs to 1730 hrs

- Chairpersons Dr. Gautam Zaveri & Dr. Sunil Katoch
- 15:30 – 16:10  
**S 19** Keynote Lectures  
Prevailing and foreseen Challenges in management of Pott's Spine  
– Dr. Ram Chaddha
- 15:45 – 16:00  
**S 20** Middle path regime for management of Pott's Spine - does it still hold promise?  
– Dr. Mathew Verghese
- 16:00 – 16:10 Discussion

Saturday, October 30, 2010

Saturday, October 30, 2010		
16:10 – 17:30	Free Papers	<b>Spinal Cord Society Annual Scientific Meeting</b> <b>0800 hrs to 1200 hrs</b>
16:10 – 16:22 <b>O 35</b>	Outcome of anterior decompression and posterior fixation in Pott's spine through posterior transpedicular approach as compare to combined anterior and posterior approach (238) – Dr. Darshan Gautam	
16:22 – 16:34 <b>O 36</b>	Single stage anterolateral/posterolateral decompression with posterior instrumentation and global fusion in patients with active thoracolumbar tuberculosis (118) – Dr. Manish Chaddha	
16:34 – 16:46 <b>O 37</b>	Simultaneously anterior decompression and posterior instrumentation by extra pleural retroperitoneal approach in thoracolumbar spine (247) – Dr. Saurabh Jain	
16:46 – 16:58 <b>O 38</b>	Instrumentation in Pott's paraplegia (82) – Prof. Rajeshwar Nath Srivastava	
16:58 – 17:10 <b>O 39</b>	Paediatric tuberculous kyphosis in very young (<5 years); pitfalls (235) – Dr. Ajay Kothari	
17:10 – 17:30	Discussion	
		<b>Chairpersons</b> Dr. S K Kame & Dr. Dilip Sinha <b>08:00 – 10:00</b> <b>Judges</b> Dr. Patrick Kluger/Dr. Nibert Passuti/Dr. Bernhard Meyer/Dr. Cody Bunger/Dr. Ruth Marshall/Dr. Fin Biering Sorensen/Dr. S K Kame <b>08:00 – 09:15</b> <b>Spinal Cord Society (SCS) Gold Medal Award for Best Paper Presenter</b> <b>08:00 – 08:06</b> <b>O 88</b> Subsidence of mesh cage in thoracolumbar vertebral body reconstruction : What are the implications? – Dr. Amrithlal Mascarenhas <b>08:06 – 08:12</b> <b>O 89</b> Is paediatric spine more accommodative for spinal cord shortening? An evaluation of results of cord level osteotomy in severe thoracic Kyphosis – Dr. J. Naresh Babu <b>08:12 – 08:18</b> <b>O 90</b> Pelvic obliquity in Neuromuscular scoliosis: Radiologic comparative results of single - stage posterior versus two stage anterior and posterior approach – Dr. Ankur Nanda

## Saturday, October 30, 2010

08:18 - 08:24  
**O 91** Mini - open thoracoscopy assisted anterior approach for corpectomy in the thoracic spine

- Dr. Vivek Mittal

08:24 - 08:30  
**O 92** Association of facet tropism with lumbar disc herniation

- Dr. Manish Chaddha

08:30 - 08:36  
**O 93** Application of ASIA grading and preventable factors in SriLankan spinal injuries

- Dr. Chandana Karunathilak

08:36 - 08:42  
**O 94** Feed back training and its effect on inter and intra rater reliability of graded mobilization

- Dr. Shalju sharma

08:42 - 08:48  
**O 95** Use of mobile phones technology to assess pressure ulcer in person with spinal cord injury post discharge from rehabilitation hospitals

- Dr. Firas Sarhan

08:48 - 08:54  
**O 96** Application of skin traction for the treatment of Grade IV pressure sore: a clinical report of 160 cases

- Dr. Chen Zu Rong

08:54 - 09:15 Discussion

09:15 - 10:00 Lectures

09:15 - 09:32  
**SCS 1** Experience of Spinal Cord Injury Rehabilitation at Paraplegic rehabilitation centre, Pune - Col. S. P. Jyoti

09:32 - 09:49  
**SCS 2** Gun Shot Injury of Spine & Its Management  
 - Dr. H S Bhatoo

09:49 - 10:00 Discussion

10:00 - 10:30 Break

Chairpersons Dr. A.K Mukherjee & Dr. Patrick Kluger

10:30 - 11:00 Spinal Cord Society Oration:

"International Spinal Cord Injury Datasets"

By Dr. Fin Biering Sorensen

11:00 - 11:30 Best Published Paper Award (sponsored by Dr. Patrick Kluger) for the Year 2009,

"Autologous olfactory mucosal transplant in chronic spinal cord injury: an Indian Pilot Study"

- Dr. H.S. Chhabra

11:30 - 12:30 Combined General Body Meeting & 13th Board Of Governor Meeting of Spinal Cord Society - Indian Chapter

12:30 - 13:30 Break

### Workshop X : Urinary Tract Infections 1330 hrs to 1730 hrs

Chairperson Dr. JJ Wyndaele

13:30 - 13:40 Welcome

- Dr Jean Jacques Wyndaele  
 Lectures

13:40 - 15:00 Mechanisms in urinary

Saturday, October 30, 2010

<b>W 38</b>	tract against infection – Dr Jean Jacques Wyndaele
14:00 – 14:20	Urinary tract infections in individuals with spinal cord lesions - frequency, evaluation, diagnosis, causes and risk factors
<b>W 39</b>	– Dr. G Singh
14:20 – 14:40	Treatment of urinary tract infection in individuals with spinal cord lesion,
<b>W 40</b>	Dr. M Agarwal
14:40 – 15:00	Discussion
15:00 – 15:30	Break
15:30 – 16:24	Lectures
15:30 – 15:50	Prevention of urinary tract infection in individuals with spinal cord lesion
<b>W 41</b>	– Prof. I Perakash
15:50 – 16:10	UTI dataset development
<b>W 42</b>	– Dr. F Bierling Sorenson
16:10 – 16:24	Discussion
16:24 – 16:31	Case presentation – Dr. G Singh
16:31 – 16:46	Case Discussion Moderator – Dr. M Agarwal
16:46 – 16:53	Case presentation – Prof. I Perakash
16:53 – 17:08	Case Discussion Moderator – Dr. G Singh
17:08 – 17:15	Case presentation – Dr. M Agarwal
17:15 – 17:30	Case Discussion Moderator – Prof. I Perakash

**Workshop IX : Ethical and Scientific Challenges in the Translation of Discoveries to Human Treatments for Spinal Cord Injury and Related Neurological Disorders**  
0800 hrs to 1230 hrs

Chairpersons	Dr. John Steeves & Dr. Geeta Jotwani
08:00 – 10:00	Lectures
08:00 – 08:10	Welcome and introduction – John Steeves and Geeta Jotwani
08:10 – 08:55	Translating biology to therapy in MS - a biologist's perspective
<b>W 33</b>	– Prof. Robin Franklin
09:00 – 09:20	Effect of lithium on the survival and differentiation of spinal stem cells – Wutian Wu
<b>W 34</b>	DTI-guided transplantation of umbilical cord mononuclear cells in patients with chronic SCI - a surgical perspective*
09:20 – 09:40	– Wai-Sang Poon
<b>W 35</b>	Guidelines for Cellular therapies in Human SCI: Are their gaps in perceptions across nations and between scientists?
09:40 – 10:00	– Dr. Harvinder Chhabra
<b>W 36</b>	
10:00 – 10:30	Break

## Saturday, October 30, 2010

- 10:30 - 11:15  
**W 37** **Lecture**  
Translational Challenges in Acute SCI - Are We Ready?<sup>2</sup>  
- **Brian Kwon**
- 11:20 - 12:30  
Discussion (chaired by John Steeves) on issues arising from lectures and questions from audience participants (Jim Guest, Gilbert Leung, and Wise Young to join above participants on discussion panel)

12:30 - 13:30 **Break**

### Workshop XI : Advances in Surgical Management of Spinal Trauma 1330 hrs to 1500 hrs

- Chairpersons** **Dr. Hans Joseph Ertl & Air Marshall A S Chahal**
- 13:30 - 15:00  
**W 43** **Lectures**  
WATS for management of vertebral fracture  
- **Dr. Hans Joseph Ertl**
- 13:45 - 13:57  
**W 44** **Current concept in management of post traumatic syringomyelia**  
- **Dr. Gilbert Leung**
- 13:57 - 14:17  
**W 45** **Clinical Trials in SCI**  
- **Dr. Wise Young**
- 14:17 - 14:30  
**W 46** **Minimal Invasive Surgery to address both Anterior & Posterior Columns in Spinal Trauma** - **Dr. Jake Timothy/ Dr. Priyank Sinha**

- 14:30 - 14:45  
**W 47** **Advances in the Management of osteoporotic fracture**  
- **Dr. Azmi Hamzanglu**
- 14:45 - 15:00 **Discussion**
- 15:00 - 15:30 **Break**

### Workshop XII : Maintaining Passion in SCI Medicine: International Perspectives 1530 hrs to 1730 hrs

- Chairpersons** **Marcallee Alexander Sipski & Claus Hulting**
- 15:30 - 17:00  
**W 48** **Lectures**  
The Importance of Passion: Course Introduction and Overview  
- **Marcallee Alexander**
- 15:35 - 15:45  
**W 49** **Balancing life and work: the ultimate challenge**  
- **Marcallee Alexander**
- 15:45 - 16:00  
**W 50** **Re-defining life: Evolution through sport**  
- **Suzy Kim**
- 16:00 - 16:15  
**W 51** **Burnout - the wicked cousin of passion**  
- **Doug Stevens**
- 16:15 - 16:30  
**W 52** **Advocating for patient's with SCIs throughout the continuum of care: From bedside to boardroom**  
- **Indira Lanig**
- 16:30 - 16:45  
**W 53** **Philosophy versus psychology: A different paradigm** - **Claus Hulting**

## Sunday, October 31, 2010

16:45 – 17:00  
**W54**

Goals and Vision: Fuel for  
passion

- Sergio Alto

17:00 – 17:30

What works for you?

Panel Discussion and  
Audience Participation

### Session XI: Cost Effective Management of Spinal Cord Injury 0800 hrs to 1230 hrs

Chairpersons

Dr U Singh & Dr Renee

(08:00 – 10:00)

Maschke

08:00 – 09:00

Keynote Lectures

08:00 – 08:25

Dedicated Centres for SCI

**S 27**

Management - Are they cost  
effective in the developing  
world scenario

- Dr. Apichana Kovindha

08:25 – 08:50

Overview of cost effective

**S 28**

measures for management  
of SCI - Dr. Douglas Brown

08:50 – 09:00

Discussion

09:00 – 10:00

Free Papers

09:00 – 09:12

Concurrent validity of the  
Berg balance scale and the  
balance master for the  
evaluation of balance in a  
spinal cord injury population  
(78)

**O 40**

- Mr. Jean-Francois Lemay

09:12 – 09:24

Peer counseling - a holistic  
psycho-social rehabilitation  
approach (75)

**O 41**

- Mr. Shivjeet Singh Raghav

09:24 – 09:36

Quality of life after  
thoracoscopic anterior  
surgery of the spine (250)

**O 42**

- H J Erli

09:36 – 09:48

Peer training as a  
cost-effective tool for SCI

**O 43**



## Sunday, October 31, 2010

- management in low income countries (199)  
 – Mrs. Jennifer Howlitt Browning
- 09:48 – 10:00 Discussion
- 10:00 – 10:30 Break
- 10:30 – 12:30 Free Papers
- Chairpersons** Dr R N Shrivastava & Dr Ruth Marshal
- 10:30 – 10:42  
**O 44** Functional outcomes of patients with SCI at the halfway hostel of centre for the rehabilitation of paralyzed (CRP) in Bangladesh (170)  
 – Mr. Md. Shariful Islam
- 10:42 – 10:54  
**O 45** Social and health care assistance of patient with congenital spinal cord lesion in Italy (201)  
 – Ms. Maria Paola Pascali
- 10:54 – 11:06  
**O 46** CPAP treatment is an important treatment of underventilation of SCI patients (200)  
 – Dr. Lena Rutberg
- 11:06 – 11:18  
**O 47** Proximal femoral resection and myocutaneous flaps for recalcitrant trochanteric pressure ulcer (108)  
 – Prof. Roop Singh
- 11:18 – 11:30  
**O 48** Reducing the cost: family and friends' role in physical rehabilitation of SCI patients (185)  
 – Mr. Pradeep Thumbikat

- 11:30 – 11:42  
**O 49** Therapeutic riding as a recreational activity - step towards balance control for quadriplegics (226)  
 – Mr. Hemant Rohilla
- 11:42 – 11:54  
**O 50** An online survey of neurogenic pain in SCI in China (112)  
 – Mr. Dajue Wang

11:54 – 12:30 Discussion

12:30 – 13:30 Break

## Hall – A1

### Session XII : Free Papers

1330 hrs to 1520 hrs

- Chairpersons** Mr Brian Gardner & Prof Amiram Catz
- 13:30 – 13:38  
**O 04** Do gastrointestinal transit times and colonic dimensions change with time since SCI? (183)  
 – Dr. Pia Møller Faaborg
- 13:38 – 13:46  
**O 52** Completed audit cycle of respiratory care in the acute stage: an Oswestry experience (106)  
 – Mrs. Rebecca Dytor
- 13:46 – 13:54  
**O 53** Are SCI patients asexual? Myth or reality: An Indian perspective (117)  
 – Dr. Shiv L. Yadav
- 13:54 – 14:02  
**O 54** Integration of the SCI centre in the training of

## Sunday, October 31, 2010

- students: Experiences in the Orthopaedic Department of the University of Ulm, Germany (94)  
– **Dr. Yorck B. Kalke**
- 14:02 – 14:10  
**O 55** Different trajectories in the course of life satisfaction in people with SCI (137)  
– **Ms. Christel Van Leeuwen**
- 14:10 – 14:18  
**O 56** Analysis of peri-operative complications of 60 cases of open transforaminal lumbar interbody fusion (TLIF) (174)  
– **Dr. Bhavin Shial**
- 14:18 – 14:26  
**O 57** The relationship between perceived stress, appraisals of disability, and coping responses on the variance in concurrent depression and anxiety in patients with acquired SCI (123)  
– **Dr. Divya Parashar**
- 14:26 – 14:34  
**O 58** New onset epilepsy in a SCI patient with multiple pressure sores (188)  
– **Mr. Pradeep Thumbikat**
- 14:34 – 14:42  
**O 59** Meeting the needs of chronic SCI individuals with significant bowel management difficulty - a neurogenic bowel care clinic (227)  
– **Ms. Maureen Coggrave**

- 14:42 – 14:50  
**O 60** Muscle rupture after minimal trauma of the spastic muscle: three case reports of patients with SCI (46) – **Dr. Thomas Carpentier**
- 14:50 – 14:58  
**O 61** SCI database in Japan (33)  
– **Mr. Mikio Sumida**
- 14:58 – 15:20 **Discussion**

## Hall – A2

### Session XIII : Free Papers 1330 hrs to 1520 hrs

- Chairpersons** **Dr. P. Hariharan & Dr. Sigrun Knutsdottir**
- 13:30 – 13:38  
**O 62** Functional outcomes for patients admitted to a spinal rehabilitation unit with acute spinal cord ischemia (160)  
– **Dr. Peter New**
- 13:38 – 13:46  
**O 63** Categories of coping as recalled by persons who sustained a SCI during adolescence (115)  
– **Mr. Marika Augutis**
- 13:46 – 13:54  
**O 64** Outpatient follow-up at the Midlands Centre for Spinal Injuries, Oswestry UK (192)  
– **Mr. Aheed Osman**
- 13:54 – 14:02  
**O 65** Transanal irrigation: 1 year follow-up with analysis regarding failure and treatment interruption (219)  
– **Mr. Giovanni Mosiello**

## Sunday, October 31, 2010

14:02 – 14:10  
**O 66** Respiratory infections and function 5 years after SCI rehabilitation (228)

- Mrs. Karin Postma

14:10 – 14:18  
**O 67** Perioperative adverse events in spine surgery: a review of 900 surgical cases (173)

- Dr. Premik Nagad

14:18 – 14:26  
**O 68** Pharmacological treatment of anejaculation and anorgasmia in men with SCI (158)

- Prof. Frederique Courtois

14:26 – 15:05 Discussion

### ASCoN Annual Scientific Meeting 0800 hrs to 1230 hrs

**Chairpersons** Dr. Eric Weerts & Mrs. Maggie Muldoon

**Lectures**

08:00 – 09:30  
**S 21** ASCoN - progress and future strategic priorities  
 - Stephen Muldoon

08:12 – 08:24  
**S 22** Patna model of SCI management  
 - Capt. Dilip Sinha

08:24 – 08:36  
**S 23** CPP model of SCI management  
 - Dr. Razzak/Dr. Sohrab

08:36 – 08:48  
**S 24** Chinese experience of SCI Management  
 - Dajue Wang

08:48 – 09:00  
**S 25** Challenges in setting up an SCI network in Vietnam  
 - Eric Weerts

09:00 – 09:12  
**S 26** Nepal experience of setting up spinal injury rehabilitation center  
 - Kanak Mani Dixit

09:12 – 09:30 Discussion

09:30 – 10:00 Free papers

**Chairpersons** Dr. Apichana Kovindha & Dr. Fazlul Hoque

**Judges** Lisa Harvey/Capt. Dilip Sinha/Dr. Hans Joseph Erli/Dr. W. Donovan/Dr. Douglas Brown/Dr. Wee Fu Tan

09:30 – 09:36  
**O 69** A Biomechanical mode to test a unique structure of subcutaneous layer with special reference to pressure sore - Prof Dajue Wang

09:36 – 09:42  
**O 70** Patients with spinal cord injury with South East Asia region: Epidemiology based on the International Spinal cord (ISCOG) data set  
 - Mr. Mohit Arora

09:42 – 09:48  
**O 71** Measuring quality of life with WHOCOL-BREF in Thai individuals with spinal cord injury

- Dr. Nittinat Wongtrangan  
 09:48 – 09:54  
**O 72** Sexual health of women with spinal cord injury  
 - Ms. Noortje Lubbers

## Sunday, October 31, 2010

09:54 - 10:00	Discussion
10:00 - 10:30	Break
10:30 - 12:30	Free Papers
10:30 - 10:36 <b>O 73</b>	Individuals with chronic spinal cord injury (SCI) in south east Asian region (SEAR) : Facilitator vs barrier vs facilitator and barrier of environmental factor based on ICF - <b>Dr. Apichana Kovindha</b>
10:36 - 10:42 <b>O 74</b>	Individuals with chronic spinal cord injury (SCI) in south east Asian region (SEAR): Analysis based on the international classification of functioning, disability and health (ICF) basic core data sets for long - term context - <b>Dr. Nazrah Hasnan</b>
10:42 - 10:48 <b>O 75</b>	The correlation between functional outcomes and quality of life in patients with spinal cord injury in Thailand - <b>Mrs. Tuenchal Attawong</b>
10:48 - 10:54 <b>O 76</b>	Common complications following spinal cord lesion after returning in the community in Bangladesh - <b>Mrs. Korny Marina Women</b>
10:54 - 11:00 <b>O 77</b>	A cost effective approach to spinal injury management in Sri Lanka - <b>Dr. Chandana Karunathilaka</b>
11:00 - 11:06 <b>O 78</b>	Functional recovery for C6 traumatic tetraplegia after completing the rehabilitation phase at centre for the rehabilitation of paralysed (ICRP), Bangladesh - <b>Ms. Anteena Aziz</b>
11:06 - 11:12 <b>O 79</b>	WI rehab in paraplegia with impaired sitting balance - <b>Dr. Wasuwat</b>
11:12 - 11:18 <b>O 80</b>	Pedicle screw fixation and conservatively treated unstable thoracolumbar fractures : A short report of prospective cohort study - <b>Dr. Abu Toha</b>
11:18 - 11:34 Discussion	
11:34 - 11:40 <b>O 81</b>	Secondary impairment after spinal cord injury : is it neglect ? - <b>Dr. Shiv L Yadav</b>
11:40 - 11:46 <b>O 82</b>	Relation between Q1 and Q26 in WHOQOL - BREF and function domains : A study in patients with spinal cord injury (SCI) - <b>Dr. Siam Tongprasert</b>
11:46 - 11:52 <b>O 83</b>	Will balance game for sitting balance training A pilot study in patients with spinal cord lesion - <b>Ms. Sununta Boonsarawang</b>

Sunday, October 31, 2010

11:52 - 11:58  
**O 84** Comparative study on different type of Indian wheelchairs activity and its effect on various parameters in normal subjects  
- Ms. Shruti Sharma

11:58 - 12:04  
**O 85** ISCoS neurogenic bowel basic data set and neurogenic bowel score: A practice with patients with SCI in Thailand  
- Ms. Warangkana Sittkhikan

12:04 - 12:10  
**O 86** Incidence of spinal cord injury (SCI) per annum and its major causes  
- Dr. Raju Dhakal

12:10 - 12:16  
**O 87** Evaluation of SCI patient after rehabilitation  
- Dr. Damodhar Thapa

12:16 - 12:30 Discussion

**IGASS Symposium: "Prevention and Management of Neurological Complications during Spine Surgery"**  
1330 hrs to 1745 hrs

Symposium Format - Panel and open house discussion on cases presented by 5 different moderators on 5 different but common scenarios in which neurological complications during spine surgery are common.

13:30 - 14:15 Prevention and management of neurological complications during deformity surgeries  
**Chairperson:**

- Dr. Nobert Passuti

**Moderator:**

- Dr. Saumyajit Basu

**Panelist:**

- Dr. Arvind Jayswal/Dr. Shanker Acharya/Dr. Surya Prakash Rao/Dr. Harshwardhan Hegde/Dr. Sajan Hegde/Dr. Sunil Katoch  
Prevention and management of neurological complications during Spondylolisthesis Surgeries

**Chairperson:**

- Dr. Nobert Passuti

**Moderator:**

- Dr. Ram Chaddha

**Panelist:**

- Dr. Cody Bunger/Dr. Arvind Jayswal/Dr. Naresh Kumar/Dr. Gautam Zaveri/Dr. Prashant Kekre/ Dr. Rushma Tandon/Dr. K.L. Kalra/Dr. Sudhir Dubey

15:00 - 15:30 Break

15:30 - 16:15 Prevention and management of neurological complications during Disc Surgeries  
**Chairperson:**

- Prof Bernhard Meyer

**Moderator:**

- Dr. Prashant Kekre

Sunday, October 31, 2010

- Panelist:  
- Dr. Cody Bunger/Dr. Rajagopalan/Dr. Manoj Sharma/Dr. Abrar Ahmed/Dr. Yash Gulati/Dr. Sudhir Dubey
- 16:15 – 17:00 Prevention and management of neurological complications during Dorsal Myelopathy Surgeries  
Chairperson:  
- Prof Bernhard Meyer  
Moderator:  
- Dr. Rajgopalan  
Panelist:  
- Dr. Wee Fu Tan/ Dr. A.K. Singh/Dr. P. Sarat Chandra/ Dr. S.M. Tuli
- 17:00 – 17:45 Prevention and Management of neurological complications during Spine Trauma Surgery (Flexion Distraction Cervical incomplete Injury)  
Chairperson:  
- Dr. Patrick Kluger  
Moderator:  
- Dr. Vikas Tandon/Dr. Ankur Nanda  
Panelist:  
- Dr. Hans Joseph Erli/Dr. Sagun Tuli/Dr. Peter Wing/ Dr. H.N. Bajaj/Dr. P. Sarat Chandra/Dr. Rana Patir
- 17:45 onwards Valedictory of IGASS forum

**Workshop XIII: From cells to bedside to community: An ICORD update**  
0800 hrs to 1000 hrs

- Chairperson Dr. Thomas Oxland  
08:00 – 08:10 Welcome & Overview of ICORD  
- Dr. Thomas Oxland
- 08:10 – 08:25 Neuroprotective and  
W55 Neuroregenerative Strategies for SCI  
- Dr. Brian Kwon
- 08:25 – 08:40 Bioengineering initiatives  
W56 towards the prevention and treatment of SCI  
- Dr. Thomas Oxland
- 08:40 – 08:55 Functional outcomes of a  
W57 novel control strategy for Lokomat-based gait retraining in people with incomplete spinal cord injury  
- Dr. Tania Lam
- 08:55 – 09:10 Abnormal autonomic  
W58 control and health of individuals with spinal cord injury  
- Dr. Andrei Krassioukov
- 09:10 – 09:25 Sexual and Fertility  
W59 Rehabilitation after SCI in Vancouver: new insights  
- Dr. Stacy Elliott

## DAY 3 Sunday October 31, 2010

09:25 – 09:40 <b>W60</b>	Clinical / Translational Initiatives in SCI – Dr. Brian Kwon
09:40 – 09:55 <b>W61</b>	The Rick Hansen Institute – Mr. Bill Barrable
09:55 – 10:00 <b>W62</b>	Opportunities for Collaboration – Dr. Thomas Oxland
10:00 – 10:30	Break

**Workshop XIV: Because SCI Shouldn't Paralyze the Caregivers: A Cross-Cultural & Interactive Workshop on Family Response & Psychosocial Adjustment Following an SCI**  
1030 hrs to 1230 hrs

Chairpersons: Dr. Stanley Ducharme,  
Dr. Divya Parashar

10:30 – 10:40 <b>W63</b>	Introduction: Sensitizing professionals to the needs and concerns of the family – Dr Divya
10:40 – 11:00	Family's response to their loved one's spinal cord injury – Dr Stanley
11:00 – 11:20	Role of the family in the holistic rehabilitation of the client – Dr. Komal Kamra & Mrs. Vicky Sigworth
11:20 – 11:40	The psychological impact of an SCI on the family: A cross-cultural comparison between India and the US – Dr Divya and Dr Stanley

11:40 – 11:55	Special mention: Caregiving stress & burnout – Dr Stanley
11:55 – 12:20	Strategies to enable coping with caregiving stress – Dr Divya
12:20 – 12:30	Concluding remarks – Dr Stanley
12:30 – 13:30	Break

**Workshop XV: It will happen again: Disaster preparation response for spinal cord injuries. Lessons from the Haitian earthquake**  
1330 hrs to 1520 hrs  
**W64**

Moderator:  
Dr. Peter Wing

13:30	Introduction to the course: – Peter Wing
13:35	Haiti government and medical care pre-2010: – Colleen O'Connell/James Guest
13:40	The Earthquake: – James Guest
13:45	First impressions and triage of overall situation: Core priorities and immediate challenges – Eric Weerts

## Sunday, October 31, 2010

- 13:50 **Coordination of Care:**  
- James Guest/Eric Weerts
- 14:00 **Acute Management:**  
- James Guest/Colleen O'Connell
- 14:15 **Potential for evacuation:**  
- Claes Hulting/Peter Wing/Colleen O'Connell
- 14:20 **Sub Acute Management:**  
- James Guest /Colleen O'Connell/Geraldine Jacquemin
- 14:45 **Long-Term Management:**  
- Colleen O'Connell
- 14:50 **Panel discussion:**  
- Peter Wing/Eric Weerts and guests
- 15:00 **Other questions to be discussed**
- 15:20 **Closure**

**Workshop XVI (ASCoN Post Conference Workshop): "Workshop to demonstrate the Beijing Peer Counseling & Education Network Model using IT as the means of communication"**  
1600 hrs to 1800 hrs

- Chairpersons** Stephen Muldoon & Dr. Dajue Wang
- 16:00 – 16:10 Opening Speech  
**Stephen Muldoon & Livability Ireland**
- 16:10 – 16:20 Introduction  
- **Dr. Dajue Wang**
- 16:20 – 17:20 **Lectures**
- 16:20 – 16:32 Acute Management of Spinal Cord Injury  
- **Dr. Vikas Tandon**
- 16:32 – 16:44 Rehabilitation  
- **Dr. Apichana Kovindha**
- 16:44 – 16:56 Basic Science  
- **Dr. Dajue Wang**
- 16:56 – 17:08 Peer Counselling  
- **Mr. Wen**
- 17:08 – 17:28 Questions & Answers
- 17:28 – 17:48 **Discussion**
- 17:48 – 18:00 Summary



## Posters for ISCoS Annual Scientific Meeting

SI No	Name of the Author	Title
P1	Prof. Giulia Bassi	International classification of functioning, disability and health (ICF) and School reintegration of patients with spinal cord injury (SCI)
P2	Dr. Zuhai Bayirli Karakoyun	Osteoporosis in spinal cord injured patients
P3	Mr. Shinsuke Katoh	Anterior decompression of the thoracic spinal cord via postero-lateral approach. A report of 4 Cases
P4	Dr. Peter Banczerowski	New minimal invasive techniques in the treatment of intramedullary pathologic Lesions to prevent destruction of the dorsal structures of the spinal Coloumn and spinal cord injuries.
P5	Dr. Sridhar Atresh *	The use of pentrox inhaler (methoxyflurane) for shoulder manipulation in a paraplegic patient With bilateral frozen shoulders
P6	Dr. Sridhar Atresh	Suprapubic catheter blockages in spinal cord injury
P7	Dr. Sridhar Atresh	Devic's syndrome-our experience in the rehabilitation ward in counties manukau
P8	Prof. Shuxun Hou	Remodeling of the spinal canal after circum decompression with posterior Approach for burst fracture
P9	Dr. Amrithlal Mascarenhas	A description of various implant- related complications in the management of vertebral Lesions

SI No	Name of the Author	Title
P10	Dr. Anupam Gupta	Repeat saline cystometry in myelopathies: changes in bladder behavior in the long term follow-up
P11	Gerold Stucki	Internal resources and strengths in persons with spinal cord injury: a Systematic literature review
P12	Gerold Stucki	Social support and social skills in spinal cord injury - a systematic literature Review
P13	Gerold Stucki	Self-efficacy and self-esteem as personal factors in the context of Functioning and disability in spinal cord injury
P14	Prof. ROOP SINGH	Body composition evaluation by dual energy X-ray absorptiometry during first Year of spinal cord injury
P15	Dr. MANISH CHADHA	Association of facet tropism with lumbar disc herniation
P16	Dr. MANISH CHADHA	Ossified ligamentum flavum- a rare cause of progressively increasing spastic Paraparesis.
P17	EH Coulter	Development and validation of an activity monitor to measure physical activity Of wheelchair users'
P18	Ms. Nancy Moodley	Post traumatic stress disorder and cognitive functioning in spinal cord Injured patients
P19	Mr. Anshul Sharma	Effect of wheelchair sports on fatigue, pain, quality of life and capacity of Upper extremities for quadriplegics

SI No	Name of the Author	Title
P20	Dr. Elena andretta	Survey on the sexuality of para-tetraplegic women
P21	Mr Yicheng Liu	A quick and economical alternative of setting up a spinal cord injury (SCI) service
P22	A Narkeesh	Clinical significance of electrodiagnosis in pavid as compared with radio diagnosis
P23	Dr. Gururaj Sangondimath	Report of the difficulties experienced in the anterior cervical plating in the Cervico-dorsal scoliosis patient- a rare case
P24	Dr. Gururaj Sangondimath J sangondimath	Sudden bilateral foot drop: a rare presentation of lumbar canal stenosis.
P25	Dr. Subramani Seetharama	Repetitive-activity based training of the upper extremity using a Electromyography controlled neurobotic device to improve function in Persons with tetraplegia.
P26	Dr. Ajay.R. Kothari	Validation of vaccaro's classification in predicting neurological recovery in Traumatic thoraco-lumbar fractures – analysis of 41 cases
P27	Ms. Jaskirat Kaur	Correlation between fatigue, depression and quality of life in spinal cord Injury in-patients
P28	Âžafak Sahir KaramehmetoÄŸlu	The evaluation of irregular follow-up in patients with spinal cord injured Patients
P29	Dr. Halil Koyuncu	The evaluation of the mental status and mortality rate of spinal cord injured Patients.
P30	Mr. Jyoti Vidhani	Impact - " increasing the impact of assistive technology" - a case study

Sl No	Name of the Author	Title
P31	Dr. Maria Paola Pascall	Neurogenic bladder treatment in spinal cord injury: experience in 37 cases
P32	Dr. ABHISHEK SRIVASTAVA	Multiple injections of in-vitro expanded autologous bone marrow Mononuclear cells (abmmnc) for cervical spinal cord injury
P33	Dr. Chandana Karunathilaka	Application of asia impairment scale in sri lankan spinal injury patients
P34	G. Onose	Integrative emphases on intimate targets and accessible related therapeutic Approaches, in spinal cord injuries (SCI)
P35	Mr Priit Eelmae	Respiratory function in subjects with cervical spinal cord injury
P36	Dr. Hitesh Dawar	Ascending myelitis in operated burst fracture L1 with paraplegia asia-a
P37	Dr. Yorck B. Kalke	The actualized osteoporosis guidelines of the german bone research societies And their value for the sci centres
P38	Dr. Yorck B. Kalke	Long-term impacts in a german patient with pottā's spine : a case report
P39	Dr. Kurian Zachariah	Spinal cord injury rehabilitation: re-uniting the patient back into society, not just re-uniting the fracture - a pilot study
P40	Mr. Arvind Bhawe	Abneedle'-new device for vertebroplasty
P41	Dr. Fahid H Malik	Surgery for unreduced cervical facet dislocations - which approach ? - our experience of 19 Patients.
P42	Dr. S S Patil	Early postoperative motor deficit following posterior lumbar spine surgery

SI No	Name of the Author	Title
P43	Ms. Christel van Leeuwen	The spique study: an ongoing prospective cohort study on quality of life of Persons with spinal cord injury in the netherlands
P44	Prof. Nalli Uvaraj	Spinopelvic stabilisation for lumbosacral tuberculosis
P45	Mr. Rick Jay	Anti-decubitus cushion outcome study
P46	A/Prof. Lisa Harvey	Elearning to teach physiotherapy students about management of sci
P47	Dr. Marcel Post	Participation profiles of persons with chronic sci in the netherlands
P48	Dr. Ralph Marino	Consumer preference in ranking walking function utilizing the walking index For spinal cord injury (wisci)
P49	Dr. Hidenori Suzuki	Transplantation of bone marrow stromal cells combined with neurospheres into injured spinal Cord : significant recovery of motor function and electrophysiological evaluation.
P50	Angela Mc Namara	The patient experience of rehabilitation
P51	Prof. Rajeshwar Nath Srivastava	Motor segmental recovery in spinal cord injury - a blessing in disguise!
P52	Prof. Rajeshwar Nath Srivastava	Prognostic factors of neurological recovery in spinal cord injury
P53	Prof. Rajeshwar Nath Srivastava	A comparative study of posterior fixation in acute unstable thoracolumbar injuries by monoaxial and polyaxial pedicle screws

SI No	Name of the Author	Title
P54	Prof. Rajeshwar Nath Srivastava	Prognostic & clinical value of mri in spinal cord injury
P55	Mr. Kiichi Sato	Physical therapy, from acute phase to home discharge, for spinal cord injured Patients. -introduction of the approach in hokkaido chuo rosai hospital spinal cord Injury center in japan-
P56	Mr Pradeep Thumbikat	Autonomic dysreflexia: do we need to learn more?
P57	Mr Pradeep Thumbikat	Long term follow up (mean 24 years) of post-traumatic lumbar syringomyelia
P58	Miss Meena Agarwal	Use of botulinum toxin in the treatment of neurogenic detrusor overactivity.
P59	Dr. Cornelia Putz	Malignant cord compression: What are reliable prognostic factors influencing the functional outcome After surgical treatment?
P60	Dr. Amitabh Jha	Utility of a sham needle in acupuncture research & preliminary findings in Persons with sci.
P61	Dr. Bum-Suk Lee	Transfer activities in patients with spinal cord injury after discharge from Hospital
P62	Dr. Lawrence Vogel	Relationships between outcomes of caregivers and youth with spinal cord Injury
P63	Dr. Lawrence Vogel	Change in economic status in young and middle-aged adults with a Pediatric-onset spinal cord injury over a ten-year period
P64	Mrs. G Fizzotti	Bladder and vaginal infections in the women with a spinal cord injury

SI No	Name of the Author	Title
P65	G Fizzotti	What the patients with a spinal cord injury think about the voiding diary?
P66	Dr. Gabriele Bazzocchi	Relationship between intestinal transit and neurogenic bowel dysfunction Score in patients with sci: both necessary for defining constipation
P67	Dr. Norhayati Hussein	Unilateral thigh swelling in paraplegia
P68	Dr. G.L Jacquemin	Tendon transfer for tetraplegia: how to start a surgery and rehabilitation Program.
P69	Dr. G.L Jacquemin	Tendon transfer in tetraplegia: how many actual candidates for surgery?
P70	Mrs. Joyce Mothabeng	Physical activity in people living with spinal cord injury
P71	Dr. Gulsun Iska	The relationship between the findings of urodynamic evaluation and Neurological examination in spinal cord injured patients with level t10-l1
P72	Dr. Kaydar Al-Chalabi	Spinal cord injuries experience of neurospinal hospital dubai
P73	Dr. Vivek Mittal	Conservatively managed epidural haematoma in the thoracolumbar spine – A case report
P74	Dr. Vivek Mittal	Mismanaged thoracolumbar spine injury – a case report
P75	Dr. Vivek Mittal	Falling neck in a patient with neuromuscular scoliosis – a case report

## Judges for the combined ASCoN & SCS Best Poster Presentation

- Dr. Fazlul Hoque
- Dr. Nazirah
- Dr. Jake Timothy

### Posters for ASCoN Annual Scientific Meeting

SI No	Name of the Author	Title
P76	Ms. Parneet Kaur Bedi	Role of spinal electrical stimulation in reduction of spasticity in sci patients :a literature review
P77	DR Gururaj	Andersons lesion in a rheumatoid arthritis patient-a rare case and literature review
P78	Mrs. Vicky Sigworth	Post-hospital resources in a developing country to empower people With sci to lead useful lives
P79	Ms. Anteena Aziz	Situation of women with spinal cord Injury in bangladesh
P80	Ms. Sonia Goel	Hindi translation and psychometric properties of quebec user Evaluation of satisfaction with assistive technology (mobilty types)
P81	Dr Gururaj	Among people with spinal cord injuries.
P82	Ms. Anteena Aziz	Sacral decompression a miraculous surgery Use of splints / orthotics in sci care in bangladesh
P83	Dr. Gururaj M Sangondimath	Autonomic dysreflexia due to injury at d12-a rare Presentation
P84	Dr. Vivek Mittal	Traumatic spondyloptosis of the thoracolumbar spine
P85	Dr. Vivek Mittal	Misjudged c2 fracture - a case report



## Posters for SCS Annual Scientific Meeting

SI No	Name of the Author	Title
P86	Dr. Vivek Mittal	Mismanaged pediatric cervical spine injury - a case report
P87	Dr. Vivek Mittal	Progressive cervical kyphosis in an operated patient of neuromuscular scoliosis - a Case report
P88	Ms. Shikha Bhat	Psychosocial influence of wheelchair training in traumatic spinal Cord injured
P89	Firas Sarhan	Pressure ulcer risk factors in persons with spinal cord injury at acute and rehabilitation stages
P90	Roop Singh	Longitudinal study of bone mineral density and biochemical markers of bone turnover after sci
P91	Roop Singh	Health-related problems and effect of specific interventions in spinal cord injury - an outcome study in northern india

## POST CONFERENCE SCHEDULE

November 1 - 3, 2010

### Day 1, Monday November 1, 2010

- 06- WORKSHOP XVII  
Active Rehabilitation Workshop  
for Wheelchairs Users  
ISIC Conference Hall
- 06- Comprehensive Management of  
Spinal Cord Injury  
Auditorium, ISIC  
0800 hrs to 1800 hrs

### Day 2, Tuesday November 2, 2010

Comprehensive Management of  
SCI: Discipline Specific Workshop for:

- 09- Doctors  
Conference Hall, ISIC  
0900 hrs to 1730 hrs
- 11- Assistive Technologists and  
Occupational Therapists  
Lecture Hall - 1  
0900 hrs - 1800 hrs
- 13- Nurses  
Lecture Hall - 2  
0900 hrs - 1800 hrs
- 14- Psychologist, Community Workers  
and Social Workers  
Lecture Hall - 3  
0900 hrs - 1800 hrs

- 16- Physiotherapists  
Auditorium, ISIC  
0800 hrs - 1700 hrs

### Day 3, Wednesday November 3, 2010

- 18- Comprehensive Management of  
SCI: Discipline Specific Workshop  
for Physiotherapists  
0815 hrs - 1700 hrs

Monday, November 1, 2010

**WORKSHOP XVIII**  
**Active Rehabilitation Workshop**  
**for Wheelchairs Users (SCIs)**  
**0900 hrs to 1730 hrs**

**Active Rehabilitation:** Dr Tomasz Tasiemski,  
Ph.D, Poland

09:00 - 10:15	Introduction to Active Rehabilitation Systems and Basic Fundamentals
10:15 - 10:30	Discussion
10:30 - 11:00	Break
11:00 - 13:00	Basic Wheelchair Skills (Main Lobby) Advanced Wheelchair Skills
13:00 - 14:00	Break

**Assistive Technology:** Nekram Upadhyay  
Venue: Rehabilitation Department

14:00 - 15:15	Importance of custom made wheelchair and seating selection procedure
15:15 - 15:30	Discussion
15:30 - 16:00	Break

**Occupational Therapy:** Anshu Bhalla  
Venue: Rehabilitation Department

16:00 - 16:25	Activities of Daily Living
16:25 - 16:50	Hippo Therapy, Practice & Benefits
16:50 - 17:15	Video Demonstration of Hippo Therapy
17:15 - 17:30	Discussion

**WORKSHOP XVII**  
**Comprehensive Management of**  
**Spinal Cord Injury**  
**Auditorium, ISIC**  
**0800 hrs to 1800 hrs**

Session - I

**Chairpersons** Dr. J J Wyndaele & Dr. Patrick Kluger

08:00 - 08:20	Clinical Assessment of Patients with SCI - Dr. Sergio Aito
08:20 - 08:40	International Standards for Neurological Classification of SCI - Dr. Claire Weeks
08:40 - 09:00	Team-based Care: Roles & responsibilities - Dr. Ruth Marshall
09:00 - 09:20	Pre-hospital and Acute Care of SCI Management - Dr. Peter Wing
09:20 - 09:35	Nutritional Management - Dr. Apichana Kovindha
09:35 - 09:50	Respiratory Management Dr. Andrei Krassioukov

09:50 - 10:15	Discussion
10:15 - 10:45	Break/ Wheelchair Rugby & Demonstration of therapeutic horse riding

Session - II

**Chairpersons** Dr. Finn Biering Sorensen & Dr. Apichana Kovindha

10:45 - 11:10	Nursing Perspectives of SCI Management - Debbie Green
---------------	---

- 11:00 - 11:35 Management of Vertebral Lesion  
- Dr. S Katoh
- 11:35 - 12:00 Physical Therapy Perspectives on Rehabilitation  
- Lisa Harvey
- 12:00 - 12:25 Occupational therapy Perspectives in SCI  
- Elma Burger
- 12:25 - 12:45 Mobility & Seating  
- Mr. Nekram Upadhyay

12:45 - 13:15 Discussion

13:15 - 14:00 Break/Wheelchair Lawn Tennis Demonstration

#### Session - III

- Chairpersons** Mr. W El Masry & Ms. Jane Horsewell
- 14:00 - 14:20 Bowel Care and Management  
- Dr. Inder Perakash
- 14:20 - 14:45 Management of Neurogenic Bladder  
- Dr. J.J. Wyndaele
- 14:45 - 15:05 Psychosocial Management of Patient and the family  
- Dr. Stanley Ducharme
- 15:05 - 15:25 Sexuality, Fertility & SCI  
- Dr. Fin Biering-Sorensen

15:25 - 15:45 Discussion

15:45 - 16:15 Break

#### Session - IV

- Chairpersons** Dr. Ruth Marshall & Dr. Andrei Krassioukov
- 16:15 - 16:40 Early and Late Complications in SCI - W El Masry
- 16:40 - 17:00 Vocational Rehabilitation  
- Cyril Siriwardane

- 17:00 - 17:20 Community Inclusion  
- Ms. Jane Horsewell
- 17:20 - 17:40 Prevention of SCI  
- Mr. Eric Weerts
- 17:40 - 18:00 Discussion

## Day 2, Tuesday November 2, 2010

### Basic Workshop on SCI Management for Doctors ISIC Conference Hall 0900 hrs - 1730 hrs

- Chairpersons** Dr. J.J Wyndaele & Dr. Clair Weeks
- 09:00 - 09:25 Acute management including pre-hospital care and emergency management  
- Dr. Peter Wing
- 09:25 - 09:50 Conservative management of vertebral lesion  
- Capt. Dilip Sinha
- 09:50 - 10:15 Surgical management of vertebral lesion  
- Dr. P. Kluger
- 10:15 - 10:30 Discussion
- 10:30 - 11:00 Break
- Chairpersons** Dr. Ruth Marshall & Dr. Dinesh Suman
- 11:00 - 11:40 Demonstration of

	Urodynamics procedure - Dr. J.J. Wyndaele & Dr. Dinesh Suman
11:40 - 12:05	Complications of urinary tract - prevention and management - Dr. Mark Nigro
12:05 - 12:30	Fertility and sexuality in SCI - Dr. Sanjeev Sharma

12:30 - 13:00 Discussion

13:00 - 14:00 Break

<b>Chairpersons</b>	<b>Capt. Dillip Sinha &amp; Dr. Charanjev Sobti</b>
14:00 - 14:25	Early complications and its management - Dr. Claire Weeks
14:25 - 14:50	Management of Spasticity & Pain - Dr. U. Singh
14:50 - 15:15	Pressure Sore - prevention and management - Dr. S.L. Yadav

15:15 - 15:30 Discussion

15:30 - 16:00 Break

<b>Chairpersons</b>	<b>Dr. U Singh &amp; Dr. K Das</b>
16:00 - 16:25	Late complications and its management - Dr. S. Y. Kothari
16:25 - 16:50	Expected Outcomes by level of injury - Dr. Sanjay Wadhwa
16:50 - 17:15	Advances in Management of SCI - Dr. Ruth Marshall

17:15 - 17:30 Discussion

## Workshop on Assistive Technology and Occupational Therapy for SCI Lecture Hall - I 0900 hrs - 1730 hrs

<b>Chairpersons</b>	<b>Ms. Elma Burger &amp; Ms. Chitra Kataria</b>
09:00 - 09:25	Impact of Assistive Technology on SCI Rehabilitation and Establishment of AT Centre - Mr. Nekram Upadhyay
09:25 - 09:50	Mobility and Seating: Wheelchairs and Pressure Relieving Cushions - Mr. Nekram Upadhyay
09:50 - 10:15	Powered Mobility: Electric wheelchair and Scooters - Ms. Swati Malik

10:15 - 10:30 Discussion

10:30 - 11:00 Break

<b>Chairpersons</b>	<b>Mr. Shivjeet Raghav &amp; Mr. Nekram Upadhyay</b>
11:00 - 11:40	Computer Accessibility: Alternative options for Quadriplegics - Ms. Jyoti Vidhani
11:40 - 12:05	Environmental Accessibility: Home and Worksite Modifications - Ms. Sonia Goel
12:05 - 12:30	Public and Private Transportation Accessibility for Wheelchair Users - Ms. Ruby Aikat/Mr. Ramaswamy

12:30 - 13:00	Discussion
13:00 - 14:00	Break
Chairpersons	Ms. Chitra Kataria & Ms. Elma Burger
14:00 - 14:25	Introduction to Occupational Therapy and Functional Independence Outcomes in SCI - Ms. Kriti Bedi & Mr. Nikunj Dhar
14:25 - 14:50	Hand Rehabilitation and Tendon Transfers, Occupational Therapy Perspective - Mr. Maneesh Bhardwaj & Ms. Rekha Bhardwaj
14:50 - 15:15	Activities of Daily Living-Training Techniques in Occupational Therapy - Ms. Harleen Dhall & Mr. Gundeep
15:15 - 15:30	Discussion
15:30 - 16:00	Break
Chairpersons	Ms. Elma Burger
16:00 - 16:25	Care Giver Training Techniques and Uses - Mr. Saket Giri & Ms. Anshu Bhalla
16:25 - 16:50	Hippo Therapy, Practice and Benefits - Ms. Anshu Bhalla & Ms. Dipika Rawat
16:50 - 17:15	Video Demonstration of Hippo Therapy - Ms. Anshu Bhalla
17:15 - 17:30	Discussion

## Discipline Specific Workshop for Nurses Lecture Hall - II 0845 hrs - 1800 hrs

08:45 - 9:00	Opening of Day - Debbie Green
Session 1	Chair: Debbie Green & Farrah Khan
09:00 - 10:00	Anatomy and physiology and acute care of the patient with spinal cord injury - Firas Sarhan
10:00 - 10:30	Care of the patient with a tracheostomy and respiratory management - Neetu Maitra
10:30 - 11:00	Break
Session 2	Chair: Firas Sarhan and Neetu Maitra
11:00 - 11:30	Nurses as rehabilitators - Debbie Green
11:30 - 12:00	Care of the patient with neurogenic bowel - Maureen Coggrave
12:00 - 12:30	Care of the patient with neurogenic bladder - Elvena Singh
12:30 - 13:00	Break
Session 3	Chair: Maureen Coggrave & Elvena Singh
13:30 - 14:00	Maintaining skin integrity following spinal cord injury - Farrah Khan

- 14:00 - 14:30 Assessment and management of pressure ulcers  
- Firas Sarhan
- 14:30 - 15:00 Sexuality  
- Debbie Green

15:00 - 15:30 Break

**Session 4**

- 15:30 - 17:30 Themed Group Work  
- All
- 17:30 - 18:00 Summary and Close  
- Maureen Coggrave

**Discipline Specific Workshop  
for Psychologist,  
Community Workers and  
Social Workers  
Lecture Hall - III  
0900 hrs - 1800 hrs**

- Chairpersons** Dr. Daniel Rohe & Dr. Divya Parashar
- 09:00 - 09:30 Recent Updates on Sexuality & SCI - Dr. Stanley Ducharme
- 09:30 - 10:00 The Power of Peer Counseling: Supporting Health and Successful Living post-SCI  
- Shivjeet Singh Raghaw
- 10:00 - 10:30 Tools for Instilling Realistic hope in Patients and their Families for Positive Lives after Injury  
- Ms. Vicky Sigworth

10:30 - 10:45 Discussion

10:45 - 11:15 Break

- Chairpersons** Ms. Vicky Sigworth & Dr. Komal Kamra
- 11:15 - 11:45 Development of Active Rehabilitation in people with SCI in Asian and African Countries  
- Tomasz Tasiemski
- 11:45 - 12:15 Challenges in assessing quality of life in people with SCI living in developing countries  
- Tomasz Tasiemski
- 12:15 - 12:45 Community Reintegration of People with SCI  
- Ms. Soni Lakra

12:45 - 13:00 Discussion

13:00 - 13:45 Break

- Chairpersons** Dr. Shashi Bhushan & Mr. Shivjeet Singh Raghaw
- 13:45 - 14:15 Personality & Vocational Interests of Males with Spinal Cord Injury: Implications for Psychosocial Interventions  
- Dr. Daniel Rohe
- 14:15 - 14:45 Chronic Pain in SCI: Assessment & Management  
- Dr. Divya Parashar
- 14:45 - 15:15 SCI and Substance Abuse: Implications for Clinical Practice  
- Dr. Manu Tiwary
- 15:15 - 15:45 Adjustment following Spinal Cord Injury  
- Bandna Rekhi

15:45- 16:00 hrs Discussion		11:00 - 12:30	<ul style="list-style-type: none"> <li>• Promoting Healthy Lifestyle after SCI - Auditorium, ISIC</li> <li>• Therapy after hand surgery - Meeting Room - A</li> <li>• Hydrotherapy for people with SCI - Gym/Pool</li> </ul>
16:00 - 16:15 hrs Break		12:30 - 13:30	Break
Chairpersons	Shivani Gupta & Prof. Tasiemski	13:30 - 15:00	<ul style="list-style-type: none"> <li>• Respiratory Management - Auditorium, ISIC</li> <li>• Teaching students on clinical placements - Meeting Room - A</li> <li>• Treadmill Training - Gym/Pool</li> </ul>
16:15 - 16:45	Role of the Social Worker in SCI Management - Simi	15:00 - 15:30	Break
16:45 - 17:15	Women with SCI: Management and Mainstreaming - Komal Kamra	15:30 - 17:00	<ul style="list-style-type: none"> <li>• Cardiovascular Fitness Training - Auditorium, ISIC</li> <li>• Incorporating ICF into practice - Meeting Room - A</li> <li>• Sports in SCI - Gym/Pool</li> </ul>
17:15 - 17:45	Useful, Social, & Employable: The role of Assistive Technology Applications in Improving Overall Quality of Life for People with SCI - Jyoti Vidhani		
17:45 - 18:00 Discussion			
<h3>Discipline Specific Workshop for Physiotherapists</h3> <p>0800 hrs - 1700 hrs</p>			
08:00 - 08:30	Welcame & introduction to SCIPT - Auditorium, ISIC		
08:30 - 09:00	Clinical Practice Guidelines		
09:00 - 09:15 Room Swap			
09:15 - 10:45	Training programme for the upper extremity - Auditorium, ISIC <ul style="list-style-type: none"> <li>• PT management of kids &amp; adolescents with SCI</li> <li>• Meeting Room - A</li> <li>• Treadmill Training - Gym/Pool</li> </ul>		
10:45 - 11:00 Break			



Day 3, Wednesday November 3, 2010

Discipline Specific Workshop  
for Physiotherapists  
Auditorium, ISIC  
0815 hrs - 1700 hrs

- 08:15 - 09:45
- An Overview of Physiotherapy Mx of SCI For the novice - Auditorium, ISIC
  - Contracture Management - Meeting Room - B
  - Bed Mobility Training - Meeting Room - A/ Gym/Pool

09:45 - 10:00 Room Swap

- 10:00 - 10:45
- Whirlwind global tour - Auditorium, ISIC

10:45 - 11:00 Break

- 11:00 - 12:30
- Training & assessing impairments: For the novice - Auditorium, ISIC
  - Outcome measures for the therapist - Meeting Room - B
  - Transfer Training - Meeting Room - A/Gym/Pool

12:30 - 13:30 Break

- 13:30 - 15:00
- International standards for Neurological Classification of SCI - Auditorium, ISIC
  - Managing the painful shoulder - Meeting Room - B
  - A bite size of everything - Meeting Room - A/ Gym/Pool

15:00 - 15:30 Break

- 15:30 - 17:00
- Orthotic Gait - Auditorium, ISIC
  - Pressure Management - Meeting Room - B
  - Setting up SCI therapy services in challenging settings - Meeting Room - A/ Gym/pool



## **ISCOS EXECUTIVE & COMMITTEES**

---

### **Executive Officers**

#### **The President**

Mr W El-Masry

#### **The Honorary Secretary**

Shinsuke Katoh, MD, PhD

#### **The Honorary Treasurer**

Mr M McClelland (UK)

#### **The Editor of SPINAL CORD**

Prof J J Wyndaele

#### **President Elect**

Prof Fin Biering-Sørensen

### **Non-Executive Officers**

#### **Vice Presidents**

Africa: Dr R Campbell (South Africa)

Europe: Dr S Aito (Italy)

Latin America: Dr J M D'Andrea Greve (Brazil)

North America: Dr Marcalee Sipski (North America)

Oceania: Dr S Engel (Australia)

SE Asia: Dr F Hoque (Bangladesh)

#### **The Committee Chairs**

Education: Dr H S Chhabra (India)

Nominations: Mr W El-Masry (UK)

Prevention: Dr D Brown (Australia)

Scientific: Dr S Charlifue (USA)

#### **Corresponding Secretaries**

##### **China**

Prof Dajue Wang

##### **Japan**

Dr Shinsuke Katoh

Scientific Secretariat

Marianne Bint (Stoke Mandeville, UK)

## ***AFFILIATED SOCIETIES OF ISCOS***

---

American Paraplegia Society (APS)

American Spinal Injury Association (ASIA)

Asian Spinal Cord Network (ASCoN)

Association Francophone Internationale des Groupes d'Animation de la Paraplégie (AFIGAP)

Australian and New Zealand Spinal Cord Society (ANZSCoS)

Chinese Association of Rehabilitation of Disabled Persons - Society of Spinal Cord Injury (CARDP - SoSCI)

Deutschsprachige Medizinische Gesellschaft für Paraplegie (DMGP)

Dutch Flemish Spinal Cord Society (DUFSCoS)

Japan Medical Society of Spinal Cord Lesions (JASCoL)

Latin American Society of Paraplegia (SLAP)

Nordic Spinal Cord Society (NoSCoS)

Romanian Spinal Cord Society (RoSCoS)

Società Medica Italiana di Paraplegia (SoMIPAR)

Southern African Spinal Cord Association (SASCA)

Spanish Society of Paraplegia (SEP)

Spinal Cord Society - Indian Chapter

Turkish Society of Spinal Cord Diseases (TrSCD)

## Representatives of ISCoS Affiliated Societies

AFFILIATED SOCIETIES	Representatives on Council of ISCoS
AFIGAP	Dr Brigitte Perrouin-Verbe (France)
APS	Dr I Lanig (USA)
ASIA	Dr L Vogel (USA)
ANZSCoS	Dr T Geraghty (Australia)
ASCoN	Dr F Hoque (Bangladesh)
CARDP-SoSCI	Prof D Wang (UK)
DMGP	Dr med Frank Rainer Abel
DUFSCoS	Dr G Snoek (Netherlands)
JASCoL	Dr S Katoh
NoSCoS	Dr S Yngvason (Iceland)
SASCA	Dr E Baalbergen (South Africa)
RoSCoS	Dr Gelu Onose (Romania)
SEP	Dr Jesus Benito (Spain)
SLAP (Brazil)	Dr Julia Maria D'Andrea Greve
SoMIPAR	Dr C Pilati (Italy)
Spinal Cord Society – Indian Chapter	Dr H S Chhabra (India)
TrSCD	Dr Mufit Akyüz (Turkey)

**ISCoS Scientific Committee-**

---

Dr S Charlifue (Chairman)

Aito, Dr S

Baalbergen, Dr E

Biering-Sorensen, Dr F

Dr D Brown(Chair Prevention Committee)

Prof A Catz

Dr H Chhabra (Chair Education)

Ditunno, Dr J

El-Masry, Mr W (President)

Frankel, Prof H L

Dr S Katoh (Honorary Secretary)

Mr M McClelland (Honorary Treasurer)

Dr G Savic

Steeves, Dr J

Wyndaele, Prof JJ (Editor)

## ISCoS Prevention Committee

---

Brown, A/Prof D J (Chair)

Acland, Dr R

Alto, Dr S

Prof F Biering-Sorensen

Campbell, Dr R

2008 Meeting Representative

Charlifue, Dr S

Chair Scientific Committee

Chhabra, Dr H

Chair Education Committee

Dr W Donovan

El-Masry, Mr Wagih

President

Dr M Fitzharris

Frankel, Prof H L

Garcla Reneses, Dr J

Katoh, Dr S

Honorary Secretary

Knutsdottir, Sigrun

Lee, Dr Bonne

McClelland, Mr M

Honorary Treasurer

Middleton, Dr J

Dr Herndon Murray

Ohry, Prof Avi

Pagliariacci, Dr C

2009 Meeting Representative

Shrosbree, Dr R

Wang, Prof D

Mr E Weerts

Wing, Mr Peter

Wyndaele, Prof J J

Editor

## ISCoS Education Committee

---

Dr H Chhabra  
Chair

Aito, Dr S  
2009 Meeting Representative

Brown, Dr D  
Prevention Chair

Charlifue, Dr S  
Scientific Chair

Dollfus, Dr Paul

El-Masry, Mr Wagih  
President

Ms Debbie Green

Greve, Dr J M

Grossmann, Simeon P

Dr Lisa Harvey

Katoh, Dr S  
Honorary Secretary

Kovindha, Ass Prof Apichana

McClelland, Mr Martin  
Honorary Treasurer

Montero, Dr F

Muldoon, Mr S

Osman, Mr A

Dr M Priebe

Shrosbree, Dr Ray

Prof M Stoehrer

Wang, Prof Dajue

Dr J Wee

Weerts, Mr Eric

Wyndaele, Prof Jean-Jacques  
Editor



## **LOCAL ORGANIZING COMMITTEE**

<b>Patrons</b>	: Maj.H.P.S.Ahluwalia, Air Marshal A.S. Chahal
<b>Organizing Chairman</b>	: Dr. A.K. Mukherjee
<b>Organizing Secretary</b>	: H.S. Chhabra
<b>Home Scientific Committee</b>	: Dr. A.K. Mukherjee, Prof. Arvind Jayaswal, Dr. H.S. Chhabra, Prof. U. Singh, Dr. Vikas Tandon, Dr. Ankur Nanda
<b>Local Advisory Committee</b>	: Dr. Patrick Kluger, Dr. Fazlul Hoque, Capt. Dilip Sinha, Dr. D.K. Taneja, Dr. S. Rajasekaran, Dr. Ram Chaddha, Dr. Ajit Kumar Varma, Dr. Sudhir Kapoor, Dr. K.V.P. Singh, Dr. N.K. Agarwal, Mr. Eric Weerts, Dr. Apichana Kovindha, Prof. Than Toe, Dr. Nazirah Hasnan, Ms. Esha Thapa, Mr. Cyril Siriwardane, Dr. Mannan, Mrs. Maggie Muldoon, Mr. Stephen Muldoon, Dr. Rajendra Prasad

## **ORGANISING COMMITTEE**

<b>Conference Hall Set Up</b>	: Dr. Kalidutta Das, Dr. Vikas Tandon, Dr. Ankur Nanda, Dr. Gururaj, Dr. Vivek Mittal, Dr. Darshan Gautam, Dr. Nishit Patel, Dr. Amit Narain, Dr. Neeraj, Mr. Mohit Arora
<b>Reception Committee</b>	: Mr. Alok Rawat, Mr. P.K. Tripathi, Mrs. Chitra Kataria, Mr. Sanjeev Sharma, Mr. Junaid Akhtar, Mr. Shridhar Aggarwal
<b>Travelling and Transport Committee</b>	: Dr. Deepak Raina, Mr. A.K. Bedi, Mr. Rohit Kumar, Mr. Ashish
<b>Food and Beverages Committee</b>	: Mr. K.V. Uthaman, Dr. Sunil K. Khetrapal, Dr. Kalidutta Das, Mr. A.K. Bedi

<b>Stall and Exhibition Committee</b>	:	Mr. K.V. Uthaman, Dr. Anita Agarwal, Dr. Ritabh Mittal, Mrs. Chitra Kataria
<b>Registration Committee</b>	:	Mr. Alok Rawat, Ms. Shashi Rautela Ms. Amita Kashyap, Mr. Rajiv Kumar, Mr. Roshan Dhawan, Mr. Hoshiyar Singh, Mr. Sajan Govindan, Mr. Kishan Singh
<b>Conference Secretariat</b>	:	Ms. Shashi Rautela Ms. Sheetal Sharma, Ms. Amita Kashyap, Mr. Rajiv Kumar, Ms. Heema Gosain
<b>General Administration Committee</b>	:	Dr. Sunil K. Khetrapal, Dr. P H Mishra, Ms. Sugandh Ahluwalia, Dr. R.K. Khetrapal, Dr. Ritabh Mittal, Dr. Bhushan Naraini, Dr. Deepak, Dr. H.K. Mahajan, Dr. Amarjit, Sis. Neetu Maitra, Dr. P R Chauhan, Dr. A.K. Sarkar, Dr. Preeti, Dr. Smita Korde, Dr. Sunil Seth, Mr. Santosh Sharma, Sis. Usha Gopinath, Col. Bhimwal, Mr. Anokhe Lal, Mr. Satish
<b>Publication Committee</b>	:	Ms. Ishika, Ms. Shashi Rautela, Ms. Amita Kashyap, Ms. Heema Gosain, Mr. Rajiv, Dr. Vikas Tandon, Dr. Ankur Nanda, Dr. Gururaj, Dr. Vivek Mittal, Dr. Darshan Gautam, Dr. Nishit Patel
<b>Audio/Visual Committee</b>	:	Dr. Kalidutta Das, Mr. Vikram Bisht, Mrs. Sheetal Bhardwaj Mr. Avdesh Bhardwaj, Mr. Manoj, Mr. Mohit Arora,
<b>Media and Public Relations Committee</b>	:	Dr. Sunil K. Khetrapal, Dr. P H Mishra, Mr. Amit Kr. Jain, Ms. Shivika
<b>Access Committee</b>	:	Mr. Nekram Upadhyay, Mr. Shivjeet Raghav, Ms. Jyoti Vidhani, Mr. Rajeev Virat, Ms. Pragya Ghidiyal

# INTERNATIONAL SPINAL CORD SOCIETY

## Society Medal Holders

1975/1976:	Sir Ludwig GUTTMANN	{UK}	{Deceased}
	Dr Ernest BORS	{USA}	{Deceased}
1978:	Dr L MICHAELIS	{UK}	{Deceased}
	Sir George BEDBROOK	{Australia}	{Deceased}
1979:	Dr Marc MAURY	{France}	
1980:	Dr J S YOUNG	{USA}	{Deceased}
1981:	Dr A G HARDY	{UK}	{Deceased}
1982:	Prof Fred MEINECKE	{Germany}	
1983:	Pror Hans FRANKEL	{UK}	
1984:	Dr Y NAKAMURA	{Japan}	{Deceased}
1985:	Dr M WEISS	{Poland}	{Posthumously}
	Mr Phillip HARRIS	{UK}	
1986:	Dr H HAHN	{USA}	{Deceased}
1987:	Professor Alain ROSSIER	{Switzerland}	{Deceased}
1988:	Dr Al JOUSSE	{Canada}	{Deceased}
1989:	Mr J COSBIE ROSS	{UK}	{Deceased}
1990:	Dr Paul DOLLFUS	{France}	
1991:	Dr Ed CARTER	{USA}	
1992:	Dr A KEY	{South Africa}	{Deceased}
1993:	Air Marshal (Rtd) Amar CHAHAL	{India}	
1994:	Mr Isaac NUSEIBEH	{UK}	
1995:	Dr Avrom E COMARR	{USA}	{Deceased}
1996:	Dr Guido ZÄCH	{Switzerland}	
1997:	Prof Helmut MADERSBACHER	{Austria}	

## **Society Medal Holders**

1998:	Prof Takaaki IKATA	(Japan)
1999:	Dr William GEISLER	(Canada)
2000:	Prof John YEO	(Australia)
2001:	Prof J J Wyndaele	(Belgium)
2002:	Mr W EL MASRI	(UK)
2003:	Prof Giles BRINDLEY	(UK)
2004:	Prof William DONOVAN	(USA)
2005:	Dr Ray SHROSBREE	(South Africa)
2006:	Dr Lee Illis	(UK)
2007:	Dr Fin Biering-Sorensen	(Denmark)
2008:	Dr J Ditunno	(USA)
2009:	A/Prof D J Brown	(Australia)
	Dr P Meyer	(USA)

## INDIAN FACULTY

S. No.	Name
1	Dr. A K Singh,
2	Dr. U Singh,
4	Dr. Rajasekaran,
5	Dr. Sunil Katoch,
6	Dr. Rajendra Prasad,
7	Dr. Rana Patir,
8	Dr. P Sarat Chandra,
9	Dr. Gautam Zaveri,
10	Dr. Sudhir Kapoor,
11	Dr. Anil Jain,
12	Dr Shekhar Bhojraj,
13	Dr. Shankar Acharya,
14	Dr. Sajan Hegde,
15	Ms. Ketna Mehta,
16	Dr. A K Mukherjee,
17	Prof. Dinesh Mohan,
18	Dr. Abhishek Srivastava,
19	Dr Rajendra Sharma,
20	Dr Mrinal Joshi,
22	Dr Ram Chadha,
23	Dr. Mathew Verghese,
24	Col. S P Jyoti,
26	Capt. Dillip Sinha,
27	Dr. Saumyajit Basu,
29	Dr. Surya Prakash Rao,
30	Dr. Harshwardhan Hegde,
31	Dr. Rajagopalan ,
32	Dr. Prashant Kekre,
33	Dr. Rushma Tandon,
34	Dr. K L Kalra,
36	Dr. Manoj Sharma,
37	Col V S Madan,
38	Dr. Mazhar Hussain,
39	Dr. Vikas Tandon,
40	Dr. Ankur Nanda,
41	Dr. Satish Rudrapa,
42	Mr. Shivjeet Singh Raghav,
43	Dr. Divya Parashar,
44	Mr. Nitin Goyal,

S. No.	Name
45	Dr. Sanjeev Sharma,
46	Dr. S Y Kothari,
47	Dr. Geeta Jotwani,
48	Dr. Arvind Jayaswal,
49	Dr. H N Bajaj
50	Dr. Yash Gulati
51	Dr. Priyank Sinha
52	Air Marshall A S Chahal
53	Dr. Dinesh Suman
54	Nalli Uvraj
55	Dr. H S Bhatoo
56	Dr. Charanjeet Sobti
57	Dr. H S Chhabra
58	Dr. Kalidutta Dass
59	Dr. R N Srivastava
60	Dr. Abrar
61	Dr. Pankaj Hariharn
62	Mr. Nekram Upadhyay
63	Swati Malik
64	Jyoti Vidhani
65	Sonia Goel
66	Ruby Aikat
67	Kriti Bedi
68	Nikunj Dhar
69	Maneesh Bhardwaj
70	Harleen Dhall
71	Gundeep
72	Anshu Bhalla
73	Dipika Rawat
74	Saket Giri
75	Neetu Maitra
76	Elvena Singh
77	Farahh Khan
78	Ms. Soni Lakra
79	Dr. Mannu Tiwari
80	Dr. Bandna Pekhi
81	Ms Komal Kamra
82	Prof. Gita Handa
83	Dr. S K Kame

## INTERNATIONAL FACULTY

S. No.	Name	S. No.	Name
1	Dr. Peter Wing,	46	Dear Mr. Wutian Wu,
2	Dr. Patrick Kluger,	47	Dear Mr. Wai-Sang Poon,
3	Dr. Wee Fu Tan,	48	Dr. Wise Young,
4	Mr. W S El Masry,	49	Dr. Azmi Hamzanglu,
5	Mr. Brian Garder,	50	Ms. Marcilee Alexander,
6	Dr. Hans Joseph Erli,	51	Ms. Suzy Kim,
7	Dr. Scott Paquette,	52	Doug Stevens,
8	Dear Prof. Bernhard Meyer,	53	Indira Lanig,
9	Dr. Naresh Kumar,	54	Claus Hulting,
10	Dr. Fazlul Hoque,	55	Mr. Stephen Muldoon,
11	Dr. Amiram Catz,	56	Dr. Razzak/
12	Dr. W Donovan,	57	Dr. Sohrab Hussain,
13	Dr. Ruth Marshall,	58	Kanak Mani Dixit,
14	Dr. Raj Singhal,	59	Dr. Abrar,
15	Dr. Sagun Tuli,	60	Mr. Jean-Francois Lemay,
16	Prof. Cody Bunger,	61	Mrs. Jennifer Howitt Browning,
17	Dr. Douglas Brown,	62	Dr. Thomas Oxland,
18	Dr. Anand Nene,	63	Dr. Tania Lam,
19	Dr. Brian Kwon,	64	Dr. Andrei Krassioukov,
20	Dr. Jake Timothy,	65	Dr. Stacy Elliott,
21	Mr. Eric Weerts,	66	Mr. Bill Barrable,
22	Mr. Ray Cripps,	67	Dr. Stanley Ducharme,
23	Dr. Bonne Lee,	68	Dear Claes Hulting,
24	Ms. Nguyen Thi Thao,	69	Dr. Mark Nigro,
25	Dr. Mike Fitzharris,	70	Dr. Claire Weeks,
26	Dr. Nazirah Hassan,	71	Ms. Debbie Green,
27	Dr. Apichana Kovindha,	72	Mr. Katoh,
28	Dr. Dajue Wang,	73	Ms. Cyril Siriwardane,
29	Dr. Herndon Murray,	74	Mr. Tomasz Tasilemski,
30	Prof Lisa Harvey,	75	Ms Reshma Parvin Nuri
31	Mr. Ralph Marino,	76	Ms. Susan Charlifue
32	Dr. Prof Robin Franklin,	77	Mr. M Mc Cleland
33	Dr. J J Wyndaele,	78	Dr. Lawrence Vogel
34	Mr. Gurpreet Singh,	79	Dr. Gilbert Leung
35	Mr. Inder Perakash,	80	Dr. Richrd Auckland
36	Dr. G Del Popolo,	81	Mrs. Maggie Muldoon
37	Dr. H Madersbacher,	82	Dr. Renee Mashke
38	Dr. M Stohrer,	83	Mrs. Sigrun Knutsdottir
39	Dr. Nobert Passuti,	84	Elma Burger
40	Mr. Jane Horsewell,	85	Firas Sarhan
41	Dr. Fin Biering-Sørensen,	86	Maureen Coggrave
42	Dear Mr. Wen,	87	Dr. Daniel Rohe
43	Dr. George Tharion,	88	Ms. Vicky Sigworth
44	Dr. John Steeves,	89	Dr. Meena Aggarwal
45	Dr Sergio Aito,		

# ABSTRACTS





# LUDWIG GUTTMAN LECTURE

## REVIEW

### Ethics, health care and spinal cord injury: research, practice and finance

WH Donovan<sup>1,2</sup>

*1Physical Medicine and Rehabilitation, University of Texas Health Science Center-Houston, Houston, TX, USA and 2The Institute for Rehabilitation and Research, Houston, TX, USA*

Dating back to ancient times, mankind has been absorbed with 'doing the right thing', that is, behaving in ways approved by the society and the culture during the era in which they lived. This has been and still is especially true for the medical and related health-care professions. Laws and professional codes have evolved over the years that provide guidelines as to how physicians should treat patients, beginning with the one authored by Hippocrates. Only more recently, however, have laws and codes been created to cover health-care research and the advances in health-care practice that have been brought to light by that research. Although these discoveries have clearly impacted the quality of life and duration of life for people with spinal cord injury and other maladies, they have also raised questions that go beyond the science. Questions such as when, why, how and for how long should such treatments be applied often relate more to what a society and its culture will condone and the answers can differ and have differed among societies depending on the prevailing ethics and morals. Modern codes and laws have been created so that the trust people have traditionally placed in their healers will not be violated or misused as happened during wars past, especially in Nazi Germany. This paper will trace the evolution of the rules that medical researchers, practitioners and payers for treatment must now follow and explain why guiding all their efforts that honesty must prevail.

Spinal Cord advance online publication, 14 September 2010;  
doi:10.1038/sc.2010.106

Keywords: ethics; morals; health care (research, practice, finance); abortion; euthanasia; academic integrity and spinal cord injury

Correspondence: Professor WH Donovan, Physical Medicine and Rehabilitation, University of Texas Health Science Center-Houston, The Institute for Rehabilitation and Research, 1333 Moursund Avenue, Houston, TX 77030, USA.  
E-mail: William.Donovan@memorialhermann.org  
Received 16 April 2010; revised 23 June 2010; accepted 14 July 2010

## Introduction

I am obliged to say at the outset that like most physicians, I am not an ethicist by formal education. In fact, a review of the literature on medical ethics reveals that most authors are not physicians. So I merely bring a perspective of a practicing physician, engaged in clinical research in an academic environment.

Ethics has become a requisite for researchers conducting research with human (as well as animal) subjects in most universities and medical schools throughout the world. Although we now have codified ethical principles to follow in medical research and practice, there are still many areas that come down to using good judgment and common sense in applying these principles.

In researching this subject, I was amazed how many theories have been advanced from ancient times to the present, many conflicting, depending on a number of factors. Although reading these diverse opinions, I was reminded of some similarities ethics shares with economics.

In 1977, soon after Jimmy Carter was elected president of the United States, he decided to convene and chair a meeting of the world's most learned economists in Washington DC in an effort to formulate a plan that would steer the country away from a financial crisis.

After the first exhaustive day of meetings, Walter Cronkite (1916–2009), reporting the evening news, called on Eric Severeid (1912–1992) to comment on the proceedings. Severeid began his remarks by recalling a previous similar meeting where it soon became clear that there were only two men in the world who really had a complete, comprehensive grasp of the topic of economics. One was British and the other French. 'What did they say?' Cronkite asked. 'They disagreed' replied Severeid.

If you Google the word 'ethics' the search engine will yield over 65 million entries. Obviously, it is a topic that has inspired many minds throughout the ages, from before Socrates (ca 469–399 BC) to the present day and demonstrates that over the millennia, mankind has been absorbed with 'doing the right thing'.<sup>1</sup>

Any analysis of the works of those who have contributed to the literature on ethics is beyond the scope of this lecture. However, such philosophers include:

Plato (ca 427–347 BC), Aristotle (384–322 BC), Epicurus (341–270 BC) Marcus Aurelius (121–180 AD), Augustine (354–430 AD) Thomas Aquinas (1225–1274), Francesco Petrarch (1304–1374), Thomas

Hobbes (1588–1679), Rene Descartes (1596–1650), Baruch Spinoza (1630–1674), John Locke (1632–1704), David Hume (1711–1776), John Gregory (1724–1773), John Stuart Mill (1806–1873) and Immanuel Kant (1724–1804).<sup>2</sup>

In more modern times, names such as Karl Marx (1818–1883), Friedrich Nietzsche (1844–1900), James Joyce (1882–1941), Louis Althusser (1918–1990) and Roland Barthes (1915–1980) among many others have written about ethics in the secular realm.<sup>2</sup>

In the spiritual realm, religions have carved moral pathways from books that believers avow are divinely inspired: for Christians the Bible, for Muslims the Koran, for Jews the Torah and Tenach, for Hindus the Vedas. Other religions have their holy books as well.<sup>3</sup>

It appears that the authors of these treatises and texts are searching for answers to various questions that amount to ‘what is the right way to think and behave’ in the face of all the vicissitudes of life. The fact that there have been so many proposed theories and doctrines, often conflicting, suggests that mankind, in the pursuit of the virtuous life, has focused not only on theories and doctrines per se but used them to reach a consensus on what is and what is not acceptable behavior in the society and the culture in which the people involved live. Throughout most of history, that ‘consensus’ was imposed by a monarch or ruler of some sort, by fiat. Today, in democracies, the rules or laws are created by the people through their elected representatives. As Thomas Jefferson (1743–1826) proclaimed to George III of England (1760–1820) in the American Declaration of Independence, governments derive ‘their just powers from the consent of the governed’. As the ‘governed’ are seldom of one mind, the rules and laws in democratic governments reflect what the majority within the society believes is right or ethical and all agree to abide by those rules or seek to change them through the political process.

In like manner, the medical and other health-care professions also have created their own rules of behavior as to what is and what is not ethical within their nation or society. Before I relate how we, in these professions got to where we are today, let me suggest a perhaps novel distinction between ethics and morals, and between laws and codes.

Most texts define and use the words ethics and morals interchangeably, the former being derived from Greek and the latter from Latin.<sup>4</sup> Although both have as their

purpose that of guiding us to act in ways that are good and to refrain from evil, I would suggest that they differ in their mutability.

By that I mean ethics is tied to societal and cultural norms. Therefore, what is considered ethical in one time and place may be unethical in another. For example, among certain tribes in Asia and Africa 'female circumcision' or excision of the clitoris and labia minora is considered ethical while the rest of the world recoils and considers it not only unethical but mutilating. As another example, from the time of Hippocrates (ca 460–370 BC) and before, until recent years, abortion was considered unethical.<sup>5–8</sup> Now many regard it as ethical. So to some extent what is considered ethical is a reflection of current attitudes of a majority within a society.<sup>9</sup>

Morals or morality on the other hand, I would suggest, in current parlance, is tied to a belief system. Using abortion again as an example, to believers of many faiths including Catholic, Orthodox, and Evangelical Christianity, Orthodox Judaism, Islam, Traditional Buddhism, Hinduism and others, the era or prevailing opinion do not matter; abortion remains (with narrow exceptions, for example, saving the mother's life) immoral. Those who adhere to such belief systems believe their rules or doctrines are divinely inspired and are codified in scripture and confirmed by tradition. Therefore, their views are more refractive to change; for 'how can God be wrong'?

Laws, regardless as to how they are derived, are written rules and also direct us to behave in 'right' or acceptable ways. Failure to abide carries a punishment. Codes, while also written rules, generally apply to specific groups and are agreed on guidelines that apply to that group, for example, the medical profession. Punishment may or may not be attached to infractions. Both are reflections of the ethics and morals that the society or the groups have agreed to abide by.

In a theocratic nation, for example, Iran, or a group like a religious order, these distinctions are blurred, but in a society governed by the 'separation of church and state', the ethics of the majority may differ from the morals of some individuals. In a civil society, if the latter seek to change the prevailing behaviors that the majority considers ethical, they may do so, employing tactics such as debates, essays, blogs, and so on (but never violence) in an effort to persuade the majority to change the relevant laws and/or codes.

This paper will trace the evolution of the codes and laws that have impacted the medical and health-care professions and guided them in ethical ways namely, health-care research and health-care practice and comment briefly on how health care is financed.

## Health-care research

Evolution of the codes of ethics involving research adopted by the medical profession and subsequently by other health professions includes: the Nuremberg Code, the Declaration of Helsinki, the Belmont Report and the Code of Federal Regulations (CFR).

Of these, the Nuremberg Code has the unique role as being the first to clearly define in writing the ethical conduct expected of the medical profession when conducting research on human subjects and also has the richest history. Accordingly, I give it the most attention.<sup>10</sup>

The first of 12 trials of perpetrators of Nazi atrocities, the Doctors' Trial, began in Nuremberg, 9 December 1946 as a military tribunal. Chief Counsel of war crimes, Brigadier General Telford Taylor (1908–1998) and the chief prosecutor for the medical case, James M McHaney (1919–1995), thought their task would be easy, given the egregious disregard for human life shown by the Nazi doctors during their experiments. All they had to do was show that the research conducted by the doctors in Nazi concentration camps transgressed the documented rules for human experimentation followed by the medical profession at large. What made his task in fact rather difficult was that there were no such documents. The Hippocratic Oath, the 1803 Code of Medical Ethics authored by the British physician, Thomas Percival (1740–1804),<sup>11</sup> which was inspired by the works of John Gregory and David Hume<sup>6</sup> and the 1847 American Medical Association (AMA) Principles of Ethics,<sup>12</sup> which incorporated much of Percival's work,<sup>7</sup> dealt with research only vaguely or not at all. In fact, General Taylor discovered that many physicians opposed the creation of specific rules because they felt it would hinder medical research. Nevertheless, a committee (which never met before the trial) was quickly named by Andrew C Ivy, MD (1893–1978) one of the prosecution's medical expert witnesses, and conclusions composed by Dr Ivy concerning the proper conduct of medical research were presented at trial.<sup>10,13</sup>

In the end, 16 of 23 defendants (20 of whom were physicians) were convicted and 7 were executed.<sup>14</sup> At the conclusion of the trial, the three judges produced a 10-point document that became known as the Nuremberg Code.<sup>15,16</sup> This document thoroughly repudiated the concepts of Nazi medicine that were based on the pseudoscience of eugenics, social Darwinism, 'racial hygiene' and other theories of Aryan supremacy that led to making the State the 'patient' rather than the person the patient. In other words, if the interests of the State conflicted with the interests of the individual, the State prevailed. Nearly 50% of German physicians were members of the Nazi party in 1942 and accepted the idea that involuntary sterilization, involuntary euthanasia and extermination of the 'sub-human population' (that is, Jews, gypsies,

Slavs, homosexuals, communists, the disabled and even some intellectuals) could be used to 'purify' the population and the State.<sup>17,18</sup> It should be noted, however, that such ideas of Aryan supremacy existed in many areas outside Nazi Germany at the time.<sup>19–21</sup>

As the code was not law, many investigators initially ignored it, but over the years, it served as the foundation for the regulations that medical investigators are ethically and legally bound to follow today. Its essential ingredients include: (1) 'the voluntary consent of the human subject is essential'. No coercion, no deceit, full explanation of risks and benefits by the investigator(s); (2) the expectation of gaining useful knowledge; (3) thorough preliminary studies; (4) avoidance of unnecessary suffering or injury; (5) no expectation of death or injury; (6) risks must not exceed benefits; (7) proper facilities are required; (8) only qualified investigators allowed; (9) subject(s) can withdraw at any time; and (10) investigator must terminate the study if harm seems likely.<sup>16</sup>

These principles were written before the birth of bioethics and antedate by 20 years the doctrine of informed consent in the practice of medicine.<sup>10,22</sup>

In 1964, the World Medical Association adopted the Declaration of Helsinki that was also based on the Nuremberg Code with some modifications.<sup>23,24</sup> It has subsequently undergone six revisions.<sup>25</sup> The first revision introduced the concept of independent oversight committees, which evolved into a system of institutional review boards in the United States and ethical review boards (committees) in other countries.<sup>26</sup> Regulations governing institutional review boards (IRB) came into effect in the United States in 1981 as a result of the Belmont report (see below).

The fourth and subsequent revisions have remained controversial and are no longer followed by the Food and Drug Administration (FDA) in the United States nor by the European Union since 2000.<sup>27</sup> Instead, they and other countries have adopted the 'Good Clinical Practices', an international set of quality standards provided by the International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH) in 2008.<sup>28</sup>

The Belmont Report, issued by the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research (1974–1978) and also known as 'Ethical Principles and Guidelines for the Protection of Human Subjects of Research' arose from the revelation that the Tuskegee Syphilis Study, conducted at Tuskegee University in Alabama between 1932 till 1972 when it was abruptly halted, had withheld penicillin from African-American subjects although it had been recognized as the standard treatment for syphilis since 1947.<sup>29</sup> The Belmont Report declared three

fundamental ethical principles that should be adhered to when human subjects are used in research: (a) autonomy: that is, respect for all persons, protecting them, treating them with courtesy, respecting their values and beliefs and requiring informed consent;<sup>4</sup> (b) beneficence: maximizing benefits for the research subjects while minimizing risks to them; (c) distributive justice: ensuring that reasonable, non-exploitative and well-considered procedures are administered fairly, with equity, that is, the fair distribution of costs and benefits to potential research participants while refraining from treating different populations, for example, rich and poor, differently.<sup>6</sup> This report remains an essential reference for IRB's today.<sup>30</sup> It is also a significant component of what is today the CFRs.

In 1991, 15 US Federal Departments and Agencies adopted the Federal Policy for the Protection of Human Subjects also known as the Common Rule or 45 CFR 46 of the Department of Health and Human Services regulations. 45 CFR 46 or Title 45 (Public Welfare) CFR Part 46 (Protection of Human Subjects), contains the rules and guidelines that must be followed by all health researchers in the United States today. It is the culmination of all the previous work and contains additional provisions for pregnant women, human fetuses, neonates, prisoners and children that are all deemed particularly vulnerable. 45 CFR 46 also clearly specified the duties of IRB's including the vetting and monitoring of research projects. It is now law in the United States and is required reading for all investigators in the field of human research, including especially, translational research.<sup>31,32</sup>

Recently, the International Campaign for Cure of Spinal Paralysis (ICCP), drawing on the above codes and laws, published a series of four white papers directed specifically at the topic of human research aimed at reversing the damage caused by spinal cord injury (SCI). They contained the recommendations of recognized leaders in the field and addressed the subject of ethics in such research along with the principles of randomization, 'blinding', appropriate inclusion and exclusion criteria as well as the generally accepted principles contained in the Belmont report and the other documents listed above. On the subject of ethics they began by saying 'a study involving risks to human subjects cannot be ethically defensible if it is not scientifically defensible.' (I would submit that the converse is also true.) They then expanded on the ethics concerning placebo and sham controls, clear explanation of risks versus benefits, fetal and stem cell research, clinical trials in developing countries and compassionate use protocols.

Finally, the articles expressed caveats to health-care providers and their patients against the lures of procedures currently offered at high prices that despite their claims have demonstrated neither safety nor efficacy in accordance with the rigorous process now accepted by the scientific community.<sup>33-36</sup>

I frequently tell my patients, if or when someone demonstrates a cure for SCI, there is no way it could be kept a secret. The fact that the claims of partial or complete reversals of SCI by entrepreneurs are not accepted by reliable investigators is caveat enough to discourage 'medical tourism'.

## Health-care practice

This brings us to the ethics concerned with the practice of medicine and other health-care professions. Evolution of the codes of ethics involving these professions include the Hippocratic Oath, the most recognized of many medical oaths;<sup>5,37,38</sup> the works of John Gregory (often referred to as the founding father of modern Western medical bioethical principles) and Thomas Percival;<sup>6,7,39</sup> the Declaration of Geneva; adoption of the principles of the Belmont Report into clinical practice, namely, respect/autonomy, beneficence and justice to which some have added non-maleficence, that is, avoidance of doing harm;<sup>40</sup> the creation of ethics committees in hospitals and other health-care facilities and the creation of the Code of Medical Ethics by the AMA.<sup>41</sup>

Hippocrates is said to have lived between 460 and 370 BC on the island of Cos. His oath has undergone many modifications over the years.<sup>37</sup> If Hippocrates were here today, he would likely be unable to identify the versions currently administered as anything like his own. The original version translated into English<sup>5</sup> consists of eight brief statements:

- (1) I swear by Apollo, the healer, Asclepius, Hygieia and Panacea, and I take to witness all the gods, all the goddesses, to keep according to my ability and my judgment, the following Oath and agreement (that is, invoking deities for a more powerful and solemn promise).
- (2) To consider dear to me, as my parents, him who taught me this art; to live in common with him and, if necessary, to share my goods with him; to look upon his children as my own brothers, to teach them this art (that is, respect for mentors and teach students).
- (3) I will prescribe regimens for the good of my patients according to my ability and my judgment and never do harm to anyone. (that is, patient comes first; protect him/her). Note: the words 'primum non nocere -first do no harm', which are often incorrectly ascribed to the Hippocratic Oath, are not used.
- (4) I will not give a lethal drug to anyone if I am asked, nor will I advise such a plan; and



similarly, I will not give a pessary to cause an abortion. (that is, euthanasia and abortion are proscribed). Note: Hippocrates recognized that there were certain cases when abortion was absolutely necessary (to save the mother's life) and knew how to proceed.<sup>42</sup>

- (5) But I will preserve the purity of my life and my arts. I will not cut for stone, even for patients in whom the disease is manifest; I will leave this operation to be performed by practitioners, specialists in this art (that is, lead a virtuous and exemplary life and know one's limits).
- (6) In every house where I come I will enter only for the good of my patients, keeping myself far from all intentional ill-doing and all seduction and especially from the pleasures of love with women or with men, be they free or slaves (that is, never use one's position to gain favors).
- (7) All that may come to my knowledge in the exercise of my profession or in daily commerce with men, which ought not to be spread abroad, I will keep secret and will never reveal (that is, maintain confidentiality).
- (8) If I keep this oath faithfully, may I enjoy my life and practice my art, respected by all men and in all times; but if I swerve from it or violate it, may the reverse be my lot (that is, rewards for good practices but punishment for bad).

It is easy to see how much of this oath, now about 2500 years old, still applies today and also how some of it has changed as ethics, itself has changed over time and among different cultures.

These changes were codified by the World Medical Association, an international group of the medical societies of different nations, at a meeting in Geneva, Switzerland in 1948, 1 year after the publication of the Nuremberg Code. The first document, the Geneva Declarations, updated the Hippocratic Oath to conform with modern language.<sup>43</sup> It has been subsequently amended five times.<sup>44</sup> It is a declaration of physicians' dedication to the humanitarian goals of medicine. This was felt to be especially important in light of the medical crimes that had been committed in Nazi Germany where nearly 50% of all practicing physicians were members of the Nazi party.<sup>45,46</sup> In the latest 2006 version, the subjects of euthanasia, abortion and using influence to gain favors have been removed along with references to a deity. Added are pledges to not discriminate on the basis of 'age, disease or disability, creed, ethnic origin, gender, political affiliation, race, sexual orientation, social standing or any other factor'; also added is a pledge 'not to use one's medical knowledge to violate human rights and civil liberties, even under threat'. The product has been criticized as being

more vague and general and straying from the Hippocratic Oath, although it contains more items; 11 compared with 8. In concept and approach, the Declaration of Geneva drew on the World Health Organization (WHO) Constitution<sup>47</sup> and the 1948 United Nations Universal Declaration of Human Rights.<sup>32,48</sup>

The first recorded administration of the Hippocratic Oath in a medical school setting was at The University of Wittenberg in Germany in 1508. It became part of a graduation ceremony for the first time in 1804 in Montpellier, France. By 1928, only 19% of medical schools in North America included an oath as part of their commencement exercises. After World War II, this progressively increased because of the Nazi atrocities.<sup>49</sup>

By 1993, 98% of 157 medical schools in the United States and Canada administered some form of Oath but only 1 used the original Hippocratic Oath while 68 used some version of it. All of those schools using oaths contained a pledge of commitment to patients, only 43% contained a vow to be accountable for one's actions, 14% included a prohibition against euthanasia, 11% invoked a deity, 8% prohibited abortion and only 3% prohibited sexual contact with patients, something that I daresay Hippocrates and John Gregory would have found surprising.<sup>4,7,50,51</sup> The study has not been repeated recently.

The physician of today, however, regardless of the kind of pledge, he or she does or does not make on graduation, enters a milieu wherein acceptable and unacceptable patterns of behavior are now more clearly identified. Owing to the documents cited earlier, particularly the Belmont Report that targeted medical research but apply to medical practice as well, namely autonomy, beneficence and justice, many nations have developed position papers on topics that fall within the ambit of these principles. For example, in the United Kingdom, the General Medical Council provides clear overall guidance in the form of its 'Good Medical Practice' statement.<sup>52</sup> In the United States, the AMA's Council on Ethical and Judicial Affairs (CEJA) has produced the 'Code of Medical Ethics'.<sup>53</sup>

Documents such as these provide guidance for practitioners, primarily physicians practicing in these countries. The British version addresses such issues as (a) euthanasia and related topics such as complex end of life issues including relief of suffering; the so called 'double effect' in which a drug such as morphine may relieve pain, but suppress respiratory drive; 'futile care' in which prolonging life only prolongs suffering with no hope of recovery; (b) confidentiality, and related topics such as notification of authorities if a physician believes the patient is about to do harm to him/herself or another; parental notification; (c) conflicts of interest and related topics, for example, referrals, vendor relationships, business practices and truth

telling. It also emphasizes the importance of ethics committees.

The AMA publication goes even further, providing ethical guidance based on Council opinions and case law on many topics. In over 200 pages, it deals with seven basic principles that should govern a physician's behavior: (1) competence and compassion, (2) honesty and patient protection, (3) patient advocacy, (4) confidentiality and patient rights, (5) physician continuing education, consultation when needed, patient education, (6) freedom for the physician to choose with whom to serve and associate and (7) community service. Within that framework, eight chapters deal with council opinions and judicial rulings on (1) social policy, including abortion, futile care, capital punishment, organ donation, euthanasia and physician-assisted suicide among others; (2) professional relations dealing with allied health professions; (3) hospital relations including contractual relations, billing for house staff and student services; (4) confidentiality, advertising and media relations including most of the areas addressed in the Health Insurance Portability and Accountability Act; (5) fees and charges including fee splitting, professional courtesy; (6) record keeping; (7) practice matters including consultations, conflict of interest, gifts from industry, informed consent, termination of the doctor-patient relationship, among others and; (8) professional rights and responsibilities including ethics committees, medical testimony, caring for the poor among others. Many examples are offered with explanations as to how decisions were reached by the council or the courts. It is a very useful document for practitioners in dealing with complicated issues and for ethics committees to help guide their deliberations.<sup>53</sup>

These documents have helped answer the concern expressed by Pellegrino in 1976 that physicians were becoming so absorbed with technology and reimbursement that humanistic values and 'sympathy', as described by Hume, and honesty and non-paternalistic treatment as described by Gregory and Percival, were becoming lost.<sup>6,39,54</sup>

## Health-care financing

The ethical considerations attached to how medical care is financed, is equally relevant for consumers and providers. Methods of payment vary throughout the world but basically are:

- (a) Direct payment from the patient to the provider.
- (b) Government payment for part or for all costs.
- (c) Private third-party insurance payment for part or for all costs.<sup>55</sup>

Although direct payment may be feasible for all costs if the cost is 'affordable', it can

easily be beyond the reach of consumers as costs rise and more care is required. So, most people require help from the government or private insurance beyond a 'deductible' or 'co-pay'.

The principle behind health insurance, like other insurance is: you pay a premium you can afford for a service you hope you'll never need so that if you ever do need it, you can have it at a cost you can afford. Unlike sweepstakes, it is the unlucky ones who get to take out more than they put in, thereby avoiding financial ruin. In order to have the resources to meet the needs of the 'unlucky ones' with big health-care costs, there must be a sufficiently large number of 'lucky' consumers with no or low health-care costs in order to keep premiums low enough for everyone to afford. For those locations and populations where the government pays the provider, the government can manage the required premiums or contributions by taxing the entire citizenry and by limiting what it pays providers and what treatments it will pay for.

For those locations where private insurance exists or co-exists with government, premiums can also be managed by raising or lowering them, by limiting payments to providers, by refusing or discontinuing those patients deemed to be high risks of loss, by steering patients to providers who provide less care or provide care for less cost and in addition, by using capital raised from 'good' investments to offset the needs to raise premiums. However, this last option can work the opposite way in bad times.

Ethical questions arise when private insurers, including those working as 'intermediaries' or essentially contracted administrators for the government, must decide to authorize or not, payment for treatments that providers say is necessary. Denial of such authorizations are common nowadays in some countries and raise concerns when requests for new medications, durable medical equipment, quality of life enhancing treatments and even some surgical procedures are denied by insurers and their company medical advisors, often on the grounds that there is a lack of medical necessity, although these advisors are often considerable distances away from the patient and have never seen much less examined him/her or spoken with the family.<sup>56-59</sup>

It becomes necessary to recognize a dichotomy in the application of insurance. To the provider, the patient's interests come first. To the insurer, the patient's interests must be weighed against the company's interests, which include other patients' claims and profits for employees, investors and executives.

In addition, providers are bound by oaths, codes and laws to put the patient's interest first not the 'State's' or the payer's. Insurers are not. Although the government is also not thusly bound, the money 'saved' from the denials by private insurers follows a

different path from that of governments. When providers and the public see the profits of the insurers, particularly when they are deemed excessive, go to company executives and investors instead of being used to lower premiums, cover high-risk consumers and provide authorizations for needed treatments, they cannot help but conclude there is a conflict of interest and question the ethics of those companies, particularly if their medical consultants are paid based on the number of requests they deny. I hasten to add this behavior does not proceed from all insurers but happens enough from some to raise concerns and forces the public's attention on the thorny issue of the rationing of care. Many nations already live with the fact that despite respect for patient autonomy and beneficence, payment for some aspects of care cannot be afforded. Although difficult, this can be more readily accepted if the principle of distributive justice has been applied equally to all, avoiding unfair selectivity ('cherry picking') and discrimination by payers and providers.<sup>4,60,61</sup>

But on the other hand, when providers overcharge or engage in fraudulent behavior when billing the government or the insurance company, their breach of ethics is just as serious as the payer's and may also break the law. And finally, when consumers try to persuade providers to prescribe things they don't really need and would not purchase even if they could afford them if they had to pay for it themselves, this also raises questions about a breach of ethics on their part.

It seems clear then, that honesty in regard to complaints, care and compensation would solve many issues related to ethics in health care, a point made by John Gregory over 200 years ago.<sup>39</sup>

## **Relation of the foregoing to SCI**

Among the many topics in these documents that fall within the ambit of medical ethics, I have chosen three that have special relevance nowadays to the field of SCI: (a) abortion because of the issue of the use of human embryonic stem cells in research; (b) euthanasia because of the issue of the value of life and quality of life for the disabled and elderly and; (c) academic integrity because of the hope and faith that translational research will yield fruitful results.

### ***Abortion***

The morality (as defined above) and efficacy of the use of human embryonic stem cells as well as the efficacy of human adult stem cells and other cells including olfactory ensheathing glia for SCI, remain a matter of debate. Excellent reviews of this topic concerning the scientific aspects have been published.<sup>62-64</sup> Although most scientists would not deny that removing a fetus equates to abortion or some synonym of it, for

example, termination, most have avoided the moral aspect, relegating that to ethicists and jurists. In this discussion, it is not my intent to take sides in the 'choice versus life' debate, but only to examine the issue in the light that science has now provided us.

As one might expect, the debate over abortion did not originate with Hippocrates. Laws concerning abortion were mentioned in the Code of Hamurabi, ca 1760 BC.<sup>65</sup> The first recorded evidence of induced abortion is from the Egyptian Ebers Papyrus in ca 1550 BC.<sup>66</sup> Since then, from ancient times to this day, advocates have used various methods to induce expulsion of the fetus such as: physical: (strenuous exercise, massage and paddling); pharmacological agents: (abortifacients, for example, hellebore, tamsy, bithwort and myrrh); devices: (for example, pessaries) and surgical procedures: (for example, blood letting, dilation and curettage) to mention a few.<sup>67</sup> Abortion remained a dangerous procedure into the early twentieth century. Of the estimated 150,000 abortions that occurred annually in the United States during the early 1900's one in six resulted in the woman's death.<sup>68</sup> The risk of maternal death when weighed against the benefit expected surely had a role in the decision of many countries and regions within countries to ban it before the midtwentieth century. The opinions of many who opposed it on moral grounds, for example, Thomas Aquinas (1225–1274)<sup>69</sup> and political grounds, for example, Susan B Anthony (1820–1906), Elizabeth Cady Stanton (1815–1902) and Horace Greeley (1811–1872) also had a role.<sup>70</sup> It is interesting that early women's rights advocates were opposed to abortion while later ones have favored it.

It is also interesting that Nazi Germany's laws allowed for abortion only under tightly controlled conditions, namely if the mother was believed to carry a fetus with a hereditary disorder, as long as it was not yet 'viable' (generally equated with quickening) and if she gave her permission. Otherwise, it was forbidden.<sup>71</sup> In 1939, the Journal of American Medical Association reported two German high court decisions regarding the law restricting abortions. The court ruled that the restriction even applied to Jewish women (and I quote) 'however undesirable the birth of Jewish children might be'.<sup>72</sup> By 1939, under Adolf Hitler (1889–1945), all vestiges of the Weimar Republic had vanished. It is hard to imagine even the high court ruling in a way opposed by the absolute dictator, a man who had no compunction at all about killing Jews who had already been born. But it indicates the generally prevailing sentiment among most nations against abortion at that time.

However by 1973, the United States Supreme Court took an opposing view, ruling that a person's right to privacy and due process under the 14th Amendment of the US Constitution allowed her to abort her fetus. Although Justice Harry Blackmun (1908–1999) writing for the majority (seven to two decision), wrote a thoughtful and well-researched decision, neither he nor the other justices could have known much

about the potential of DNA, let alone its future uses in forensic medicine and for purposes of establishing identity.<sup>73</sup> Watson and Crick<sup>74</sup> had only reported this discovery in 1953 in the scientific journal, *Nature*, and much more was yet to be learned about it. We know that the penetration of a human ovum by a human sperm initiates a process that will produce a mature human being unless interrupted by natural or unnatural means. Both the ovum and the sperm contain human DNA and the resulting zygote contains human DNA. Thus, once a haploid ovum has been penetrated by a haploid sperm, forming a diploid zygote, proof of its viability is provided by its cellular division; thus human DNA now has human life. Whether one is discussing a seedling, a larva or a mammalian embryo, clearly the object is in a different form from the mature one it will become, yet the DNA remains the same.

Justice Blackmun based his ruling on the supposition that the fetus 'becomes human' at some point during gestation. Knowing what we know now about DNA, such arguments would appear sophomoric. I would submit to you that perhaps we have taken the polemic in the wrong direction and what we should be discussing is when is it ethically permissible for one or more members of a society to extinguish the life of one or more other members? Situations that would clearly not be permissible include murder while situations that would clearly be permissible include killing in self-defense. Those aside, I submit that there are four situations, the ethics of which fall within the ambit of this question namely: abortion, euthanasia (voluntary or 'doctor assisted'), judicial executions and warfare. All involve the extinguishing of human life. I would not be surprised to learn that some people might take an advocacy position on one of the four and an opposing position on another, depending on one's culture, education and beliefs. Or in some instances, people have decided that only if certain thresholds were exceeded, would it

justify the taking of human life. For abortion, such thresholds have included: protection of the woman's life, her physical health, her mental health, rape, fetal defects, socioeconomic factors and 'convenience'. Views on all of them differ from nation to nation - from Chile and others where none justify abortion to Iceland and others where all do, further highlighting the fact that what is considered ethical cannot be applied worldwide because of the influence of cultural differences discussed above.<sup>75,76</sup>

### ***Euthanasia***

The primary focus of health care has always, quite rightly, been the saving and the improving of the quality of life. Such 'quality' at the 'end of life' has recently gained more attention, difficult to discuss as it may be.

The depression that follows SCI and its influence on quality of life and on the effectiveness of coping mechanisms has been well documented.<sup>77–79</sup> Suicide has crossed the minds of some persons with SCI at some point during their lives. A recent survey by Kennedy et al.<sup>80</sup> reported nearly 50% of those responding expressed overall dissatisfaction with life during the early post-injury period. In 1991, a study revealed suicide was 10 times more likely among those with SCI during the first 5 years post-injury but after that, the incidence was equal to the general population.<sup>81</sup> The US National Spinal Cord Injury Statistical Center at the University of Alabama, Birmingham recently reported that among the causes of death of 9774 persons with SCI, suicide was the cause for between 3 and 4% and ranked as the eighth or tenth most common cause, depending on the way the data were analyzed.<sup>82</sup> Yet also documented is the difference between the desire by patients to go on living and the perception of that desire by their caregivers; the former being higher.<sup>83</sup> In the discussion that follows, the term euthanasia is used in the broadest sense, referring to end of life issues in general that patients and their families sometimes inquire about but providers are often reluctant to bring up because to many, it connotes a failure: of the patient to cope and/or the providers to provide adequately. So the topic would seem appropriate to include in a discussion on ethics.

Although Hippocrates also enjoined physicians to refrain from euthanasia, it was not uncommonly performed in Greek and Roman times. The word itself, comes from the Greek 'eu' fgood and 'thanatos' fdeath, that is, dying well.

Euthanasia conducted with the patient's consent is termed voluntary euthanasia. Euthanasia without that consent is termed involuntary euthanasia. In medical circles, the latter is generally construed to mean it is conducted when another individual makes the decision for the patient when he/she is incapable of doing so and clear authority has been delegated by the patient to a specific individual to make that decision. Historically, as noted below, the term has carried other more sinister connotations wherein neither the comfort of the patient nor the patient himself is the driving force.<sup>84</sup>

Euthanasia may also be passive or active, primarily based on whether an intervention to hasten death is or is not taken.<sup>84</sup> In those locations where it is legal, it is passive voluntary euthanasia that is usually practiced, although it is generally not labeled as such, because of the connotation of the word. Beyond simply 'letting nature take its course', this usually entails, (a) the withholding or withdrawal of common treatments, that is, medications or surgery either because risks outweigh benefits or because of patient wishes, expressed either directly or by a living will, or (b) by the administration of treatments that have a 'double effect', for example, morphine given to relieve pain despite its risks of suppressing respiration. In general, this form of euthanasia does not carry a pejorative connotation and is practiced in many hospitals under the guidance of



ethics committees and advanced directives especially when issues of deteriorating quality of life, insufferable pain, futility of further interventions and devastating comorbidities loom large.<sup>85</sup>

The courts and ethics committees in many nations have generally approved the withholding or withdrawal of life sustaining medical treatment in which the treatment 'serves to prolong life without reversing the underlying medical condition'.<sup>86</sup> Under the principle of autonomy, as defined in the Belmont Report, the physician should respect the patient's decision to such withholding of treatment as long as he/she possesses decision-making capacity. The AMA CEJA states that the same applies even if the patient is incompetent or unconscious if he/she has formulated an advanced directive indicating a point in which treatments such as 'mechanical ventilation, renal dialysis, chemotherapy, antibiotics and artificial nutrition and hydration' among others are not desired. It further states that the patient's or the patient's duly appointed surrogate's wishes should always be respected except '(a) when there is no available family member willing to be the surrogate decision maker, (b) there is a dispute among family members and there is no decision maker designated in advance, (c) a health-care provider believes that the family's decision is clearly not what the patient would have decided if competent and; (d) a health-care provider believes that the decision is not a decision that could reasonably be judged to be in the patient's best interest. These situations should be referred to ethics committees for resolution before resorting to the courts'.<sup>86–87</sup> In the United States, it was the decision rendered in the Karen Ann Quinlan (1954–1985) case that influenced much of public opinion in favor of legal protection for voluntary passive euthanasia.<sup>88</sup> Thus, lately, the courts have generally ruled that when the patient is unconscious (for example, persistent vegetative state) or incompetent, that it is ethical to withhold life sustaining measures as was the case with Terri Schiavo (1964–2005).<sup>89</sup> In 1997, the Philadelphia County Court issued a declaratory judgment that a conscious patient was entitled to the same right under the principle of autonomy.<sup>90</sup>

Active euthanasia on the other hand entails the use of lethal substances or forces to end life and includes the topics of physician-assisted suicide and so called 'mercy killing'.<sup>84</sup>

In this regard, several nations, including the Netherlands and Belgium and states within Australia (Northern Territories) and the United States (Oregon and Washington) have passed laws legalizing physician-assisted suicide. In fact, the Oregon Death with Dignity Act states that active voluntary euthanasia (in the form of 'doctor-assisted suicide') as performed under the Act, 'is not suicide so should not affect insurance by that definition'.<sup>91–94</sup> Most government entities, however, have relied on court rulings and the opinions of national ethics committees such as the General Medical Council in the United Kingdom and the AMA's CEJA in the United States. For example, in Great

Britain, in 1957, the court ruled in the trial of Dr John Bodkin Adams (1899–1983), that 'causing death through the administration of lethal drugs to a patient, if the intention is solely to alleviate pain, is not considered murder, even if death is a potential, or even likely outcome'.<sup>95–96</sup> In Switzerland, in 1937, doctor-assisted euthanasia was declared legal as long as the doctor ending the life had nothing to gain from it.<sup>97</sup> Nevertheless, although court rulings and opinions have varied, they have generally disapproved of voluntary euthanasia in the form of doctor-assisted suicide, regarding the principle of patient autonomy to be outweighed by concerns over the lack of clarity and consensus about the ethics of it which have been viewed by the courts as a proper concern of the State where intervention to end life must be balanced by commitments to 'first do no harm' or non-maleficence. This issue is likely to evolve further over time.<sup>86–93</sup>

However, it is the involuntary and active form of euthanasia (ending one's life without one's consent) that has generated the most concern over a 'slippery slope' by raising the question, where in any given culture, will the line be drawn (between voluntary and involuntary euthanasia) so that once crossed, involuntary active euthanasia would be considered ethical, and who will be making the end of life decisions if not the patient or family? Just as for voluntary euthanasia, this is especially important to consider when the patient is not on life support and does not have a terminal illness, so these factors are not present but he/she does have an incurable condition.<sup>86</sup>

This concern over the 'slippery slope' does have historical relevance, most notably during the Nazi control of Germany's Third Reich when voluntary euthanasia devolved into involuntary euthanasia when about 70 000 disabled people were put to death between 1939 and 1941. The Nazis justified this by saying the country, left financially crippled by World War I, could not afford to treat people with chronic physical or mental illness; instead all had to focus on staying well. This pogrom came to a halt largely as a result of the sermons and writings of the Catholic archbishop of Munich, Clemens von Galen who condemned the carnage. The text of this sermon was duplicated and copies were distributed throughout Germany and occupied territories and reached the troops fighting on the Russian front. To them, von Galen directly addressed the terrible question as to what they might expect, if wounded and permanently disabled, from a nation that took the lives of people that were no longer capable of being productive. Hitler, weighing the political consequences, in a rare display of acquiescence, called the pogrom to a halt.<sup>98–99</sup>

Now, involuntary active euthanasia is illegal in all countries of the world except in the Netherlands, where it is practiced under an agreement between physicians and district attorneys that was ratified by the Dutch National Associations of Paediatricians under the Gronigen Protocol, which applies only to certain deformed newborns.<sup>100</sup>

Although events that occurred under the Nazi regime or during the Tuskegee research project could not happen again in most nations throughout the world, it is nevertheless understandable if people with chronic conditions such as SCI get a little bit nervous and carry a haunting and often silent suspicion when their leaders start talking about reducing the cost of health care and they worry that someone in power will make an unfavorable value judgment about continuing to fund the treatment they need to sustain life as well as quality of life. They worry that the issue of cost will supersede distributive justice.

My patients tell me that it's not that a person with a disability or their loved ones object to talking about end of life issues, it's just that decisions about if, what and when treatment should be withheld or when further treatment would be futile or whether the process of dying should be 'helped along' or whether organs should be donated, and so on are personal, voluntary decisions and should remain so, as they are now, and should not be made by legislators or bureaucrats far removed from the persons who could be affected by that legislation.

Thus, it is with some justifications that organizations such as CEJA advise caution and clear guidelines allowing for autonomy, beneficence, non-maleficence and justice if or when voluntary doctor-assisted suicide is sanctioned.<sup>86</sup>

### ***Academic integrity***

This term is often used when referring to cheating by students in the classroom setting and how it can be discouraged. Hinman<sup>101</sup> has emphasized the virtue of honesty to others and to one's self. He gives the following example to his students at the outset of the course he is teaching: a student cheated undetected on all the quizzes and final exam, receiving a 98% grade. When the final marks were posted, he was shocked to see he had gotten a D. When he confronted the teacher, asking how he received the D when his marks should have earned him an A, the teacher replied 'I know what you are saying but I lied to the provost about your grades and she gave you a D'. 'You lied'? The student asked dumbstruck. 'You can't lie about my grades'. 'Why not?' replied the teacher. 'You did.'

The main reason why cheating as a student should not be tolerated is that research and practice in the health sciences abjure dishonesty of any kind because of the potential harm it can bring to people's health. Thus, dishonesty should never become a part of a professional's or future professional's behavior. It is the behavior of the professionals, both established and aspiring that concern us here.

Although many nations have taken steps to insure such honesty, I shall use those taken in the United States as examples.

The Office of Research Integrity (ORI) in the US Department of Health and Human Services has published what it calls 'points for discussion', which addresses many issues including research misconduct, institutional responsibilities, conflicts of interest, the research environment, collaboration, data management and scientific journals among others.<sup>102</sup>

Unlike research subject recruitment and patient treatment for which we now have codes and laws, as noted earlier, these topics deal more with how discoveries are documented and disseminated. Yet they have just as great a ripple effect on society because societies expect that researchers will truthfully report what works, seems to work, seems to not work, and doesn't work at all and they trust that practitioners will truthfully convey that information to their patients.

However, King<sup>103</sup> has stated that in one sense, researchers themselves should not 'trust' each other, meaning that all research data, including raw data, should be open to scrutiny by colleagues so that the work can be reproduced and its rigor verified.

Failure to allow one's evidence to be examined by colleagues simply encourages suspicions of research misconduct. The National Academy of Sciences (NAS) has aptly addressed possible reasons for research misconduct: '(a) funding and career pressures of the contemporary research environment; (b) inadequate institutional oversight; (c) inappropriate forms of collaborative arrangements between academic scientists and commercial firms; (d) inadequate training in the methods and traditions of science; (e) the increasing scale and complexity of the research environment, leading to erosion of peer review, mentorship and educational processes in science and; (f) the possibility of misconduct in science is an expression of a broader social pattern of deviation from traditional norms'.<sup>104</sup> The Scientific Research Society has stated that a common avenue to research misconduct is through statistics—either through carelessness or dishonesty, for example, 'bending' the data to conform to a preconceived outcome or expectation.<sup>105</sup>

The ORI points out that responsibility for maintaining honest and transparent research lies with several entities: (1) the scientists and their scientific societies should adhere to honest reporting and collegial scrutiny of their colleagues' work. The scientists, particularly the principal investigators are, along with their institutions, responsible for the research environment in which carelessness, apathy or fraud cannot be tolerated. This applies not only to the conduct of the research but to other aspects as well such as honest timeeffort reporting and full disclosure of funding sources; (2) the institutions themselves are also responsible for the research environment.<sup>102</sup> According to the Institute of Medicine (IOM), institutions 'need to demonstrate more active interest in assuring faithfulness to the ethics and ideals that already form the foundation of the ethics of science in the academic sector' and 'need personnel who think critically

about the integrity and quality of the research environment and ways in which it can be improved'.<sup>106</sup> The NAS has also advised that the institution is responsible for 'ensuring that good scientific practices are observed and that balanced reward systems appropriately recognize research quality, integrity, teaching and mentorship'.<sup>104</sup> When an environment that encourages quality and discourages carelessness exists, formal complaints and 'whistle blowing' would not be encountered; (3) Both researchers and their institutions are responsible for dealing appropriately with collaborations, co-authorships and conflict of interest.<sup>102</sup> Juliano and Oxford<sup>107</sup> remark that the 'entire reward and advancement process in universities focuses on individual accomplishments rather than collaborative effort. In this system, credit is attributed largely to the team leader and not to others. Inevitably, the result is that the researchers seek to further their individual credibility, rather than necessarily attacking scientific problems in the most efficient manner'. Although this clearly isn't always true, the comment reflects the fact that publications are 'academic currency' when it comes to promotion and securing grant awards. This also relates directly to decisions as to co-authorship and the rank order of authors. The IOM has stated 'authorship of a scientific report is a responsibility as well as a privilege. It implies that a person has contributed essentially and substantially to the study and is able and willing to defend the work publicly. This does not mean that each author participated in all parts of the study, but it does mean that all authors have familiarized themselves with the general principles of all aspects of the study'.<sup>106</sup>

Collaboration with industry, in which systems of rewards and pressures differ somewhat from academe, requires further vigilance to maintain integrity. The Association of American Universities has said, 'research universities are concerned about financial conflict of interest (individual and institutional) because it strikes to the heart of the integrity of the institution and the public's confidence in that integrity'.<sup>108</sup>

Industry, that is, manufacturers of pharmaceuticals, surgical instruments, devices (implantable and non-implantable), durable medical equipment and so forth also have incentives to maintain integrity, both internal-including preserving their reputations and the ability to recruit meritorious scientists and to sell their products to a public that trusts them as a result of that reputation, and external-including the financial loss that can result from product recalls, government imposed penalties and litigations. However, it would seem that in order for a 'marriage' between academic and industry investigators to be successful, each must be aware of factors beyond the science that the other must live with, namely 'publish or perish' on the one hand and 'capture the market share' on the other, and not allow these influences, particularly 'marketing' to researchers and practitioners to stain the process or the products of discovery.<sup>109,110</sup>

In either arena, scientists have the responsibility to ensure that their data are clearly

and accurately recorded and reported so that others can attempt to reproduce the data and that errors are corrected when they are recognized. Editors of scientific journals also share in these responsibilities.<sup>104</sup>

Regarding the responsibilities of scientific journals, the IOM has stated, they must be alert for 'repetitive publications, supernumerary authorship, institutional fulfillment of responsibilities for disclosure and notification of research misconduct in publication, the use and misuse of pre-publication peer review and the appropriate response to suspicions or confirmations of misconduct in published works or works submitted for publication'.<sup>106</sup> Journals also have an obligation to publish retractions of published reports that have been found erroneous by the original authors or that has been declared fraudulent by appropriate authorities at the research institutions.<sup>106</sup> The International Committee of Medical Journal Editors (ICMJE) has now incorporated these recommendations into their Uniform Requirements for Manuscripts. Journals enrolled by the ICMJE must follow those requirements before a manuscript will be accepted for publication. The requirements also include registering the investigation with [clinicaltrials.gov](http://clinicaltrials.gov) or similar registry before enrollment of subjects and thereby agreeing to report trials with negative results to the registry.<sup>111</sup> The following of these requirements has now been specified by the FDA for all investigations needing FDA approval.<sup>112</sup>

In this role, scientific journals can be viewed as a final portal as scientific information passes from discovery to dissemination and thus an important part of the preservation of medical ethics.

As dissemination passes into practice in which scientific discoveries are applied to people who need them, it becomes the responsibility of the practitioners to use the information and products in the ways in which their safety and efficacy have been proven in accordance with the laws and codes that reflect the ethics of their communities.

This becomes a major concern in which applications of discoveries are anxiously awaited and their application begins before safety and efficacy are fully known. Often this is done under the rubric of translational science in an effort to move knowledge from the bench to the bedside rapidly. Although support for that aspiration might well be universal, it has become apparent in recent times that the desire to find a cure for SCI as soon as possible has allowed some people who have little or no credibility as research scientists to proceed to offer to persons with SCI treatments that have shown no evidence that the information learned in the laboratory can now be translated to humans and worse yet, that the safety of such treatments has not yet been fully assessed. This deviation from the recommendations offered by the ICCP becomes egregious when vast sums of money are charged for the 'treatments'. Clearly, more

research is needed, both in the laboratory and at the bedside, conducted according to the ICCP Guidelines so that safe effective treatments can one day be applied for all persons with SCI.113

## **Conclusion**

The history of medical ethics dates back to even before the time of Hippocrates and although the topic has undergone changes to conform to prevailing times and cultures, it can be said that certain virtues of the human spirit have prevailed through it all: concern for the best interests of the patient, applying the best, most efficacious and appropriate treatment available and above all, maintaining honesty in the discovery, dissemination and application of knowledge.

In the words of Henry David Thoreau (1816–1862): 'Rather than love, than money, than fame, give me truth'.

## **Conflict of Interest**

The author declares no conflict of interest.

## **Acknowledgements**

This work was supported in part by funds from grant H133N0600003 from the National Institute on Disability and Rehabilitation Research in the Office of Special Education and Rehabilitation Services in the US Department of Education.

## ***PRESIDENTIAL LECTURE***

---

Strategy for conservative management of vertebral fractures;  
Current Management of Traumatic Spinal Injuries and concerns about the interpretation of outcomes of future interventions

**W S El Masri(y)**

Consultant Surgeon in Spinal Injuries  
President : International Spinal Cord Society

### ***INTRODUCTION***

Traumatic spinal cord injuries (TSCI) are life changing events. Their effects are multiple and complex requiring the expertise of a well trained and well coordinated multidisciplinary team 1. TSCI are not however catastrophic injuries unless they are mismanaged.

With simultaneous Active Physiological Conservative Management (APCM) of the injured spine, the multisystem physiological impairment and malfunction and with adequate planning, monitoring and recalibration of the management especially during the transitional period between spinal shock (areflexia) and recovery of reflexes; the majority of patients with incomplete spinal cord injury patients recover significantly to ambulate 2,3

With simultaneous equally good attention to the psychological, social, emotional, financial, vocational, environmental and economic consequences, patients who do not recover ambulation and those who do can, lead healthy, fulfilling , productive and competitive lives 2

Non Orthopaedic Effects of Traumatic Spinal Injuries with Neural Tissue Damage :

These are wide ranging and varied

- ***Physiological Instability (PI) of the Spinal Cord***

The injured spinal cord is physiologically unstable due to loss of auto-regulatory mechanisms, disruption of the blood brain barrier and a range of metabolic, cellular and cell membrane disturbances that occur following injury. This PI renders the spinal cord vulnerable and unable to defend itself from non- mechanical complications such as hypoxia, sepsis, hypotension,



hypertension, anaemia 4. These can easily occur in the neurologically impaired patient in further manifest neurological deterioration or indeed lack of neurological recovery (silent deterioration). In the absence of blood loss, the administration of vaso-pressors to patients presenting in spinal shock with bradycardia is a source of concern to the authors, since due to loss of autoregulatory mechanisms of the spinal cord, an increase of blood pressure may result in bleeding within the cord and further detriment. What perhaps may not be appreciated is that the hypotension of spinal shock is a "low resistance" hypotension due to sympathetic areflexia causing generalised vasodilatation as opposed to the high resistance hypotension associated with blood loss.

While early mobilisation/verticalisation of the neurologically intact patient with a stable or surgically stabilised fracture is advantageous since the patient can be discharged home soon after, early mobilisation/verticalisation of a neurologically impaired patient with a physiologically unstable spinal cord, is unlikely to offer the same advantages and can be hazardous 3 (see below)

- **Generalised multi-system physiological impairment (MSPI) and malfunction (MSMf)**. The functioning of the various systems of the body is abnormal and now depends on the reflex activity of the spinal cord (SC) distal to the level of injury as well as on the intrinsic ability of the various systems of the body to function unconnected to the brain. 2,3
- **The reflex activity of the SC segments below the level of injury changes often unpredictably throughout the patient's life affecting function.** Rapid changes are particularly more pronounced during the transition period between spinal shock and full recovery of spinal cord reflexes which can last for a few months. Consequently predictable and unpredictable changes in the functioning of the various systems of the body occur 2,3.
- **Intersystem effects**  
The interruption of the higher co-ordinating and moderating functions of the brain usually result in a wide range of multiple cascading intersystem effects and in complications that are rarely seen in other conditions 2,3.
- **Potential of wide range of disabilities and wide range of complications:**  
Because of the impaired physiology, impaired function and the interruption of the higher co-ordinating and moderating functions of the brain, individual system malfunction becomes a source of one or more disability and a potential source for a wide range of complications of various severity

ref 1. Complications following SCI increase morbidity cost of treatment and the already heavy burden to patients and family members. Some can potentially cause death others e.g pressure sores can result in high risk of permanent recurrence for life.

- The sensory impairment/loss present diagnostic challenges to clinicians since the usual anticipated symptoms and physical signs of associated injuries, pathology and/or complications are unreliable in these patients.
- The added non medical effects such as loss of independence, social, emotional, financial, vocational, environmental and economic consequences add to the burden of the patient and all those involved with his/her management.

With good comprehensive management and support by an expert multidisciplinary team, the impact on medical, physical and mental health can be markedly diminished and almost all complications can be mitigated or significantly minimised.

### ***CHANGE IN THE STANDARD OF CARE OF THE INJURED SPINE***

In the last 3-4 decades many factors have combined to change the standard of care in patients with traumatic spinal cord injuries and promote surgical decompression and stabilisation. Advances in imaging with the advent of CT & MRI scans, improvement of design and material of spinal instrumentation, improvement in anaesthetics, patients beliefs and expectations, pressures and fragmentation of funding sources, changes in Clinicians' training and allied professionals' were all factors favouring surgery.

One of the most important factors was however, a genuine belief Based on Laboratory Animal Findings that Traumatic Spinal Canal Encroachment and Cord or Cauda Equina Compression can prevent neurological recovery and/or cause further damage to neural tissue. This seems to have popularised and legitimised the global practice of Surgical Decompression and Stabilisation of the Injured Spine as first choice of treatment.

There is a wide range of interventions other than surgery that claim benefit to the neurology of the SCI individual that have been developing over the last couple of decades. Most of the outcomes have been and are being compared to surgical outcomes.

## THE RJAH OSWESTRY DILEMMA

With the introduction of CT in 1987 followed by MRI in 1994 Oswestry had to define its Strategy as regard the management of TSCI.

The results of Conservative Management in this Orthopaedic Institution with dedicated spinal surgeons were excellent. We had confirmed the findings of Frankel et al in 1969 5 and the European and Australian groups who had subsequently established reproducibility 6. We had also observed that with Conservative management and equal attention to the Physiological Instability of the injured spinal cord and the Biomechanical Instability of the spinal column; the majority of patients with incomplete cord injuries made significant neurological recovery irrespective of the degree of canal stenosis, malalignment, anticipated canal encroachment and cord compression as seen on X rays.

Furthermore the incidence of pain following Conservative Management was less than 10% in both the short and the very long term

A decision had to be made.

### THE PROCESS

We trusted our judgement and observations that the great majority of patients who had the clinical prognostic indicators of recovery recovered 7, 8, 9, 10, 11. We assumed that some if not many of these patients must have had spinal canal encroachment and neural tissue compression that could not be seen on plain X Rays.

We also reviewed the literature related to the controversy around the hypothesis of the secondary injury 3,6 . We also studied the literature about the Laboratory findings on experimental animals. We could not accept that the level of evidence was strong enough to be applicable to humans especially that there were relevant differences between the species.

### LABORATORY FINDINGS

We considered it unlikely that the 20 to 60 million years of evolution between the laboratory (rodents, cats, dogs) and humans would have selectively spared the spinal cord from evolving . There were other factors as well:

We reflected on the effects of surgery on blood pressure, spinal cord blood flow and on the respiratory functions and stipulated they are likely to be different between quadrupeds and in humans.

We considered the difference in the duration of spinal shock measured in hours in the laboratory animal and in days to weeks in the majority of humans. We thought this is likely to add to the differences in the effects of mobilisation on neurological functions between quadrupeds and bipeds.

We considered the difficulty in assessing subtle gait abnormalities in the laboratory animal and relative ease of detecting minor gait abnormalities in humans and believed this may explain why some of the observed positive results of interventions in the laboratory animal could not be confirmed in humans.

We therefore decided, with some trepidation, to determine the significance of traumatic canal encroachment and cord compression in humans while continuing treating our patients conservatively rather than implement change of practice and carry out routine surgical decompression and stabilisation.

Conservative treatment consisted of 4-6 weeks of bed rest during which attention is equally given to the multisystem impairment and malfunction as well as to the non medical effects of the spinal cord injury. This followed by mobilisation in a brace for a further 6 weeks during active locomotor rehabilitation and in parallel with the continuing treatment and support.

## **NEUROLOGICAL OUTCOME**

### **TRAUMATIC SPINAL CANAL ENCROACHMENT**

The first case reports to suggest that traumatic canal encroachment as demonstrated by computerised tomography does not correlate with the degree of neurological impairment, does not prevent neurological recovery and does not result in neurological deterioration of cord function were published by El Masri et al in 1992.<sup>6,12</sup> The same conclusions were made by reviewing the outcome of conservative treatment of 50 consecutive patients with between 10% to 90% canal encroachment in Frankel C, D and E groups. Patients in Frankel C&D group recovered ambulation. None of the patients in Frankel C, D and E groups deteriorated neurologically or otherwise. This work was presented to the second Neurotrauma Symposium in Holland 1993 and the American Federation of Spinal Surgeons in February 1994. It was also published in abstract form El Masry et al 1993.<sup>13,14</sup> Other groups have since published similar findings.<sup>15,16,17</sup> There is no evidence to suggest that early or late surgical decompression achieves better or earlier neurological recovery than APCM in humans with incomplete cord or cauda equina injury.

Equally there is no evidence to suggest that surgical decompression is beneficial to humans with complete traumatic cord or cauda equina injury . In 53 consecutive patients with complete cord injury (FA) but with pin prick sensation in the zone of partial preservation will recover significant and useful motor power in the correspondent myotomes 11 . A neurological level higher than the bony level of fracture is another good prognostic indicator of zonal recovery 11

## **TRAUMATIC SPINAL CORD COMPRESSION**

Unlike in the laboratory situation where it is observed that the longer the cord compression is unrelieved the more damage and neurological loss occurs; Traumatic Cord Compression does not appear to prevent neurological recovery in humans, with incomplete cord injuries 2,14,18,3,19 figure. Equally interesting is that traumatic cord compression is not necessarily always associated with neurological damage and maintenance of neurological free status can be maintained without surgical decompression or realignment. Fig Y

Since the installation of the MRI scanner in our institution we have been monitoring (both prospectively and retrospectively) the neurological progress of conservatively managed patients with cord compression. The preliminary results indicate that the same clinical prognostic indicators of recovery apply whether there is cord compression or not. What is perhaps not highlighted enough is that Surgical decompression does not seem to be beneficial to either the laboratory animal or to humans when the severity of the initial impact on the spinal cord is beyond a certain magnitude as recovery will not occur 20,21,22

## **TRAUMATIC BIOMECHANICAL INSTABILITY (BI) OF THE SPINAL COLUMN**

The most biomechanically unstable fractures heal within 6-12 weeks from injury when Biomechanical Stability (BS) is restored. Ligamentous injuries, however, can take much longer to heal. BI is therefore time related. Containment of the most Biomechanically Unstable injuries can be easily and safely maintained with APCM in recumbency for 4-6 weeks followed by bracing during mobilisation for a further 6 weeks. The great majority of injuries become biomechanically stable, pain free, allowing an excellent range of movement. Mechanical damage or further damage to the spinal cord at the site of the fracture is extremely rare in recumbency.

There is no evidence to suggest that surgical stabilisation enhances the speed of healing or achieves stability earlier than with APCM except in pure ligamentous injuries with translation and without bony damage when about 50% of the patients develop prolonged BI and are likely to require surgical stabilisation.

The spinal canal has been known to remodel since the mid eighties. Often the vertebral body remodels as well with APCM.

Admittedly the incidence of kyphotic deformities is lower following surgical stabilisation than following APCM, however the greatest majority of these kyphotic deformities are painless. The discrepancy between kyphotic deformity and pain has been known for some time 6. A painless 40-50o kyphotic deformity enhances wheelchair bound patients' independence and is certainly much preferable to a stiff straight neck or back.

Admittedly the incidence of kyphotic deformities is lower following surgical stabilisation than following APCM, however the greatest majority of these kyphotic deformities are painless. The discrepancy between deformity and pain has been known for some time 3. A painless kyphotic deformity enhances wheelchair bound patients' independence and is certainly much preferable to a stiff straight neck or back.

The benefit of surgical decompression to neurological outcome and of surgical stabilisation were not the only beliefs that required challenging.

**SURGERY FOR: EARLY MOBILISATION (EM) - REDUCTION OF COMPLICATIONS - REDUCTION OF PERIOD OF REHABILITATION & HOSPITALISATION - FACILITATION OF NURSING:**

There was a general belief and an assertion that surgery was beneficial to achieve early mobilisation, reduce complications of recumbency, expedite rehabilitation and shorten hospitalisation time.

Although we were in agreement that Early Mobilisation is certainly advantageous to neurologically intact patients who can be discharged soon after successful surgical stabilisation, there were many reasons why this was not the case in the neurologically impaired patient.

Over six decades ago Guttmann demonstrated that the complications of recumbency in SCI patients are caused by the inadequate management of the recumbent patient and are almost completely preventable.

Furthermore the physiological responses to posture differ between the neurologically intact and the neurologically impaired.

## **Posture and the Respiratory System**

Although the vital capacity the neurologically intact patient increases in the vertical position, Early mobilization before return of reflex activity of patients with complete upper thoracic and cervical cord injuries is associated with reduction of lung volumes and vital Capacity 23, 24, 25, 26, a potential drop of oxygen saturation as well as marked Postural Hypotension. These findings have been confirmed repeatedly.

The combination of hypotension, reduced vital capacity and potential reduction of oxygen saturation may not only further impair cord functions, but also imposes great limitations on the physical ability of the patient who requires energy, motivation and a sense of well being to engage in the arduous, tedious and demanding process of Rehabilitation.

Assisted coughing, which is essential to get rid of bronchial secretions in patients with paralysed abdominal muscles who are unable to expectorate, is easier and more effective in recumbency than in the vertical position. The struggle against gravity to achieve successful assisted expectoration is minimised in recumbency.

The incidence of chest infections in tetraplegic and paraplegic patients treated with APCM in the acute phase in the MCS1 is less than 3%. The incidence of tetraplegic and paraplegic patients requiring short term ventilation is less than 2% when they present in the acute phase breathing spontaneously and without associated chest injuries or past history of chronic respiratory disease.

Postural hypotension is most profound during the stage of spinal shock. EM of patients with cord injury but with biomechanically stable injuries can cause temporary neurological deterioration that recovers immediately when the patient is returned to recumbency.(phys. Ins). Administration of ephedrine before verticalisation abolishes both the drop of blood pressure and the neurological loss suggesting that cord haemodynamics influence neural functions and suggesting that the physiological instability of the spinal cord needs at least equal attention to the biomechanical instability of the spinal column.

## **Posture and Pressure sores**

The risk of pressure sores over the ischial tuberosities and sacro coccygeal prominences is indeed increased when the patient is mobilised in the wheel chair particularly during the stage of spinal shock when the skin blood flow is at its poorest. The forces which in recumbency are spread across all bony

prominences become concentrated on the ischial tuberosities and sacro coccygeal prominences when the patient is mobilised/verticalised.

### **Posture, Rehabilitation and Total Hospitalisation**

There is no evidence to suggest that early mobilisation in patients with SCI shortens the period of treatment of the multi system impairment and malfunction, rehabilitation and or hospitalisation. Such periods are influenced if not governed by many factors: the range of services provided by the hospital to the various effects of the SCI, the model of service provision, the subjective experience of the clinician, the system of funding, the system of social support and the ewaponsibility of the hospital to the patient following discharge from hospital.

Moreover there is no homogeneity in the definition of the end point of the episode of treatment. Furthermore there is no evidence to suggest that the period of hospitalisation during the acute stage reflects the total hospitalisation for the management of the multisystem physiological impairment and malfunction, rehabilitation and return of the patient to his/her own community.

### **PROGNOSTIC INDICATORS OF RECOVERY**

The neurological findings at 48 – 72 hours from injury are essential in predicting neurological recovery. Over 85% of tetraparetic patients who present in the first 72 hours from injury with any distal movement however isolated, little and/or patchy (FC), and over 75% of patients who present 48 – 72 hours from injury with no motor power but with preservation of pin prick sensation down to S3 (FB) will recover to walk again at 4-6 months from injury and the great majority in one year 7,8,9,10 provided they are not harmed by the treatment. In 53 consecutive patients with complete cord injury (FA) but with pin prick sensation in the zone of partial preservation will recover significant and useful motor power in the correspondent myotomes 11. A neurological level higher than the bony level of fracture is another good prognostic indicator of zonal recovery 11

### **POSSIBLE MECHANISMS OF NEUROLOGICAL DETERIORATION ASSOCIATED WITH SURGICAL INTERVENTION:**

Although surgery in skilled hands and in an ideal environment is generally safe, the true incidence of manifest neurological deterioration or lack of neurological recovery (silent deterioration) is unknown. Mechanisms of neurological deterioration associated with surgery range from mechanical damage during handling preoperatively, per operatively or during intubation; clamping of a major feeder to



stop bleeding; hypotensive or hypoxic attack during anaesthesia; post operative bleeding around the cord or cauda equina ; post operative sepsis and post operative premature failure of implant.

Close monitoring of neurology in Conservatively managed patients in our institution revealed a temporary increase in density or ascent by one or two levels at around 48-72 hours from injury in 10%-15% of patients. The great majority of of these patients recover to at least initial level or better. This we think is related to oedema of the spinal cord which subsides within 2-3 weeks from injury 8,11.

With modest care, permanent and significant neurological deterioration in recumbency is extremely rare irrespective of the degree and severity of the biomechanical instability. Most of the significant and permanent deterioration occurs when the patient with a biomechanically unstable spine and/or a physiologically unstable spinal cord is sat up in bed or mobilised out of bed.

We believe that patients undergoing any type of treatment should be given this information

#### **RJAH OSWESTRY INDICATIONS FOR SURGEY:**

The uncontrolled epileptic , the mentally challenged and patients who are unable to comply with bed rest are likely to be benefit from surgical stabilisation as they are likely to be difficult to manage Conservatively . Patients with Biomechanical Instability from pure ligamentous injuries without bony injury are at risk of developing late instability and may opt for early surgery.

Patients who exhibit signs of neurological deterioration with evidence of further compression of neural tissues on MRI may benefit from surgical decompression.

#### **Discussions**

Patients with incomplete cord injuries make significant neurological recovery irrespective of the degree of canal stenosis, canal encroachment, malalignment and or cord compression 3,6,9,14 provided both the BI of the spinal column and the PI of the spinal cord are well contained.

The findings in the laboratory animal do not appear to be mirrored in the clinical situation. This could be related to differences between species during evolution as well as the differences in the effect of the spinal cord pathophysiology between quadrupeds and bipeds especially on the autonomic and respiratory system. In any case translation from the laboratory animal to the clinical situation requires caution 27.

We believe, based on current knowledge and level of evidence, there is no need for immediacy in surgical decompression and/or stabilisation and/or any other intervention. Surgery should not supersede the need of a thorough neurological examination, adequate enough to compare with, monitor and determine neurological outcome at later stages of injury. This should apply to any intervention not only surgery.

We also believe that should surgery be contemplated it should be carried out by the most experienced and skilled spinal surgeon in an environment where patients with such generalised physiological impairment can be looked after and supported safely.

In the absence of the best surgical skill and expertise and/or appropriate infrastructure all patients with SCI can be treated Conservatively safely in recumbency until they are referred to a spinal injury centre where they can also have expert simultaneous treatment to all the medical and non medical effects of the spinal cord injury.

## **CONCLUSIONS**

Conservative management of the injured spine is safe and easy to conduct provided the patient is agreeable to remain in recumbency for up to 6 weeks.

The outcomes of Conservative management are excellent and remain unchallenged by any of the wide range of interventions

Conservative Management can be conducted in any Institution as long as the patient is agreeable to remain recumbent . The multisystem physiological impairment and malfunction and the non medical effects are much more demanding and require the skills of a well coordinated multi disciplinary team of well trained and experienced staff that can only be found in dedicated SI Centres. The majority of Spinal Injury Centres also have the expertise of skilled Surgeons and can offer equally skilled Conservative and Surgical management with the added benefit of informed consent by the patient.

### ***Putting myelin back on axons: from biology to therapy***

**Robin J.M. Franklin**

*Professor of Neuroscience, MRC Cambridge Centre for Stem Cell Biology and Regenerative Medicine, University of Cambridge, UK*

Remyelination, the process by which new myelin sheaths are restored to demyelinated axons, represents one of the most compelling examples of adult multipotent stem cells contributing to regeneration of the injured CNS. This process can occur with remarkable efficiency in both clinical disease, such as spinal cord injury (SCI), and in experimental models, revealing an impressive ability of the adult CNS to repair itself. However, the inconsistency of remyelination in many diseases and the loss of axonal integrity that results from its failure makes enhancement of remyelination an important therapeutic objective. This talk will review recent studies we have undertaken aimed at obtaining a detailed understanding of the mechanisms of regulating differentiation during remyelination and hence identifying novel therapeutic targets. In particular it will focus on the effects of ageing and genomic approaches to identifying key pathways involved in the regulation of this important regenerative process.

## SCS ORATION

### ***INTERNATIONAL SPINAL CORD INJURY DATA SETS***

---

#### **F. Biering-Sørensen**

Survival of spinal cord injury (SCI) with a reasonable quality of life has increasingly become an expected outcome worldwide. As a result there is an increasing need for standards, data, and measures pertaining to SCI. Therefore the intention is that common International SCI Data Sets should be collected on individuals with SCI to facilitate comparisons regarding injuries, treatments, and outcomes between patients, centers and countries. The process for establishing International SCI Data Sets started at an International meeting of experts in SCI data collection and analysis prior to the combined meeting of International Spinal Cord Society (ISCoS) and American Spinal Injury Society (ASIA) in Vancouver, Canada in 2002. At this meeting a process was developed for selection of data elements to be included in International SCI Data Sets. An overall structure and terminology has been developed following the format of the International Classification of Function (ICF) (Biering-Sørensen et al. 2006).

The ***International SCI Core Data Set*** was the first one to be developed, with the purpose to standardize the collection and reporting of a minimal amount of information necessary to evaluate and compare results of published studies. At minimum, published studies should include information on the gender and age of the study population at the time of injury, the current age of the study population, the length of elapsed time after injury when data are being collected, the calendar time frame during which the study was conducted, the causes of spinal cord lesion, and the neurologic status of the study population according to the International Standards for Neurological Classification of SCI. These and other data included in the Core Data Set are recommended, as a descriptive table in most publications including individuals with SCI. Inclusion of more detailed information will depend on the research topic. It is extremely important that data be collected in a uniform manner (DeVivo et al. 2006).

***International SCI Basic Data Sets***, are the minimal number of data elements, which should be collected in daily clinical practice for a particular topic. This means that the various Basic SCI Data Sets in the future may be the basis for a structured record in centres worldwide caring for persons with SCI. Several are published (see refs below).

***International Extended SCI Data Sets***, are a more detailed data sets, which may be used as optional for a topic, but may be recommended for specific research studies within the particular area. Two published and more on the way.

**International SCI Data Sets developments** are ongoing in topic-specific expert working groups, and each new developed data set are scrutinised in a 10 step approval process.

**Data set presentation.** As soon as a new International SCI Data Set is developed in this iterative manner, consensus has been obtained, and the final draft has been approved together with an appropriate training program with cases, they will be disseminated at meetings, and published in Spinal Cord and through the web sites of ISCoS ([www.iscos.org.uk](http://www.iscos.org.uk)), and ASIA ([www.asia-spinalinjury.org](http://www.asia-spinalinjury.org)).

Biering-Sørensen F, Charlifue S, DeVivo M, Noonan V, Post M, Stripling T, Wing P. International Spinal Cord Injury Data Sets. *Spinal Cord* 2006;44:530-4.

DeVivo M, Biering-Sørensen F, Charlifue S, Noonan V, Post M, Stripling T, Wing P. International Spinal Cord Injury Core Data Set. *Spinal Cord* 2006;44:535-40.

Biering-Sørensen F, Craggs M, Kennelly M, Schick E, Wyndaele JJ. International Lower Urinary Tract Function Basic Spinal Cord Injury Data Set. *Spinal Cord* 2008 May;46(5):325-30.

Biering-Sørensen F, Craggs M, Kennelly M, Schick E, Wyndaele JJ. International urodynamic basic spinal cord injury data set. *Spinal Cord* 2008 Jul;46(7):513-6.

Widerström-Noga E, Biering-Sørensen F, Bryce T, Cardenas DD, Finnerup NB, Jensen MP, Richards S, Siddall PJ. The International Spinal Cord Injury Pain Basic Data Set. *Spinal Cord* 2008;46:818-23.

Krogh K, Perkash I, Stiens SA, Biering-Sørensen F. International bowel function basic spinal cord injury data set. *Spinal Cord*. 2009 Mar;47(3):230-4.

Krogh K, Perkash I, Stiens SA, Biering-Sørensen F. International bowel function extended spinal cord injury data set. *Spinal Cord*. 2009 Mar;47(3):235-41.

Biering-Sørensen F, Craggs M, Kennelly M, Schick E, Wyndaele J-J. International urinary tract imaging basic spinal cord injury data set. *Spinal Cord* 2009;47:379-83.

Lee BB, Cripps RA, Woodman RJ, Biering-Sørensen F, Wing P, Campbell R, Noonan VK, Wang D, Stander J, Lee BS, Harrison JE. Development of an international spinal injury prevention module: application of the international classification of external cause of injury to spinal cord injury. *Spinal Cord*. 2010 Jun;48(6):498-503.

Krassioukov A, Alexander MS, Karlsson AK, Donovan W, Mathias CJ, Biering-Sørensen F. International spinal cord injury cardiovascular function basic data set. *Spinal Cord*. 2010 Aug;48(8):586-90.

# **ABSTRACTS OF TALKS**

4

57

58

# ABSTRACTS OF WORKSHOP

## Workshop I

---

(W 01)

### **Thoracolumbar Fracture Classification Systems and Their Role in Determining Treatment (W 02)**

Prof S Rajasekaran PhD

An ideal classification system for thoracolumbar (TL) spine fractures should aid easy communication between treating surgeons and guide treatment. The classification system should be comprehensive and simple to implement. At the present time, no classification system can fully meet these criteria. The classification of TL injuries started with Boehler's attempt in 1929. Since then a variety of classification systems including that of Holdsworth, Denis, McAfee, McCormack and the AO system have been proposed, each trying to cover up the deficiencies of the other. All the initial classifications were based on the biomechanical basis of load-bearing columns of the spinal column. This involved a combination of the morphology of the fracture as well as the mechanism of injury that lead to these fractures. Some of these were limited by their complexity, reproducibility and poor reliability. They were based either on a single individual's experience, or a small group's retrospective review of case series. But each successive system played an important role in advancing one's understanding of TL injuries. Considering the fact that injury severity and neurological damage would affect the treatment plan, the Thoracolumbar Injury Severity Score/Thoracolumbar Injury Classification and Severity Score (TLISS/TLICS) has recently been developed underscoring the importance of biomechanical stability, injury mechanism, and neurologic status. This system also incorporates features from earlier systems and represents the most comprehensive of all the available. Despite its advantages, more work in terms of refining the classification and defining its validity by controlled multicentric trials remains to be performed.

### **Cervical fracture classification systems and their role in determining treatment (W 03)**

Sagun tulli

Assessment of classification systems requires testing for validity, reliability and interpretability. The various cervical spine fracture classification systems are discussed and their treatment options. The *guidelines for the management of acute spine and spinal cord injuries based on Section on Disorders of the Spine and Peripheral*



*Nerve of the AANS and CNS is provided. Validation of the classification systems is described. It is noted that classification systems have loose association with determination of stability which intern are poor predictors of treatment options. A proposal for a future cervical fracture classification system is provided.*

#### **Panel & Open House Discussion - Protocol for Management of Vertebral Lesion in Spinal Cord Injury**

*Consensus statement of a debate between Mr W El Masri & Dr Patrick Kluger moderated by Dr H S Chhabra during Indian Orthopaedic Association meeting in 2004 on "Conservative versus Surgical management of Spinal Injured" to be used as draft for discussion.*

There is a controversy regarding the management of Spinal Cord Injury due to a lack of adequate knowledge of data and outcome

#### **There is consensus on:**

- There is no evidence that surgery improves neurological outcome
- Parasurgical processes carry potential risks to neurology
- Inadequate conservative management carries its own risk to neurology
- Patients with spinal cord injuries should be managed holistically in specialised SCI centres
- Spinal cord injury centres should be capable and able to offer both conservative and surgical management, at any time
- General hospitals admitting patients with SCI should be able to prevent all avoidable complications related to the paralysis. This can be achieved by early close liaison with the nearest SCI centre
- Disco-fibrous injuries are usually unpredictable in their healing potentials and are generally likely to benefit from surgery
- In patients with impaired compliance, by mental disorders, by age, or by drug addiction, conservative management is more difficult
- In polytraumatised patients, surgical management is more frequently needed
- In all cases patients should be given an informed choice between conservative and surgical management with full information about potential outcome, limitation of the type of treatment and potential complications
- Conservative management is not synonymous with non-surgical management
- Surgical stabilisation should involve the smallest number of units of motion
- The presence of SCI does not decrease the risk of spinal surgery nor the requirements in surgical skills.

- The shorter the fusion the more demanding the procedure is, requiring a longer learning curve and expertise that is difficult to develop and to maintain with small numbers of patients
- The skills and expertise in spinal surgery should not primarily be acquired in living humans
- Standardised programmes for education and training in spinal surgery are due to be established
- Qualification as spine surgeon must include an educational rotation of 4 Months minimum in a specialised centre for spinal cord injuries

**Conflicting opinions requiring further research are**

- o Statistically valid Outcome measurements of both methods of management:
  - § Neurological Outcome
  - § Short / Long term complications
  - § Duration of Hospitalisation
  - § Cost of treatment
  - § Psycho-social and vocational impact
- o Impact of timing of mobilisation on neurological outcome
- o Impact of timing of mobilisation on duration of rehabilitation
- o Impact of malalignment on myelopathy / syringomyelia
- o Impact of malalignment on deformity-related pain

## Workshop II

### DATA COLLECTION IN SCI (W 04)

Eric Weerts

Dehli – India Data collection on the outcomes of the care have been used. Since 2007 in Vietnam , more emphasis was done on collecting information on causes and circumstances of injuries on the patients when they are admitted. As other data on SCI injury is very scarce in Vietnam and access to SCI patients only possible and effective when they are admitted , questionnaires were developed with HIB to gather information quickly in order to define swiftly which strategies of prevention could work for public awareness and education . Moreover , some type of accidents were better documented and their relationship with existing safety campaigns and poverty risks after onset clarified

This resulted in 2008 the issuance of a questionnaire at the publication of the Asian Spinal Cord Network guidelines on Prevention . This questionnaire was transformed in a software platform and translated in Vietnamese and Chinese and baptized as ASCON registry with the help of Mister Raymond Crisp and Dctr Bonne Lee from Australie (Flinders University – Sidney Prince of Wales Hospital) . This registry was presented at the ASCON conference in Nepal in October 2009 .

*Alongside the International Classification of External Injury Causes has also a software version that codifies all injuries and in which SCI can also be included.*

*The needs for SCI car programs in Asia require more comprehensive reporting on causes of injuries with standardized tools. Currently, the tools are tested in one center and the number of entries cover the majority of patients admitted in the center.*

*There is a need now to extend the use of this tool to other centers in Vietnam. This will enhance the reporting quality for project donors, highlight / analyze injury issues leading to severe disabilities in Vietnam and elsewhere and report to MOH for consideration. Potentially this information can be used for future monitoring of injury occurrence and might be useful for new prevention activities in Vietnam*

*This know how ( ASCON registry use and ICECI ) should be promoted and taught to ASCON countries at appropriate level of instruction : ASCON registry is user friendly and simple to administer for all professionals as to ICECI is designed for selected professionals interested in injury causes data collection.*

## ***Objectives of the Workshop***

### ***1 Objectives***

To raise awareness to key persons ( MOH , researchers , labor bodies ) about the need for standardized injury data collection in SCI and in general by extension.

To teach the use of ASCON Registry to interested SCI professionals

To teach the ICECI system of selected data collectors of SCI injuries

To launch a network of periodical data collection within ASCON network contributing to global mapping project within ISCOS

### ***2 Expected results***

Participants at the opening session will learn about the necessity of injury data collection, how it can be used for prevention programs , reporting on SCI epidemiology worldwide and more particularly in less resourced countries .

ASCON participants have a better understanding on how to feed data on injury causes in the ASCON and ICECI registries ( from questionnaire taking , formulating a convertible narrative towards data entry and graphics visualization.

Selected participants will be introduced to ICECI data collection methodology through practical exercises and skills testing to obtain the best match possible with the golden standard on injury codification.

## Workshop III

---

### Global Mapping of SCI – Incidence and Prevalence (W 05)

Mr. Peter Wing

The last prior international reviews of the epidemiological literature for SCI were performed in 2004 by Ackery et al. and in 2006 by Wyndaele. This review builds on that body of work, updating figures for incidence and prevalence to the present day, with etiology where available.

Our ability to review and analyse large quantities of data is influenced by the format in which those data are presented – in text format, in the form of tables of data or in graphical formats. Mackay, and Rosling (<http://www.gapminder.org/>) have shown the value of enhanced mapping techniques in the portrayal of health data of national and international significance. These techniques will be presented, displaying data appropriate to each region or country. This project is part of a world-wide spinal cord injury mapping project undertaken by the Prevention Committee of ISCoS and aims to:

- 1) Inform the ISCoS Prevention Committee for coordination of future prevention strategies.
- 2) Provide data to stakeholders seeking information to support injury prevention (specifically to inform regional or national spinal cord injury (SCI) prevention programs).
- 3) Provide a platform for development of specific tools to facilitate injury prevention and encourage uniformity of data collection.
- 4) Create partnerships within ISCoS to facilitate development of strategies for primary and secondary prevention of SCI.
- 5) Provide the structure for an ongoing data repository.
- 6) Inform the ISCoS Prevention Committee for coordination of future prevention strategies.
- 7) Provide data to stakeholders seeking information to support injury prevention (specifically to inform regional or national spinal cord injury (SCI) prevention programs).
- 8) Provide a platform for development of specific tools to facilitate injury prevention and encourage uniformity of data collection.
- 9) Create partnerships within ISCoS to facilitate development of strategies for primary and secondary prevention of SCI.
- 10) Provide the structure for an ongoing data repository.

It is intended that this work continue as an ongoing review open to contributions of published and unpublished data to assist the ISCoS Prevention Committee and other organisations in the task of spinal cord injury prevention. This report suggests a data repository structure which allows for simple conversion to a graphical, easily interpretable map of global trends in spinal cord injury which can be easily updated and published as a living document through the ISCoS website.

## **Australian Spinal Cord Injury Register ( W 06 )**

**Bonne Lee, Ray Cripps**

Dr Lee will discuss the status of published SCI data globally from the perspective of registry completeness and coverage and briefly outline the ASCIR registry including strengths, weaknesses, opportunities and threats from the stakeholder perspective of a clinician in a contributing unit within a developed country. A brief history of the registry will be given and an outline of the challenges involved in maintaining (and evolving) a long term longitudinal project.

ASCIR will be matched to data deficits outlined by the ISCoS prevention committee's global mapping project and compared to the International Classification of External Causes of Injury (ICECI-WHO FIC) which has been evaluated by the ISCoS prevention committee as a vehicle to assist SCI collection of injury data globally. The ICECI will then be briefly described as well as a summary of the evaluation, training and technical ICECI support projects conducted through the ISCoS prevention and International datasets working groups.

## **Causes of SCI in Africa: gaps in data and the opportunities and challenges for improved data collection ( W 07 )**

**Dr Michael Fitzharris**

There is limited epidemiological data pertaining to spinal cord injury in Africa. Much of the data stems from mortality reporting systems, with limited causative data for those injured. Indeed, some of the most complete data stems from studies of the sport of rugby. Road crashes – particularly rollover crashes, industrial accidents and to a lesser extent assaults represent the dominant mechanisms of SCI. This paper will provide an outline of these estimates, and then will shift focus to demonstrate the opportunities for improved data collection, the challenges of access, data quality and training requirements. Three potential data sources are examined: motor vehicle fund compensation systems, hospital data, and mortality data. The strengths and limitations of each these data sources is examined, with evidence presented from the conduct of an injury surveillance study conducted in Namibia.

It is argued that in the context of limited resources, the incidence of SCI can act as an 'index' injury that can be used in epidemiological terms to define the range of injury prevention programs required and to monitor changes over time and evaluate public health interventions, such as road safety initiatives and industrial safety laws. Moreover, in the developing country context when it is not financially viable to establish complete trauma registry systems, monitoring SCI can be useful in assessing trauma system performance, from the pre-hospital context through to patient outcomes following rehabilitation.

## W 08

Dr. H. S. Chhabra

### Abstract

**Objective:** To identify the demographic profile of patients with spinal cord injury admitted at the centre.

**Setting:** Indian Spinal Injuries Centre, New Delhi, INDIA.

**Study Design and subjects:** Retrospective analysis of case records of patients with Spinal Cord Injuries admitted to this tertiary level centre from January 2002 to May 2010.

**Methodology:** Information was collected from case sheets of 1138 patients. The medical records of patients with traumatic spinal cord injuries were studied for various characteristics like Age, gender, marital status, geographical location, rural: urban distribution, time of injury, mode of injury, type of injury, vertebral & neurological level, type of treatment, length of stay/hospitalization and American Spinal Injury Association Impairment Scale at admission & at discharge. Also an especially designed questionnaire was used for telephonic survey to get further insight into fall from height (n=150) and road traffic accident (n=200) as a mode of injury.

**Results:** The study revealed that the age distribution of patients was more or less the same as that of developed countries with the exception that the percentage of geriatric patients was lower. The male female ratio was 5.9:1. Higher percentage of SCI were married at the time of injury i.e. 63.18% (n=719). Road traffic Accidents (RTA's) and Fall From Height (FFH) are the commonest (43.5%, n=320) and second most common (38.04%, n=280) mode of injury respectively. Sports and violence accounted for only 2% & 5.71% of injuries. 65% of patients suffered paraplegia and 69.25% had complete injuries.

**Conclusion:** Our study thus reveals that the epidemiology of spinal injury in India differs significantly from that in the other developed countries. It also suggests that some of the conclusions drawn from previous smaller Indian pilot studies may not be correct.

## **(W 09)**

**ERIC WEERTS:**

### **Back ground of Handicap International Vietnam**

Vietnam's level of economic growth places it in the 'Development' contextual category.

Since 2003, Handicap International Belgium (HIB) has set up Spinal Cord Injury (SCI) care programs in Vietnam, starting with a 50-bed center in Ho Chi Minh City, three provincial units in Khanh Hoa, Phu Yen and Danang and, in 2008, one 20-bed unit in Bach Mai National Rehabilitation Center in Hanoi.

### **Data collection and its purpose**

To satisfy the goals of comprehensive reporting on causes of SCI using tools which conform to international standards, namely, the International Spinal Cord Society's (ISCoS) International SCI core data set and the International Classification of External Causes of Injury (ICECI) and to contribute to a SCI global mapping project within ISCoS, we at HIB, in February 2009, began a pilot to introduce and use the ASCoN SCI register (which conforms to the above standards) in Bach Mai Center, Hanoi. We are also planning to extend the use of the ASCoN SCI register software in other centers in Vietnam in the near future.

### **Findings**

There were 268 patients who were distributed by 10 age groups (0-4 years to 75years and above). Based on the collected data (Figure 1), men were more likely than women to suffer SCI at all ages. Moreover, age 35-54 years showed maximum number of patients suffering SCI (65% for male and 55% for female). The age range was between 5



years and 75 years with the age, on average, 39 years. Out of 268 patients, 54% (n=144) were below 39 years and 46% (n=124) were 39 years and above. 38% of patients had cervical lesion with the majority (n=48) at the C5 level; 18% of patients suffered from lumbar lesions with the highest number (n=28) at the level of L1. Thoracic lesions appeared to be the most common with 44% of patients having an injury to this spinal region. T12 neurological level accounted for about 13% (n=34)

In terms of neurological categories, 6% (n=17) of patients had complete tetraplegia and 28% (n=74) incomplete tetraplegia (Figure 3). In addition to tetraplegic cases, the database recorded 29% (n=79) cases of complete paraplegia and 26% (n=69) with incomplete paraplegia.

Based on etiology, 31% (n= 84) are due to transport, 44% (n= 119) due to falls, 2% (n= 6) due to assault, 1% (n= 2) due to sports activities, 9% (n= 24) due to other traumatic causes and 12% (n= 31) due to non-traumatic causes like tuberculosis in the spine, transverse myelitis...

#### **Discussion:**

When the statistical data gathered in 2008 and 2009 are combined with this data, it showed that there was a shift among the causes of injuries. The leading cause of SCI, RTA, was gradually being replaced by falls. In 2008, RTA and falls accounted for 26% and 25%, respectively; but in 2009, falls became the major cause of SCI with 34% of cases and RTA ranked as the second with 31%. The situation has continued in 2010 with 44% due to falls and 31% due to RTA. This change can be explained thanks to the successful helmet law in 2007 as well as the achievement that Vietnam's Government has reached in terms of road safety laws, such as launching many campaigns to encourage people to wear helmets when traveling, setting up the penalty system applied for those people who break the rules (for example: traveling when being drunk), national press conferences and public education.

#### **Conclusion**

It is still necessary to further the data collection at this point and extend it to additional centers in Vietnam . Although this methodology has its shortcomings It is a first step towards getting a more realistic picture on the possible prevalence of SCI and its shifting pattern of etiology . These shifts in causes need to be addressed by better prevention programs in Vietnam.

### **Causes of Spinal Cord Injury – The Malaysian scene (W 10)**

**N Hasnan, PE Julia, TY Chung**

Department of Rehabilitation Medicine, Faculty of Medicine, University of Malaya, Malaysia.

We are presenting data extracted from a study of characteristics of spinal cord injury patients seen in a non-specialized spinal rehabilitation unit within an acute hospital over a three month period in 2009 at the University of Malaya Medical Centre. All the information was collected using the International SCI Core Data Set. All patients referred to the inpatient and outpatient spinal rehabilitation service and patients returning for follow-up were included in the study. 154 patients (19.4% in-patients, 80.6% out-patients) were included. There were more male patients (70.2%). The mean age was 43.2 years. Non-traumatic spinal cord dysfunction constituted 40.7% of the cases seen. For traumatic spinal cord injury, half (51.0%) were due to transport-related accidents, followed by fall (35.4%). Sports injury and assault each contributed 2% to the traumatic causes. Almost 10% of the traumatic SCI were due to other traumatic causes. There were more paraplegic (62.0%) compared to tetraplegic patients (35.1%) and 59.0% had incomplete lesions; 34.5% ASIA A, 31.0% ASIA D, 16.4% ASIA C and 11.7% ASIA B.

Conclusion: Educating the public about transport safety and fall precautions play a role in prevention of spinal cord injury.

### **Causes of Spinal Cord Injury in Thailand: from past to present (W 11)** **Apichana Kovindha, MD**

**Objective:** To review causes of spinal cord injury (SCI) in Thailand.

**Method:** Review published studies and unpublished data.

**Results:** The first study is a 5 years (1977-1981) retrospective study in Chiang Mai reporting that 278 (48%) of 577 patients with spinal injury also had SCI, 40% had complete lesion and 65% became paraplegic. The second paper of a 7 years (1985-1991) retrospective study reports 398 SCI patients admitted with an estimated incidence of SCI in Chiang Mai of 23 per million per year. According to these studies, road traffic accident (RTA) increased from 28.4% to 47% (54% motorcycle, 17% car, 4% bicycle, and 3% pedestrian); falls dropped from 44.5% (42.8% falling from height and 1.7% falls) to 33%; and fallen upon from 13.3% to 8%; Of those injured from RTA in the second study, 57% were drivers/riders, 55% ran off/overturned, 20% drank alcohol; 30% were admitted within 6 hours and 55% with 24 hours.

The third one is a 6 years (1989-1994) retrospective study of 219 SCI patients and the fourth one is a 4 years (1997-2000) prospective study of 83 SCI patients, done in Bangkok. According to these studies, RTA increased from 50.7% to 74.8% (49.5% of car and 25.3% of motorcycle) while falls decreased from 31% to 16.9% and assaults were the same (8.7% and 8.4%).

According to the fifth prospective study on incidence of disability and impact from RTA with data collection from 8 out of 28 sentinel centers in Thailand done in 2006, 3.2% of 9,737 severely injured patients became disabled while another 1.2% had permanent impairment but not counted as disabled persons according to the Thai law. Of these disabled persons, 82.2% involved in motorcycle accident, 73.9% was a rider/driver, 43.5% got injury between 21.00-24.00 hours, 35.2% drank alcohol, 84.1% did not wear a safety belt, 81.0% did not use a helmet; 92.4% arrived at hospital within 24 hours; 63.5% were under universal coverage for health service, and 1/4 was a breadwinner of the family. In addition, 10.4% got SCI with 12% of paraplegia AB, 7% paraplegia CD, 26% tetraplegia AB and 55% tetraplegia CD.

The last unpublished data extracted from the ICF core set study for SCI done in Chiang Mai, of 59 post-acute SCI patients, 64.4% was injured from RTA, 23.7% falls, 1.7% sport injury, 1.7% non-traumatic, 8.5% others and no assault injury reported; mean age was 45.7 (SD 14.5, range 18-74); male to female ratio was 3:1; and 56% were paid-employed or self-employed.

**Conclusion:** Road traffic accident is increasing and a major cause of spinal cord injury in Thailand. Road safety law should be strictly implied.

## China's SCI Service and Science Past, Present and Future (W 12)

Dr Dajue Wang

### Epidemiological background

From social and geographical perspectives, causes of SCI can be divided into four major categories.

1. Metropolitan accidents (fall from height at construction site)
2. Mine industries (collapse of ceiling)
3. Natural disaster (earthquake)
4. Others (cave dwellers)

They are in contrast to western nations where motor vehicle accidents (road traffic accidents), sports and fall of elderly are the main causes. The victims of the first two groups are low on the social ladder and the injury is rare. As a result, SCI does not appear to be high priority in official health policy. The third group may affect the entire population of the disaster region. However, again, those who can afford buildings of high safety standard may escape the damage even in an earthquake. In the fourth group, a small minority still lived in unsafe earth caves before this century. Their social status was even lower than the first two groups. Therefore, there is a social dimension of the care. In short, SCI care is not just a medical issue but also a politico-economical one. Until the politico-economical situation improves tremendously, a radical change for the good of SCI care is unlikely.

Two epidemiological studies have been conducted. One involved 1982-86 whilst the other 2002. The former included only permanent residents of Beijing. This excluded a large number of construction workers who were mainly migrants. This explains why the incidence was as low as 6.9 per million population. In the 2002 (survey conducted in 2003) one, the incidence shot up to around 70 per million population. Such high incidence was due to the fact that the survey was conducted at the peak of construction in preparation for the 2008 Beijing Olympic. As a result, a huge number of migrant construction workers were included in the study. Since then, the incidence has been dropped according to a hospital where normally a large number of such injuries were admitted although no further survey has been carried out. This was obviously due to the more strict safety and insurance policies imposed by the government on the industry

### **Past – before 1980s**

Only acute care existed. It was nothing more than planting a pair of useless metal plates along the spinous processes and a permanent indwelling urethral catheter in situ. After the acute stage, even medical profession did not know what to do. Although Sir Ludwig Guttman introduced his concept of comprehensive management in as early as 1940s, China was busy at World War II and civil war and could not spare any resources or efforts on SCI. After the founding of the People's Republic, it was isolated from the outside world and probably only one or two orthopaedic surgeons who had received training in UK were aware of the existence of proper SCI care. No survey was done during this period but common sense has told us that most SCI persons died of complications years after injury.

### **Present – 1980 to date**

China opened its door to the outside world in late 1970s. Information began to pour in. In 1982, a pioneer orthopaedic surgeon, Dr Furong Yuan, set up an SCI unit in Xi'an, Shaanxi Province, where the terracotta of China's first emperor were unearthed. There were a large number of earth caves and coal mines in the province. Dr Yuan and his team were highly committed to the care of SCI victims of these locations. They were offered a loan of an equivalent of only 10,000 USD to build a primitive unit with their own hands. This unit became China's first in adopting comprehensive care. Many of the SCI persons were rehabilitated medically and socially. Some of them managed to organise their humble self-employed businesses. Few others were married and had children.

In the mid 2000s an economical boom kicked off. Due to poorly regulated private businesses, a developer in the region illegally forced the unit to close down and demolished it. Although Dr Yuan won the legal case on paper in court, he did not win the unit back. It was a tragedy for the SCI persons.

Another landmark development of SCI service and science was the setting up of the China Rehabilitation Research Centre in Beijing in the 1980s. The paraplegic son of China's top leader, Mr Pufang Deng visited Canada. The tour opened his eyes to the comprehensive service to the SCI persons. He was determined to set up a rehabilitation service in Beijing with emphasis on SCI. For the purpose, he recruited Dr Dajue Wang (DW), a neuro-orthopaedic surgeon in 1983 to help set up such an institution along with other experts.

DW was the only professional from China who had received training of comprehensive management at the National Spinal Injuries Centre, Stoke Mandeville Hospital, UK. Opinions of Chinese experts of various disciplines divided. The majority saw SCI care as passive physical therapy in a sanatorium without active purpose. After fierce debates and with the support of Mr Deng, the concept of isolated rehabilitation institution with only physical therapy was rejected. A multi-disciplinary general hospital was born and rehabilitation within its boundaries was supported by all necessary disciplines. Hi-tech research facilities were also set up. This centre has become the core of SCI service and science in China. The centre is under the administration of China's Federation of Disabled Persons that is supervised by the Ministry of Civil Affairs. There is no similar service within the Ministry of Health. Due to the complexity of China's politics, the centre has not lived to its expectations to expand high standard service beyond its boundaries.

A single hospital under the Ministry of Civil Affairs with limited medical expertise cannot meet the national demands. As China's door opens more and more widely to the world, increasing number of senior medical professionals begin to see the need of setting up a system of comprehensive service for the SCI persons. This new trend has prompted DW to help organise a limited number of SCI units based on existing multi-disciplinary general hospitals within the system of Civilian and Military Health Authorities. This would not have been possible without the support of Mr Wagih S El-Masry (ESW), Chairman of the charity SPIRIT and Medical Director of the Midlands Centre for Spinal Injuries, Oswestry, UK, where more than a dozen of Chinese professionals were trained with the purpose of setting up SCI service back in their hospitals. The program is still ongoing. Five large multi-disciplinary general hospitals have started preparation for setting up SCI comprehensive care on their grounds. It is imperative that no isolated SCI units be planned or set up without easy access to the multi-disciplinary support they need. Such isolated centres could only increase tremendously the overall cost of health care whilst fragmenting the comprehensive care that requires multi-disciplinary expertise. Such a structure is possible only if the hospital has a very strong leadership that can glue all relevant disciplines together, which is quite often a serious challenge in China.

Psychosocial aspect is equally important for the SCI person's well-being. This is a weak

link. Fortunately, a paraplegic, Mr Jun Wen came to fill the gap. He set up a free peer-counselling service since 1999 to help his fellow sufferers. The service has developed from post office to internet. Now, a nationwide network has been established and can be extended beyond China's boundaries. His initiative and efforts have won high acclaim nationally and internationally.

The SCI science is associated with two parallel academic societies. One is under the Ministry of Civil Affairs whilst the other Ministry of Health. Both are part of two different rehabilitation associations. The former focuses on rehabilitation whilst the latter on spine surgery.

Another factor inspiring these hospitals to set up an SCI unit is the interest in spinal cord repair with cell therapy that is popular, if not fashionable in China and a few other countries. The orthopaedic surgeons who have such interest realise that without a proper SCI service, they are not able to do control study comparing natural history of recovery and outcome of cell therapy. The background of a neurosurgeon, who had experience and knowledge in basic neuroscience has made DW a natural coordinator between basic research and clinical trial.

A society of International Association of Neural Restoratology (IANR) was founded in China in 2008. It was initiated by Prof Hongyun Huang, a neurosurgeon of China and Prof Geoffrey Raisman, a Fellow of the Royal Society of UK. Both of them have been working on olfactory ensheathing cells for long. Three international conferences have been organised with success. Its influence is expanding to all continents. This is a society aiming at achieving realistic success in functional recovery instead of unrealistic cure with stem cell transplantation. ESW and DW have been invited to speak at the conferences in support of a realistic target instead of a fantasy. Much needs to be done for the society to achieve real success in clinical trial on sound scientific ground. However, there is no restriction on animal experiments that cover all strategies for the future.

### **Future**

A proper national system of comprehensive care and research should be four-dimensional. That is:

1. All SCI persons (regional and national) – one dimension of a cross-section
2. All disciplines (medical and psychosocial) – another cross-sectional dimension
3. From accident to death (lifetime) – longitudinal
4. Developing new method and strategy (research) – forward looking

From the scientific perspective, the future development of SCI service will heavily depend upon achievements in neuroscience on top of physical medicine and all other

relevant disciplines. The only discipline that has already been successfully integrated into SCI service and science is neuro-urology. Other disciplines should catch up to make the integration complete.

The service the above-mentioned to-be-established SCI units can offer is very limited. After all, the health authorities must do something substantial and radical if properly organised comprehensive care is to be offered to persons with such a devastating injuries and disabilities throughout China.

It is hoped that when the above-mentioned SCI units have been established and run successfully, there would be a chance of persuading health and the entire society to set up a nationwide SCI comprehensive service and research efforts. Whether this can be achieved depends upon China's politico-economical stability and progress. Although the success depends upon collective efforts of the entire society, medical professionals are on the frontline to raise its awareness.

### **Diving Injuries: Are They Really Preventable? YES! ( W 13)**

**H. Herndon Murray, M.D.**

In Greek mythology, Sisyphus was condemned to an eternity or ceaselessly rolling a boulder to the top of a mountain, only to watch it roll back down the other side, forcing him to begin again. He thus exemplifies futile labor, pointless actions, torment which never knows an end, an endless and unavailing task.

Spinal cord injuries from diving accidents occur around the world, they are not unique to any geographic area or culture.

The incidence rates vary, the numbers in pools versus natural bodies of water vary, what does not vary is the tragedy and the concept that each was a preventable injury. In fact, just about everyone agrees that they are indeed preventable, but are they really?

In the medical literature there are multiple reports of studies of diving injuries, usually with emphasis on risk factors and suggestions for prevention:

*"Research has shown that typical no-diving signs are seldom noticed..."*

*"...few reported that they were aware of the hazard of diving headfirst"*

*"The most appropriated target population for (a prevention) program...younger...males...often still students."*

*"Evidently there is an alarming lack of awareness among young people regarding the danger of such pools. It was astounding that individuals dove from sites such as roofs, windows, and second-floor balconies with or without alcohol."*

One finally begins to wonder if diving injuries really are preventable! We will show examples of prevention videos, education programs, cartoons, booklets, each with something to offer, but are they effective, and are they reaching the target group?

We must agree that *"Even a single case must be considered unacceptable"?*

We must increase awareness that *"Any dive can result in a lifetime of severe disability, or death."*

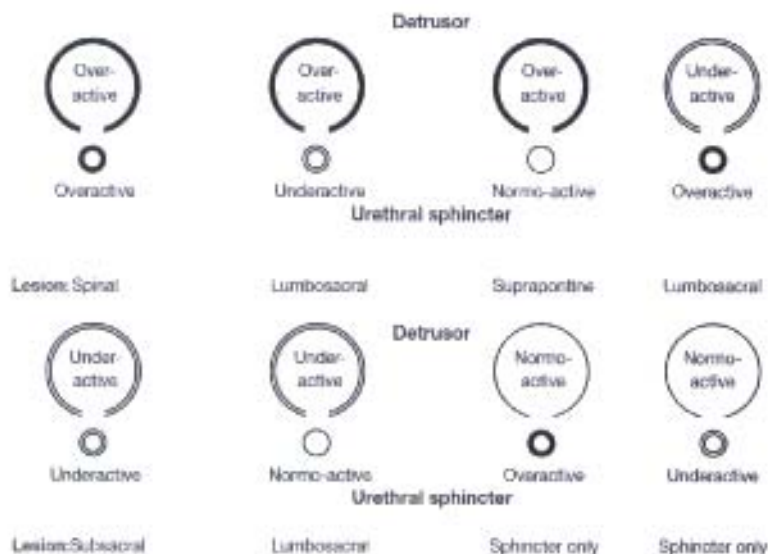


## Workshop IV

### NEUROGENIC BLADDER AFTER SPINAL CORD INJURY: PATHOPHYSIOLOGY AND EPIDEMIOLOGY ( W14 )

Giulio Del Popolo

After spinal cord lesion a neurogenic lower urinary tract (NLUTD) dysfunction is present in most patients. This will express itself in various symptoms: Disorder or failure of bladder sensation, failing or incomplete emptying, urinary incontinence. The acute phase of the spinal cord lesion is called "spinal shock". The bladder is able to store urine, but unable to void. Overdistension of the bladder with incontinence will occur. The normal LUT function depends on neural integration at, and between, the peripheral, spinal cord, and central nervous systems. After spinal shock period the type of NLUTD is dependent on the location and the extent of the lesion: suprapontine or pontine, suprasacral spinal cord, or subsacral and peripheral.. Madersbacher presented a very simple classification, which basically focused on the therapeutic consequences (Figure .1). It is based on the clinical concept that the important differentiation in the diagnosis exists between the situations of high and low detrusor pressure during the filling phase and urethral sphincter relaxation and non- relaxation or DSD during the voiding phase. A non-relaxed sphincter or DSD will cause high detrusor pressure during the voiding phase.



Spinal cord lesions can be traumatic, vascular, medical or congenital. An incidence of 30-40 new cases per million population is the accepted average for the USA. In Europe the incidence is ranged from 15 to 30 per million. Most of these patients will develop NLUTD

**(W 15) NA**

**(W 16) NA**

### **TRICK OF TRADE OF CATHETERS (W 17)**

**H. Madersbacher**

Innsbruck / Austria

This presentation deals with intermittent catheterization as well as with indwelling transurethral and suprapubic catheters and with the need for additional therapeutic measures.

In the first part (1), after a brief historic review on intermittent catheterization, I will discuss sterile versus clean catheterization technique, coated (pre-lubricated) versus uncoated (separate lubricant) catheters, single (sterile) or multiple use (clean) catheters, self-catheterization versus catheterization by others, and any other strategies designed to reduce UTIs in respect of incidence of symptomatic UTI, haematuria, other infections and user preference, in adults and children with incomplete bladder emptying as well as complications and health related quality of life. However, the current research evidence is weak and there is only little evidence that one catheter type, technique or strategy is better than the other. Nevertheless it should be recommended to use intermittent catheterization as the first choice of treatment for those with inability to empty the bladder adequately and safely. Proper education and teaching are necessary to permit a good outcome.

Special attention is paid to {self} – catheterization in patients with physical impairments and the tricks how to overcome difficulties created by them.

The second part (2) deals with indwelling catheters – transurethrally/suprapubic – concluding that a suprapubic catheter is a reasonable alternative to an indwelling urethral catheter, but both are clearly inferior to intermittent catheterization.

Indwelling catheterization is therefore not recommended for the routine use for the long term management of the neurogenic bladder. Longterm indwelling catheterization may be safe only if a careful check-up with urodynamics, renal function

testing and upper and lower tract imaging is performed regularly at least yearly.

In the third part (3) methods will be discussed to relax a concomitant overactive detrusor to achieve urinary continence between catheterizations, as well as the possible value of and the indication for infection prophylaxis.

## **Surgical treatment of neurogenic bladder (W 18)**

**M.Stoehrer**

Urethral and bladder neck procedures

Increasing the bladder outlet resistance has the inherent risk of causing high intravesical pressure during the filling and even more during the voiding phase. These procedures to treat the sphincteric incontinence are suitable only when the detrusor activity is or can be controlled, when no significant reflux is present. Moreover they require a good condition of the urethra and bladder neck and will mostly lead to perform intermittent catheterization after the procedure.

Urethral sling: Various materials have been used for this procedure with enduring positive results. The procedure is established in women; for men the artificial sphincter is obviously the first choice. Artificial urinary sphincter: This device stood the test of time in patients with NLUTD. It was introduced by Light and Scott for this patient group and the need for revisions have decreased significantly with the new generations of devices.

Functional sphincter augmentation: By transposing the gracilis muscle to the bladder neck or to the proximal urethra the possibility exists to create a functional autologous sphincter by electrical stimulation. This would open the possibility to restore the control over the urethral closure. Bladder neck and urethra reconstruction: The classical Young-Dees-Leadbetter procedure for reconstruction of the bladder neck in children with bladder exstrophy and the Kropp urethral lengthening improved by Salle are established methods to restore continence provided that intermittent catheterization is practised and/or bladder augmentation is performed.

### **Detrusor myectomy (auto-augmentation)**

The idea of enlarging a shrunken bladder by removal of lateral detrusor tissue to free the entrapped ureter in a non-functional fibrotic detrusor was put forward by Couvelaire. Since its clinical introduction by Cartwright and Snow in children and by Stoehrer in adults, this procedure to reduce detrusor overactivity or to improve low detrusor compliance has gained popularity because of its acceptable long-term results, its low surgical burden, its low rate of long term adverse effects, its

positive effect on the patient's quality of life, and because it does not preclude further interventions .The procedure is performed extraperitoneally under general anaesthesia and consists of the dissection of about 20% of the detrusor tissue around the umbilicus, leaving the mucosa intact . A diverticulum will develop, but this may take 1-2 years in adults. The laparoscopic procedure: the covering of the mucosa at the detrusor defect (transperitoneal!), supporting the bladder, or simple incision of the detrusor muscle (detrusor myotomy) are proposed variations of the procedure but offer no essential advantages.

### **Denervation, deafferentation, neurostimulation, neuromodulation**

Various procedures that were estimated to destroy the peripheral detrusor innervation have been abandoned because of poor long term results and severe complications . These procedures include bladder distension, cystolysis, transvaginal denervation (Ingelman-Sundberg procedure) and subtrigonal phenol injections.

Sacral rhizotomy, also known as sacral deafferentation (SDAF), has achieved some success in reducing detrusor overactivity , but it is used nowadays mostly as an adjuvant to sacral anterior root stimulation . Alternatives for the rhizotomy are sought in this treatment combination .

Sacral anterior root stimulation (SARS) is aimed at producing a detrusor contraction. The technique was developed by Brindley and is applicable only in complete lesions above the implant location because of its stimulation amplitude over the pain threshold. The urethral sphincter efferents are also stimulated, but as the striated muscle relaxes faster than the smooth muscle of the detrusor, a so-called "post-stimulus voiding" will occur. This approach has been successful in highly selected patients . By changing the stimulation parameters this method can also induce defecation or erection.

The sacral nerve stimulation or sacral neuromodulation is based on the research by Schmidt and Tanagho . This technique stimulates the afferents and thereby probably restores the correct balance between excitatory and inhibitory impulses from and to the pelvic organs at a sacral and supra-sacral level, thus reducing the detrusor overactivity . It is used either as a temporary procedure using foramen electrodes with an external stimulator, with the expectation of perseverance of the changes after treatment, or as a chronic procedure with an implanted stimulator. In the latter case a test procedure, the percutaneous nerve evaluation (PNE), with an external stimulator is performed before the implant to judge the patient's response. This procedure also has considerable success in selected patients .On the basis of the successful application of these systems, future developments towards a device that may be more integrated in the body are under research.

## **Bladder augmentation or substitution**

Replacing or expanding the bladder by intestine or other passive expandable coverage will reduce the detrusor compliance and at least reduce the pressure effect of the detrusor overactivity. The inherent complications associated with these procedures include recurrent infection, stone building, perforation or diverticula, possible malignant changes, and for intestine metabolic abnormality, mucus production and impaired bowel function

As the NLUTD patient population's age when the surgery is performed is generally much lower than the patients with bladder malignancy who are elected for this surgery, the possible very long term complications must be appraised in particular. Thus the procedures should be used with caution in NLUTD patients, but may become necessary if all less invasive methods of treatment have failed. Bladder augmentation, by procedures such as the clam cystoplasty, is a valid option to decrease detrusor pressure and increase bladder capacity whenever more conservative approaches have failed. A number of different techniques have been published. The results of the various procedures are very good and comparable. Bladder substitution to create a low pressure reservoir may be indicated in patients with severely thick and fibrotic bladder wall. Scaffolds, probably of tissue-engineered material for bladder augmentation or substitution or alternative techniques are promising future options.

## **Urinary diversion**

When no other therapy has been successful urinary diversion must be considered for the protection of the upper tract and for the patient's quality of life. Continent diversion: This should be the first choice for diversion. In patients for whom indwelling catheterization or suprapubic catheterization is the only feasible treatment option the change to a continent stoma may be a better prospect. Some patients with limited dexterity prefer a stoma above using the urethra for catheterization. The continent stoma is created following various techniques. All of them however do show frequent complications, including leakage or stenosis. The short term continence rates are over 80% and good protection of the upper urinary tract is achieved. For cosmetic reasons, the umbilicus is often used for the stoma site, but this may have a higher risk of stenosis. Incontinent diversion: If catheterization is impossible, incontinent diversion with a urine collecting device is indicated. Fortunately, nowadays, this indication is seldom because many appropriate alternatives can be offered. Ultimately it could be considered in patients who are wheelchair bound or bed-ridden with intractable and untreatable incontinence, in devastated lower urinary tracts, when the upper urinary tract is severely compromised, and in patients who refuse other therapy. An ileal segment is used for the deviation in most cases. The rather poor long term results and the expected complications warrant a permanent follow-up.

**Undiversion:** Long-standing diversions may be successfully undiverted or an incontinent diversion changed to a continent one with the emergence of new and better techniques for control of the detrusor pressure and the incontinence . Also, in young patients the body image may play a role . The patient must be carefully counselled and must comply meticulously with the instructions . Successful undiversion than can be performed .

## Workshop V

### Bone substitutes and osteo-inductive factors (W 19)

Dr Nibert Passuti

#### Introduction

Although autogenous cancellous bone graft is currently the most effective means of promoting fusion in spinal arthrodesis, morbidity at the donor site can lead to blood loss, hematoma, septic complications, and iliac crest pain. Moreover, only a limited quantity of bone graft may be available for long spinal fusions, especially, when scoliosis is involved.

These disadvantages can be overcome by the use of allograft bone; however, this material is less capable of promoting bone growth and may transmit disease.

These limitations have led to the development of synthetic materials as an alternative to autogenous bone graft. Various materials, including hydroxyapatite (HA), tricalcium phosphate (TCP), biphasic calcium phosphate (BCP) collagen, demineralised bone matrix, and growth factors have been investigated in different experimental and clinical settings. Comparative studies have shown that their efficacy as substitute materials for spine fusion depends, as expected, on physicochemical properties.

#### Experimental data concerning macroporous biphasic calcium phosphate ceramics

Calcium phosphate ceramics, because of their chemical composition close to bone mineral, are considered to be biocompatible and bioactive. They are able to promote bone formation by osteoconduction. Their bioactivity is linked, among other things, to their micro- and macroporosity. The macropores (diameter > 100 microns) provide a scaffold for bone ingrowth inside the ceramic and the micropores (diameter < 10 microns) allow fluid circulation and determine the dissolution and degradation rates.

Calcium phosphate ceramics are widely used as bone graft substitutes for filling bone defects because of their similar chemical composition to the mineral part of bone and their excellent biocompatibility. They undergo a resorption/bone substitution process, particularly when they are macroporous, and form a strong bond with the host bone. This property is known as bioactivity and has been described by several authors. Bioactivity includes biodegradation/dissolution of the ceramic and biological apatite precipitation. Many factors influence the degradation/dissolution property: physical

form, composition and crystallinity. The process of degradation/dissolution results in physical changes (loss of mechanical strength) and chemical changes (pH reduction in the implant environment causing notably partial dissolution of the material). Dissolution provokes an elevation of the calcium and phosphate ion concentrations in the microenvironment, leading to the precipitation of a biological apatitic phase. These new microcrystals were evidenced regardless of the site of implantation (osseous or non-osseous).

However, no work has clearly demonstrated the presence of "true bone" in a non-osseous site and thus the osteoinductivity of calcium phosphates. Differences in features between implants from osseous and non-osseous sites.

However, the outcome of autograft in the lumbar spine fusion is associated with donor site morbidity, including risks of infection, bleeding, fracture, wound healing problems, and increased postoperative pain.

These iatrogenic complications originating from the bone graft harvesting can result in disability and thus increase the recovery time and care cost of patients. To eliminate bone grafting harvesting, a variety of bone graft substitutes have been used in posterolateral lumbar fusion.

Bone graft substitutes are commonly used in spinal fusion surgery. Calcium phosphate biomaterials have the bioactive and osteoconductive properties that allow propagation of new bone formation on their surface and thus formation of strong interface, and provide the carriers or scaffolds of growth factors or mesenchymal stem cells when used for bone regeneration. The differential biodegradation and biodissolution of calcium phosphate biomaterials might be accompanied with a progressive osteointegration in different rates. The quality of calcium phosphate biomaterials used for spinal fusion has been found to be satisfactory in animal models and in clinical practice.

Bone marrow has a higher osteogenic potential than blood so some studies conclude that aspiration either from vertebral body or the iliac crest is preferable to simple venous blood although, if possible iliac crest aspiration should be preferred.

BMP's are osteoinductive factors and have been used in prospective studies for lumbar fusion or combined with extensive instrumentation in adult deformities.

The optimal dose of OP-1 in posterolateral fusion has yet to be determined. OP-1 Putty is approved by the FDA under the Humanitarian Device Exemption regulation and is indicated as an alternative to autograft in compromised patients requiring revision posterolateral lumbar fusion surgery and for whom autologous bone and bone



marrow harvest is not feasible or in whom such treatment is not expected to promote fusion. Examples of compromising factors include osteoporosis, smoking, and diabetes.

Infuse (rhBMP-2) is approved for use in ALIF, although off-label use for posterolateral fusion is common. In a randomised trial of Infuse versus ICBG in allograft dowels for ALIF, all 23 patients who received Infuse showed 100% fusion. Dimar et al demonstrated a higher rate of fusion with high-dose rhBMP-2 than with ICBG in single-level posterolateral fusions (88% versus 73%) in a small, randomised trial. The safety of BMPs is still in question. Reported side effects include increased swelling and dysphagia in cervical fusion surgery and ectopic bone formation leading to radiculitis in posterolateral lumbar fusion.

Many physicians use osteobiologics in off-label capacities, and although evidence may support their use, such application should be presented to the patient as off-label.

Off-label use may expose the surgeon to regulatory and civil litigation. The FDA recently issued a warning against the off-label use of BMPs in cervical spine surgery because of safety concerns.

## **Posterior dynamic stabilization of the thoracolumbar spine with the COSMIC®-system – 24 months FU ( W 20)**

**Dr Bernhard Meyer**

**Objective:** COSMIC® (Ulrich) is a dynamic screw-rod system for the thoracolumbar spine. It provides stability against rotation and translation while maintaining flexibility in the sagittal plane. This study describes our experience in a prospective observational design.

**Patients and Methods:** Data collection was completed in 95/103 treated patients (median FU: 24 months, mean age 65 years (30-88y), 66 female/37 male). Indication for dynamic stabilization was painful degenerative instability (Th11-S1). Dynamic stabilization was performed as first tier surgery in n=43 and as second tier therapy in n=60 cases. Pre-/postoperative CT-scans/radiographs (2 planes/flexion/extension) were performed in all patients. Clinical assessment using standard scales was acquired prospectively in pre-defined time intervals (VAS, ODI, SF36).

**Results:** In 103 patients 162 motion segments (1-3) were instrumented. n=47 patients achieved mono-segmental, n=47 bi-segmental and n=9 tri-segmental instrumentation. Additional decompression was performed in n=86 cases. Significant postoperative pain relief could be documented with the VAS and

ODI (VAS preOP 65±1 to last FU 20±2; ODI preOP 51%±1 to 17%±2). SF36 demonstrated a significant improvement in physical (pre-op:41, last FU:45) and mental health (pre-op:44, post-op:46). n=84/95 patients were satisfied with the treatment after 2 years. n=17 Patients needed revision surgery due to problems within or adjacent to the instrumented segments. (n=1 osteoporotic fracture in an adjacent vertebra, n=3 re-decompression within the instrumented segment, n=8 symptomatic degeneration of an adjacent segment, n=3 insufficient improvement with dynamic stabilization, n=2 infection). Of those n=8 patients with symptomatic degeneration of an adjacent segment n=2 had received mono-segmental (4% of all mono-segmental) , n=5 bi-segmental (11%) and n=1 tri-segmental (11%) stabilization. The risk for revision surgery in the subgroup of patients  $\leq 66$  y (n= 50) is 28 %, in the subgroup  $\geq 67$  y (n=53) only 8%.

**Conclusions:** Dynamic stabilization with COSMIC<sup>®</sup> achieved a significant improvement of pain, mobility, and quality of life. An expected re-operation rate of 17 % and a low risk for intraoperative complications are encouraging facts. Thereby patients with mono-segmental instability and of higher age do best. A prospective randomized trial (spondylodesis vs. dynamic stabilization) is warranted and planned.

## GROWTH INSTRUMENTATION IN THE IMMATURE SCOLIOTIC SPINE ( W 21)

Dr Cody Bunger

Preservation of growth, curve control and avoidance of complications in the patient with major growth potential remain a major challenge in scoliosis surgery. Based on problems with posterior tethering with Luque Trolley technique most recent technique uses interval lengthening of the rods. Randomized studies in pigs have shown interval locking to decrease spinal growth by 70% compared to unlocked systems. The aim of the present study was to analyse correction of Cobb angle, growth preservation and complications in relation to instrumentation technique. Material and Methods 20 patients, median age 6 years and Cobb 78 degrees were treated from 1996 to 2009. Underlying diagnoses were SMA 7, congenital scoliosis 4, juvenile idiopathic scoliosis 3, Recklinghausen 2, Vaters 1, Prader-Willi 1, Cruzon 1 and OI 1. Convex epiphysiodesis and Luque Trolley technique was used in 7 Children, whereas interval lengthening with single or double growth rods in 13 children. Results. Postop scoliosis was reduced to median 25 degrees. In LC one early postop death in SMA patient. Over 8 years major longitudinally spine growth of 7 cm was observed in 5, chrankshaft in 4 and no growth in 2 pat. One reop with elongation to sacrum. 3 conversions to growth rod. GR group lengthened every 6m showed growth of 1,3 cm per year, rod breakage in 4, screw loosening in 2 pat. and curve progression in all pat. Recent unlocked double rods with apical control seemed most promising. Further developed individualized techniques are needed for this heterogenic patient group.

## Workshop VII

---

## Workshop VIII

---

### **Cervical Total Disc Replacement Surgery ( W 30)**

**Dr Wee.Fu. Tan**

Anterior cervical discectomy for cervical root compression by disc protrusion is a very common surgical procedure. Until now the debate on whether to perform a fusion in addition to the discectomy either using autologous bone or implants is still not settled. The newest additional technique using a artificial disc adds a new argument to the discussion making it even more difficult to choose what technique to use.

Many studies have been published on the several techniques yet none of these have been able to prove its superiority above the other. In a recent study Nandoe Tewarie et al showed though without statistical evidence that a superiority of ACDF compared to ACD could not be shown. They concluded that a randomized trial comparing ACD and ACDF will be needed.

Studies on cervical disc prosthesis used after ACD show conflicting results.

In several studies Gofin et al showed that the results of the use of Bryan prosthesis were as good as ACDF using cages. However other recent studies showed that the use of prosthesis showed had inferior results to ACDF as procedure.

In conclusion: though several surgical techniques for cervical disc protrusion have been studied no one technique has proven to give superior results over the other techniques.

The Spine Intervention Prognostic Study Group in The Netherlands has recently started The Netherlands Cervical Kinematics (NECK) Trial, a randomized multicenter prospective trial comparing ACD to ACDF and ACD and disc replacement. A total of 675 patients will be entered in this trial to compare these 3 techniques. After this study we think we will be able to conclude if there is a technique superior to the other in cervical disc surgery.

### **Recent Advances in Management of 'Cervical Spondylotic Myelopathy'. ( W 31)**

**Dr Naresh Kumar**

'Cervical Spondylotic Myelopathy' is the most frequent cause of myelopathy over the

age of 50years. It is believed to have gradual progression with sudden deterioration following a head or neck injury, leading to disability. There is definite evidence to say that mild and moderate forms of the disease do not show better results than conservative management in the long run. Recently we have had early results of well-designed prospective multicentre study to study the efficacy of surgery. It clearly shows advantage of operative treatment.

Proper evaluation would require proper 'clinical grading' and improvement in evaluation of daily activities. Improvement in pre-op evaluation with 'Modified Japanese Orthopaedic Association' helps us in objectively following up such cases. It was seen that these scores are universal, reproducible, valid, and sensitive to document effect of treatments.

The development of 'Multimodal Intraoperative Monitoring' (MIOM) has become routine in the management of these problems in several spine centers. 'Wake up tests' are not used routinely to assess these patients. Preoperative 'Somatosensory Evoked Potentials' (SSEP) are also tools to assess the patient pre-operatively. They are also used to find out the effect of interventions.

Comparison is made between the type of approach whether anterior / posterior with the outcome. It is suggested that anterior surgery has better clinical outcome and more complications at early stage after operation for both Spondylotic and OPLL patients. Posterior surgery on the other hand has similar clinical outcomes compared to anterior surgery but complications are late to present. Improvement in 'laminoplasty' techniques has recently resulted in the improvement in clinical outcomes after these procedures. The improved technique tends to get better out come and reduce the long-term problem of restenosis.

Recent improvement in the use of 'cervical pedicular screw systems' would give a good correction of the cervical spine deformity as well as addressing the compressive element of cervical spine. There is also a role of use of 'artificial disc replacement' in patients with symptomatic myelopathy. There is now evidence to say the artificial disc replacement does not cause worsening of myelopathic symptoms if offered to patients with symptomatic myelopathy.

## **Outcome results for the use of XLIF Cage in the management of acute thoraco-lumbar discitis ( W 32)**

**Dr Jake. Timothy**

**Objective:** Management of acute bacterial discitis varies from conservative treatment with antibiotics and bed rest to aggressive debridement anteriorly and posterior

fixation. The extreme lateral inter-body fusion (XLIF) technique is minimally invasive and provides direct access to the disc space lending itself to directly removing the source of infection, providing a microbiological diagnosis, and stabilizing the painful segment. It improves the speed of mobilization and reduces the length of hospital stay.

**Methods:** 7 patients over a 6-month period presented with thoraco-lumbar discitis. 6 patients underwent stand-alone XLIF and one had XLIF with posterior fixation. Pre-operative back and leg pain was measured using the Visual Analogue Scale (VAS) and functional disability was measured using the Oswestry Disability Index (ODI). Outcomes were repeated at six weeks post operatively in 6 patients and 6 month post-operative data is currently available for 2 patients. Samples of infected disc material were sent off for microbiological investigation in all cases.

**Results:** Pre-operative mean VAS score was 7.1 (5–8.2) for back pain and 4.3 (0.1–7.1) for leg pain. These had reduced to 3.5 and 1.68 at 6 weeks post operatively. Mean pre-operative ODI score was 64.3% (52–80%) this reduced to 45% (14–74%) at 6 weeks post operatively. In 5 cases, no growth or causative organism was cultured from disc material obtained during the procedure. Mycobacterium tuberculosis complex was isolated from one patient and staphylococcus aureus cultured from another patient. In two cases, bacterial DNA was found to be positive. Of these, Staphylococcus warneri/pasteuri was identified in one case. Patients were discharged back to the referring hospital within 3 days post-operatively.

**Conclusions:** Stand-alone XLIF is a minimally invasive technique that can be used to treat acute discitis. It allows direct debridement and stabilization of the painful level. It may help prevent post infection kyphosis and has a clinically significant effect on pain and disability. Although there is a low culture rate obtained from tissue samples obtained intra-operatively, this may be explained by the use of antibiotic treatment prior to referral. By allowing early mobilization of these patients after their procedure, hospital stay can be significantly reduced.

## Workshop IX

### W 33 -NA

#### Effect of lithium on the survival and differentiation of spinal stem cells ( W 34)

Wutian Wu, MD, PhD

Department of Anatomy, State Key Laboratory of Brain and Cognitive Sciences, Research Center of Reproduction, Development and Growth, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Pokfulam, Hong Kong SAR, China; Joint Laboratory for Brain Function and Health (BFAH), Jinan University and The University of Hong Kong, Guangzhou, China

Transplantation of neural progenitor cells (NPCs) holds great potential for the treatment of spinal cord injuries. The survival and differential fate of transplanted NPCs in the cord are key factors contributing to the success of cell transplantation therapies. In this study, we investigated the effects of lithium, a widely used antidepressant drug, on the survival, proliferation and differentiation of NPCs after transplantation into the spinal cord. Our results showed that clinically relevant doses of lithium remarkably increased the survival and proliferation of grafted NPCs in the spinal cord. The drug also increased neuronal generation by grafted NPCs post-grafting. However, the effect of lithium on the differentiation of grafted NPCs was selective. Lithium did not cause preferential differentiation of grafted cells into astrocytes or oligodendrocytes after transplantation, which was confirmed by *in vitro*. Our results also showed that chronic treatment of lithium (up to 4 weeks) favored grafted NPC survival by reducing microglia and macrophages activation. Results of the present study provide strong evidence that lithium has the therapeutic potentials in treatment of cell replacement strategies for spinal cord injury due to its ability to promote proliferation and neuronal generation of grafted NPCs and reduce the host immune reaction.

### (W 35) NA

## Guidelines for Cellular therapies for Human SCI: Are there gaps in perceptions across Nations and investigators? (W08)

Dr. H. S. Chhabra

### Abstract

**Objective:** To identify the demographic profile of patients with spinal cord injury admitted at the centre.

**Setting:** Indian Spinal Injuries Centre, New Delhi, INDIA.

**Study Design and subjects:** Retrospective analysis of case records of patients with Spinal Cord Injuries admitted to this tertiary level centre from January 2002 to May 2010.

**Methodology:** Information was collected from case sheets of 1138 patients. The medical records of patients with traumatic spinal cord injuries were studied for various characteristics like Age, gender, marital status, geographical location, rural: urban distribution, time of injury, mode of injury, type of injury, vertebral & neurological level, type of treatment, length of stay/hospitalization and American Spinal Injury Association Impairment Scale at admission & at discharge. Also an especially designed questionnaire was used for telephonic survey to get further insight into fall from height (n=150) and road traffic accident (n=200) as a mode of injury.

**Results:** The study revealed that the age distribution of patients was more or less the same as that of developed countries with the exception that the percentage of geriatric patients was lower. The male female ratio was 5.9:1. Higher percentage of SCI were married at the time of injury i.e. 63.18% (n=719). Road traffic Accidents (RTA's) and Fall From Height (FFH) are the commonest (43.5%, n=320) and second most common (38.04%, n=280) mode of injury respectively. Sports and violence accounted for only 2% & 5.71% of injuries. 65% of patients suffered paraplegia and 69.25% had complete injuries.

**Conclusion:** Our study thus reveals that the epidemiology of spinal injury in India differs significantly from that in the other developed countries. It also suggests that some of the conclusions drawn from previous smaller Indian pilot studies may not be correct.



## **Translational Challenges in Acute SCI – Are We Ready? (W 37)**

**Brian K. Kwon, MD, PhD, FRCSC**

The urgent need to establish effective treatments for spinal cord injury has led to the development of many therapeutic strategies over the past 30 years. A handful have been evaluated in human trials and many more are emerging from scientific laboratories and vying for clinical translation. Desperate hope in "cures" has led many patients into partaking in experimental transplantation procedures. History has revealed, however, that once promising SCI experimental treatments reach the point of translation into human evaluation, their validation in clinical trials is exceedingly challenging. The relatively low annual incidence of traumatic SCI makes patient recruitment into acute SCI trials an agonizingly slow process. And yet, large numbers of patients are typically needed to answer the question of whether the treatment being studied promotes neurologic recovery, because spontaneous neurologic recovery occurs with substantial variability. The enormity of this process compels the scientific community to carefully decide which of the many experimental treatments available is to be advanced into human trials. Clearly, the decision to proceed with the clinical translation of experimental treatments is not one to be taken lightly.

In this lecture, we will discuss a series of issues pertaining to the translation of therapies into clinical trials in spinal cord injury. Perspectives from the research community and patient community on the need for evidence of efficacy in preclinical research will be described. An approach has recently been developed to evaluate the 'readiness' of preclinical therapies and this will be outlined. Finally, the challenging nature of conducting clinical trials in acute SCI will also be discussed.

## Workshop X

---

### W 38-NA

Urinary Tract Infections in Spinal Cord Injury patients Frequency, evaluation, diagnosis, causes and risk factors.

### (W 39)

Dr G Singh

Urinary tract infection is an inflammatory response of the urothelium to bacterial invasion that is usually associated with bacteruria and pyuria. It is defined by urine cultures showing more than 10 to the power of 5 bacterial colonies in 1ml of urine. Bacteruria is the presence of bacteria in the urine and pyuria is the presence of white blood cells.

UTI's are the most common urological complication in patients with neurogenic bladders and it has been estimated that SIU patients run at about 33% bacteruria incidents at any one time. The incidence of febrile illness associated with bacteruria is estimated at between 1.8 episodes per person per year. Urinary tract infections are the most common cause of fever in the spinal cord injury patient. In our centre we found complications related to urinary tract infections, the single most important reason for readmission in spinal cord injury patients. UTI's can be acute or chronic, relapsing or recurrent; relapsing means infection by the same organisms whereas a recurrent infection implies infections with a different strain of bacteria.

Diagnosis has to be done with meticulous sample collection and culture as soon as possible or sub-optimally, sample refrigeration and culture in 24 hours. In patients with neuropathic bladder dysfunction collection might be helped with triggered voiding or if this is impossible a single catheterisation is permissible.

Risk factors identified included over distension of the bladder, elevated intravesical pressure, increased risk of urinary tract obstruction, vesico ureteric reflux, presence of bladder diverticulæ, impaired voiding, instrumentation and increased incidence of stones. Other factors that have been implicated are decreased fluid intake, poor hygiene, perineal colonisation, decubiti and other evidence of local tissue trauma and reduced host defence associated with chronic illness. The method of bladder management has a profound effect on UTI's and this will be discussed in greater detail.

Urinary tract infections could be lower urinary tract infections (cystitis); and these are

by far the more common. Symptoms would depend upon the type of neuropathic lesion and the method of bladder emptying. Upper urinary tract infections are more debilitating but infrequent. The two main risk factors contributing to pyelonephritis among neuropathic patients include recurrent lower urinary tract infections, interfering with the anti reflux mechanisms; and functional infravesical obstruction including detrusor sphincter dyssynergia with stases and high intravesical pressure.

By the end of the talk the audience should have an idea of why urinary tract infections happen in spinal cord injury patients and what should be done to prevent them. By the end of the workshop hopefully the audience would be able to manage urinary tract infection and it's implication in neuropathic patients.

## **Treatment of urinary tract infection in individuals with spinal cord lesion ( W 40)**

Dr M Agarwal

The treatment of urinary tract infections in patients with Spinal cord injury is directed towards achieving 3 different aims – 1) To keep the bacteriuria under control, 2) To provide low pressure storage of urine, and 3) to keep the patient catheter - free as far as possible. We will discuss various conservative and surgical methods to achieve these aims.

## **W 41-NA**

### **International Spinal Cord Injury Urinary Tract Infection**

#### **Basic Data Set (W 42)**

Dr Fin Biering-Sørensen

**Objective:** Present the background, purpose, development process, and current results for the International Spinal Cord Injury (SCI) Urinary Tract Infection (UTI) Basic Data Set.

**Background:** The purpose of the International SCI UTI Basic Data Set for individuals with SCI is to standardize the collection and reporting of a minimal amount of information related to a possible UTI in daily practice in accordance with the purpose and vision of the International SCI Data Sets (Biering-Sørensen et al. 2006). This will also make it possible to evaluate and compare results from various published studies.

The data in this International SCI UTI Basic Data Set will generally be used in connection with data in the International SCI Core Data Set (DeVlvo et al. 2006), which includes information on date of birth and injury, gender, the cause of spinal cord lesion, and neurological status. In addition, the International SCI UTI Basic Data Set will be seen in

relation to the International SCI Lower Urinary Tract Basic Data Set (Blering-Sørensen et al. 2008), which among other things contain information on the bladder emptying method(s), involuntary urine leakage (incontinence), drugs for the urinary tract within the last year, including antibiotics/antiseptics for treatment of UTI or for prophylactic reasons.

**Setting:** International.

**Methods:** An initial meeting in Denmark in 2009 was established to select and define data elements to be included in an International SCI UTI Basic Data Set; the further description was made with **survey of literature, followed by extensive e-mail correspondence within the group to facilitate the development.**

A draft data set is being developed for dissemination to appropriate individuals and organizations for comment. All suggested revisions will be considered, and a final version of the International SCI UTI Basic Data Set will be disseminated again for approval and adoption, and finally made publicly available in Spinal Cord and at the web-sites of ISCoS (International Spinal Cord Society) and ASIA (American Spinal Injury Association).

**Results:** The International SCI UTI Basic Data Set will consist of variables describing, Symptoms on UTI; Urine dipstick test for nitrite and leukocyte esterase; Urine microscopy; and Urine culture.

**Conclusion:** Collection of the International SCI UTI Basic Data Set should be a basic ingredient of all future studies of UTI in SCI to facilitate accurate description for comparison of treatment, and outcomes across published studies from around the world.

## Workshop XI

### VATS FOR MANAGEMENT OF VERTEBRAL FRACTURES ( W 43)

DR HANS JOSEF ERLI

Video assisted thoracoscopic techniques have been shown to be beneficial in anterior spine surgery of the thoracic and upper lumbar spine. In treating fractures anterior techniques using implant systems adapted for minimal invasive application are used as routine treatments in specialised departments. In some cases these systems can be used as stand-alone instrumentations or in combination with posterior internal fixation and anterior grafting, e.g. in highly instable fractures.

Enhanced visualization is the most striking advantage of endoscopic surgery. Advantages for the endoscope can even be seen in comparison to the microscope. The possibility to use angulated optics (30° as a standard) allows a close-up vision of the operation site, even if a more lateral view is needed. This can be the case for canal clearance from a lateral approach, the standard approach for anterior thoracic and lumbar surgeries. Using endoscopic procedures, the good visualization allows an exact discrimination between spinal cord, healthy vertebral bone and the tissue causing compression.

Besides the experience in fracture treatment thoracic disc herniations and tumors of the vertebral body are good indications for endoscopic spine surgery. Endoscopic spine surgery helps to minimize approach morbidity and improves the visualization in anterior spine procedures.

#### Surgical Technique

For a standard thoracoscopic procedure in lateral position of the patient we use 4 trocars, one above the operated segment, one 2 Intercostal spaces cranially or caudally to the operation site and 2 additional anterior trocars for retractor and suction. These approaches allow a good exposition for mono- or bisegmental procedures with disc resection, corpectomy, vertebral body replacement or instrumentation.

In fractures with the need of spinal decompression we resect the disc with the fractured part of the vertebral body to get approach to the fragments prolapsed into the canal. In case of a burst fracture we resect the vertebral body and the two adjacent discs. The possibility to visualize the operation site on the screen allows a discrimination of the prolapsed bony fragment from the healthy vertebral bone,

permitting a safe resection of the intraspinal fragment and decompression of the spinal cord.

An alternative to the classical endoscopic procedure is the use of an endoscope combined with a minimal-invasive open approach. This technique provides reduced approach morbidity, excellent vision and an easier learning curve. Nevertheless special instruments and training is necessary. An advantage is the easier use of anterior plate systems for anterior stabilization of vertebral fractures.

### **Discussion**

We use endoscopic procedures in spine surgery in our practice since 2002. Anterior decompression along with the stabilization was performed in 20 % of our cases. Successful decompression and good results after endoscopic anterior procedures have also been published by other authors reporting on these procedures. Especially compared to open anterior procedures better outcome has clearly been demonstrated, mainly concerning the postoperative pulmonary function.

The development of posterior techniques like costotransversectomy and extended TLIF approaches today permits approach to the anterior column also from posterior approaches. This along with the learning curve and the need for specialized equipment has prevented a more widespread use of VATS. Nevertheless the use and further development of these techniques is promising and will have its place in the treatment of vertebral fractures.

**W 44-47 -NA**

## Workshop XII

---

### **Maintaining Passion in SCI Medicine: International Perspectives**

#### **The importance of Passion (W 48 )**

Marcalee Alexander

#### **Course Synopsis:**

Physicians that work in the field of SCI medicine have an important impact on the emotional needs of persons with SCIs. At a Think-Tank held after the 2009 ISCOS meeting, members of the Landsort group identified the issue of maintaining passion as one of the four top priorities in SCI medicine. In this symposium we will bring together a international group of physicians to discuss the issue of how the physician's passion and love for practicing SCI medicine affects persons with SCIs. Each of the panel members will provide a 15 minute talk followed by a 30 minute discussion where audience members will be encouraged to discuss their clinical practices and how they maintain passion for caring for persons with SCIs. The overall goal of this symposium is to encourage health care professionals to learn from each other about the importance of maintaining passion for their work and lives and thereby promote improved satisfaction with life for patients with SCIs.

#### **Educational Objectives:**

- 1) To discuss positive and negative professional and personal issues that occur during the practice of clinical medicine that impact upon the ability of physicians in various countries to practice SCI medicine.
- 2) To identify positive strategies learned by physicians in different countries to maintain their passion for caring for patients with SCIs.
- 3) To understand the concept of philosophical counseling and its potential usefulness in SCI medicine.
- 4) To be able to understand the positive effects of advocating for your patients.
- 5) To be aware of the benefits of participation in professional societies or academic pursuits as a means to maintain passion in a medical career.
- 6) To be able to recognize the potential for burnout in SCI medicine along with its signs and method of prevention and treatment.
- 7) To recognize the importance of balance in medicine and life and its relationship to maintaining passion.
- 8) To recognize the importance of having a personal vision and goals in maintaining passion.

To recognize the importance of spirituality in caring for persons with SCIs

### **Balancing life and work: the ultimate challenge (W 49 )**

**Marcalee Alexander**

In this presentation, the relationship between balance and passion will be addressed. The importance of balance as a means to maintain passion and avoid burnout will be discussed. In addition ways to achieve balance will be addressed as will the concept of intermittent intense along with low level chronic balance. Work, family, self, spirituality, recreation, and relationships as issues to be balanced will be addressed. Furthermore, practical methods to set limits and boundaries while caring for needy patients, staff and family members will be reviewed.

### **Re-defining life: evolution through sport. ( W 50 )**

**Suzy Kim**

Surfing, as Dr. Kim's greatest passion, ruined and saved her life. In this presentation Dr. Kim will share her personal experiences as a patient and physician within the framework of the sport of surfing. The dilemma of "sink or swim" was literally meaningful on the day of her injury, but in hindsight, a concept innate in a surfer. With the technical aspects of being a surfer, catching the perfect wave requires looking "down the line" to anticipate how the wave will shape, adapting to other surfers-the implied etiquette, and developing your style -aka passion. In this presentation Dr. Kim will focus on how self-advocacy as a patient evolved for her into patient advocacy as a physician.

### **Burnout--- the wicked cousin of passion. (W 51)**

**Doug Stevens**

In this presentation, classic settings/situations that can be a recipe for burnout will be discussed. The point that patients and caregivers can experience burnout, as well, due to experiences that parallel healthcare providers will also be discussed. Participants will be given a brief burnout inventory that they can take to assess their own lives. Signs and symptoms of burnout, unhealthy and destructive behaviors that can accelerate and deepen the despair of burnout and various coping strategies to help reverse the downward spiral of burnout will be reviewed. The use of available professional services to complement personal efforts to maintain passion while avoiding burnout will be addressed. The concepts of addiction, depression, poetry, exercise, 12-step programs, pets, impaired-caregiver organizations, faith & religion will be considered as part of the remedy for burnout.



## **Advocating for patients with SCI throughout the continuum of care: from bedside to boardroom. ( W 52)**

**IndiraS. Lanig MD**

In this presentation, the issue of advocacy will be tied to various aspects of patient care. Relationships established at the bedside during initial care and the need to cultivate patient self advocacy through heightening their sense of self efficacy on a variety of levels will be addressed along with the professional commitment to patient advocacy as one delineates a therapeutic care plan for the average patient with limited resources. In addition, the professional and personal commitment to advocating on behalf of those with SCI through involvement in professional societies and forums for education that will benefit those living with and loving those with SCI will be reviewed.

The role of participation in committee and leadership activities in professional societies in keeping one's passion ardently aglow, even if one is not in a large academic setting, will be addressed along with the nature of balancing income generating and non-income generating aspects of work. The value of educating others in the care of persons with SCI as we mentor the next generation of SCI professionals will be reviewed.

## **"Philosophy versus psychology: a different paradigm (W 53)**

**Claus Hulting**

To understand the concept of philosophical counselling and its potential usefulness in spinal cord injured medicine rehabilitation.

The question that came about was how we could improve our contribution to the newly injured spinal cord patients and the chronic spinal cord injured patients when it comes to being better and more professional in providing support for not only the broken body, but also for the soul and mind.

For years we have been utilizing cognitive behavioural therapy both on an individual basis and also in groups. Nevertheless after more than ten years of continues cognitive behavioural therapy conducted at the Spinalis spinal cord injury unit in Stockholm we were still not satisfied and happy.

After reading "Plato not Prozac", written by the American philosopher Lou Marinoff we felt challenged to see if we could implement philosophy into the daily treatment with our patients. Through Lou Marinoff who has been very active in APPA (American Philosophical Practitioners Association). APPA gives courses in philosophical praxis

and also runs seminar and workshops. They are entitled to examine people after a certain amount of groundwork.

During the last decades medicine over all has been aiming towards more and more evidence-based practise. A problem for philosophy is that it has been difficult to apply evidence-based medicine application on a philosophical approach. Even though psychology, psychiatry, psychoanalysis all has its origin in philosophy and this other "expressions" are a couple of thousand years younger than philosophy - still there is a conceptual obstacles to overcome before it can be thought of as a "natural ingredient" in the over all ward concept.

There is no doubt that people suffering huge trauma in life are entering into something called the "crystallization point". The difficulties for the surrounding world, including all people involved in "care" is to enhance the grief process in a way so that "the force" is guided a long one direction. It is a matter of stabilizing the internal compass in the "victim".

We are used to very imperative care patterns, but we have forgotten the care ideology. We are constantly trying to put a dressing on to a damaged soul instead of cleaning up a damaged soul, because we have been lacking the instrument for that process.

We have all experienced, most of us, how the newly spinal cord injured patient push the alarm bell button at 3 o'clock at night. When the nurse enters the room the patient usually ask for another sleeping pill or a glass of water or for something else "trivial". The main reason might be much more existential and boils down to that the patient wants to address "meaning of life" or exercise his or here grief together with somebody

What we have done at Spinalis in Stockholm in Sweden is to implement a well-designed educational program that started 2.5 year ago. It included several visits by Lou Marinoff from New York and Michael Russell from Los Angeles. Between the visits of these philosophers from United States, practising philosophers and theoretic philosophers in Sweden helped with "hands on" courses and theoretical background for 20 staff members at our unit. The unique thing with this education programme was that the staffs were composed of occupational therapists, social workers, physical therapists, nurses and doctors. The reason for this was the following:

The occupational therapist can be much better suited in catching a philosophical situation on volley, during an OT session. When "James" starts a session at 10 o'clock on Tuesday morning practising wrist extension he can then forget about wrist extension and continue for an hour with questions addressing the metaphysics

and philosophical values, if he feel it's time to do so. (Instead of waiting for a social worker late next day)

We hired an extra nurse halftime on the night shift in order to be able to again address the true matters that engaged your soul and mind when they occur.

We realised that Prozac is a great pharmaceutical agent for a large number of people in the world but we believe strongly that you should exercise your grief after a spinal cord injury. Staff with passion carries out true philosophical counselling.

Perfection can be reached with experts. Excellence needs passion

## **Goals and Vision: fuel for passion. (W 54)**

**Sergio Aito**

The importance of having a person vision and mission will be discussed in this presentation. Without a mission that translates into a specific project, passion can slip away and without passion no project can be really finalized. Passion represents the "primum movens", in other words the initial fire to begin, as it happens in a couple when they start a relationship. However, if there are no common goals passion can die along with the relationship. In this presentation participants will be asked to write down their own mission and think about how what they are doing in their own lives to achieve these goals. The lack of a vision and goals can impact on the development of burnout in SCI medicine. Participation in scientific societies, groups, research, represent useful instruments to reach individual goals.

## Workshop XIII

---

### **Neuroprotective and Neuroregenerative Strategies (W 55)**

**Brian K. Kwon**

One of the fundamental ICORD initiatives is to develop neuroprotective and neuroregenerative strategies that are applicable to human SCI. In this lecture we will describe a variety of approaches that ICORD investigators have explored in experimental models of SCI. These include efforts to modify the nutritional status after acute injury with either intermittent fasting or a ketogenic diet. We have also explored a number of pharmacologic strategies for acute SCI, including erythropoietin, minocycline, magnesium, and simvastatin. Cellular transplantation approaches are also of interest to us, and we have been actively investigating Schwann cells derived from skin-derived neural precursors (SKPs). We have been also interested in the development of new testing models for preclinical therapies, including a cervical contusion injury in rodents, and a thoracic contusion injury in pigs. An overview of these approaches will be described.

### **W 56 -NA**

#### **Functional outcomes of a novel control strategy for Lokomat- based gait retraining in people with incomplete spinal cord injury ( W 57)**

**Tania Lam**

**INTRODUCTION:** While positive outcomes have been reported following intensive treadmill training for the recovery of walking, ambulatory individuals with SCI still show deficits in functional ambulation, such as slow gait velocity and difficulty in clearing obstacles. Such deficits may be associated with inadequate flexor muscle activity during the swing phase. The objective of this study is to evaluate the effect of a novel Lokomat-based treadmill gait training strategy designed to target training of flexor muscle activity during the swing phase of walking. We hypothesized that Lokomat-applied resistance against leg flexion during treadmill training be an effective approach to enhance flexor muscle activation and improve functional outcomes in individuals with motor-incomplete spinal cord injury. **METHODS:** Adult participants with chronic (>1 year) spinal cord injury were randomly allocated to receive either a robotic-assisted or robotic-resisted treadmill training intervention. Inclusion criteria included the ability to walk on a treadmill with partial body weight support. Treadmill

training was implemented using the Lokomat® (Hocoma AG, Volketswil, Switzerland). The control therapy involved Lokomat training where leg movements are assisted using the standard software control of the device. The experimental therapy involved Lokomat training whereby the robot's motors applied a velocity-dependent torque against hip movements. Treatments took place 3 times/week for 12 weeks, 45 minutes per session. Outcome variables included 10-meter walk test, 6-minute walk test, functional walking tasks (such as the ability to climb stairs or step over obstacles), and kinematic gait parameters. RESULTS: Preliminary results have been obtained from 8 participants. Participants tolerated the modified approach to treadmill training well and showed improvements in their ability to train for longer bouts with fewer rest breaks over the 12-week training period. Both groups showed improvements in overground walking parameters (overground gait velocity, endurance) but individuals in the experimental group showed better improvement in more skilled walking tasks such as obstacle crossing and stair climbing. Participants in the experimental group also showed better lower limb joint excursion post-training. CONCLUSIONS: Our results to-date indicate that there are promising effects of this modified approach to treadmill training, particularly for individuals who have already attained a basic level of gait function.

### **Abnormal autonomic control and health individuals with spinal cord injury. (W 58)**

Andrei Krassioukov MD, PhD, FRCPC

Autonomic dysfunction after spinal cord injury (SCI) manifests in various forms (abnormal cardiovascular control, urinary bladder and bowel dysfunctions, abnormal sweating, loss of temperature control and sexual dysfunctions), and has been described in both clinical and experimental studies of SCI.

These dysfunctions commonly occur in both the acute and chronic phases of SCI, although their presentation may vary with the severity and location of the injury, and with injury duration. For example, acute SCI in humans generally associated with a low arterial blood pressure; especially with cervical injuries, this is also commonly accompanied by bradycardias, which are components of the phenomena known as neurogenic shock. There is clinical and experimental evidence that suggests the degree of cardiovascular dysfunction following SCI is correlated to the severity of injury to spinal motor and sensory pathways. Unfortunately, we still do not fully understand pathophysiology of the autonomic dysfunctions following SCI.

Loss of descending inhibition, plastic changes within spinal neurons, sprouting of primary afferents, and sensitization of peripheral alpha-adrenergic receptors have all been considered mechanisms for hypertensive crises. The investigation of plastic

changes within the spinal and peripheral autonomic circuits also provides us with insight to the possible mechanisms underlying abnormal autonomic control following SCI. Over the last decade, we have developed and significantly improved the assessment of individuals with SCI. However, until recently we only relied on assessments of motor and sensory deficits and do not evaluate autonomic function following SCI. The lack of standards for the assessment of autonomic function following SCI has led to the development of the International Autonomic Standards in order to examine remaining autonomic functions following SCI.

Abnormal cardiovascular control with persistent low resting arterial blood pressure, and periods with either high (autonomic dysreflexia) or lower (orthostatic hypotension) are common in individuals following SCI. Furthermore, clinical observations suggest that individuals with SCI have an increased risk of mortality from cardiovascular diseases including both ischemic and non-ischemic heart disease. This presentation will address the latest evidence-based practices on management of autonomic dysreflexia, orthostatic hypotension in acute and chronic stages of SCI. Data from the spinal cord injury evidence research (SCI-ER) project will be presented.

### **“Sexual and Fertility Rehabilitation after SCI in Vancouver: new insights” ( W 59)**

**Dr. Stacy Elliott**

This lecture will review the use of the Vancouver developed Sexual Rehabilitation Framework to comprehensively evaluate sexual and fertility issues in persons with SCI. In view of this, recent manuals and/or guidelines to assist health care professionals to manage this area will be highlighted as well as the progress of such research items initiated in Vancouver as sexual sensory substitution (neuroplasticity), prototypes of specialized vibrators for both men and women with SCI and the recent findings of autonomic dysreflexia issues with ejaculation after SCI.

### **Clinical and Translational Initiatives in Acute SCI ( W 60)**

**Brian K. Kwon, MD, PhD, FRCSC**

A cornerstone of ICORD's vision is in acute human SCI. In this lecture we will describe a series of studies that have been conducted in patients with acute spinal cord injuries. We initiated a clinical trial to evaluate cerebrospinal fluid (CSF) pressure in acute SCI patients, and found surprising changes in this pressure in the post-operative period. Unexpected increases in CSF pressure may cause decreases in spinal cord perfusion pressure, and this may be an important consideration in the hemodynamic management of these patients. Additionally, we obtained CSF samples from these patients to perform biochemical and cellular studies and shed new light on the

pathophysiology of human SCI. These studies revealed biomarkers of injury severity, and provided information on the temporal pattern of expression for specific inflammatory cytokines. These findings have been expanded into a national multicenter initiative. These approaches and how they might facilitate future clinical and translational initiatives in acute SCI will be described.

## **Rick Hansen Institute (W 61)**

**Mr Bill Barrable**

Twenty-five years ago, the possibility of finding a cure for spinal cord injury (SCI) inspired Rick Hansen's *Man in Motion World Tour*. Today, with support from governments, corporations and individuals alike, the Rick Hansen Institute (RHI) is bringing Rick's dream to life with a vision of *a world without paralysis after spinal cord injury*.

RHI represents a relatively new organization in Canada for networks and initiatives that have been strongly supported in the past by government and non-governmental stakeholders. The Rick Hansen Institute's role is to help influence all elements of the innovation system for SCI treatment, care and other services, including developing new therapies and decreasing the time for research to be translated into real-life benefits. RHI CEO Bill Barrable will discuss how the Vancouver, BC-based organization does this by leading collaboration between researchers, clinicians, funding agencies, government and non-governmental agencies nationally, and, increasingly, internationally.

## **W 62-NA**

## Workshop XIV

---

### **Sensitizing Professionals to the Needs and Concerns of the Family (W 63)**

**Dr. Stanley Ducharme and Dr. Divya Parashar**

The psychological impact of a spinal cord injury can be devastating to most individuals and their families. Yet, the emotional needs of the family are often minimized and not adequately addressed by members of the rehabilitation team. Often, the family's response is seen as an obstacle to the patient's progress through rehabilitation. Yet, the family's response will ultimately be a major factor in how the patient will cope with and perceive the injury. The family's ability to support the patient and to handle the demands of caregiving are extremely important to the individual's ability to successfully reintegrate back into the community.

This presentation and interactive workshop will focus on the psychological adjustment of the family as well as the stress of providing care to the individual with a SCI. The workshop will also focus on the relationship between culture and family response to injury. By addressing the needs and difficulties of the family, it is hoped that rehabilitation professionals will be better equipped to provide strategies that will assist with coping and the stress of pr.



## Workshop XV

---

### Introduction to the course:

Peter Wing

- Earthquake in Haiti.
- Introduction of the speakers.
- Basic Facts re Haiti, economically and demographically

### Haiti government and medical care pre-2010:

Colleen /Jim Guest

- Limits of medical care/ major diseases/Map of centers and capabilities.
- Importance of longstanding NGOs in Haiti in the earthquake response.
- State of SCI and other rehab care in Haiti prior to earthquake
- Additional comments re susceptibilities in PauP/region. (High pop density, etc)

### The Earthquake:

Jim Guest

- Epicenter- duration- extent of initial damage and map of disabled care centers
  - Aftershocks and their implications as a risk to the nascent hospital.
  - Brief comments re lack of resilience of structures in Haiti to earthquake.
- First impressions** and triage of overall situation:

### Core priorities and immediate challenges

Eric Weerts

### Coordination of Care:

Jim Guest / Eric Weerts

- Military role: US Army, Israeli Army, UN field operations, transitions of coordination.
- Non governmental organizations (NGOs)
- World Health Organisation, the Pan American Health Organisation
- The cluster meetings – how it worked in Haiti

### Acute Management

Jim Guest / Colleen O'Connell

- Salvage of wounded and trapped
- Initial organization of care for wounded/Initial salvageable and non-salvageable injuries. Compartment syndrome, gangrene, role for amputation.

- Key elements to acceleration care delivery/ Anesthesia, x-ray, blood bank, lab tests, / role of the USS Comfort.
- Triage decision-making re SCI. Dealing with the high level tetraplegic.
- Restoration of roads / communications / / airport/food / water/shelter.
- Security and its implications for the safety of care providers.

#### Potential for evacuation

Claes/Peter/Colleen

- Closure of evacuation possibilities- causes-
- Problems related to safety of air transport of patients with SCI.
- Potential for repatriation.

#### Sub Acute Management

Jim /Colleen/Geraldine

- The shift to focus on managing the entire SCI treatment course within Haiti.
- Evolution of surgical capabilities and relative extent of non-surgical/ brace- bedrest success and associated benefits and limitations.
- Evolution of rehab center opening and increased capability.
- Complications of SCI- pressure sores- pain- UTI etc. Challenges and mgt .
- Critical need to avoid and treat pressure sores.
- Challenges to adequate nutrition
- Challenges to SCI patient transport within Haiti.
- Personal experiences with different NGOs.

#### Long-Term Management:

Colleen

- Local training and supply needs

### **It will happen again: disaster preparation response for spinal cord injuries.**

#### **Lessons from the Haitian earthquake. (W 64)**

**Dr Eric Weerts**

After the onset of the earthquake in Haiti MSF Belgium contacted Handicap International Belgium for an urgent assessment mission on the needs for follow-up on trauma victims in 3 care institutions (Martissant, Choscal, Chancerelle). Observations are based on the situation between January 19 until 24. Given the priorities of life saving surgery, prioritizing turnover of occupancy for the most urgent cases and effects of the aftershocks on the infrastructure, triage guidelines focused on evacuating the

5 SCI persons encountered to surgical facilities ( when possible ) mainly and providing early counseling and advise to accompanying family members ( using information from measuring scales and guidelines on breaking bad news). In the 3 care institutions , no specific facilities ( beds , pressure relief, standardized urological management , ..) were foreseen for spine fractures with neurological outfall in these facilities . Health staff was not sufficiently trained nor available for dedicated SCI care. Administrative considerations, communications breakdown and security issues added to the difficulties in orienting patients to a suitable care facility. Although spontaneous initiatives promised a prompt solution for the most severe SCI cases, these initiatives did not succeed to address the most urgent needs of the victims in the immediate aftermath of the seismic event meaning :

- admission to a dedicated centralized SCI care entity with special acute care administered by trained staff
- admission to a dedicated centralized SCI care entity with special acute care administered by trained staff
- standard identification of each case using datasets
- centralized information point on realistic evacuation possibilities to a specialized unit for the patients and their families , based on the severity of the observed lesion .
- Lack of foresight in adjusting available resources for the mid and long term needs of SCI victims and their families

An informal network ( LandsOrt group ) was extremely helpful in connecting known specialists with each other and starting up an information sharing network. The latter should be kept on alert ( and upgraded with operative capacity ) for any future disaster that would occur .

#### **Panel Discussion Eric Weerts – Susan Nielsen**

When natural disasters occur in a given setting , it is possible to produce early predictors on how local authorities would respond to early recovery of victims and orientation of these victims to the most appropriate site for care and follow-up . Perspectives from Earthquake in China have given interesting point of views on how the emergency phase shifts into a " reconstruction phase " with clear indicators on the ground announced by local civilian and medical authorities . These contexts provide a learning ground for other parts of the world where , in the case of SCI victims , early care issues should produce predictive information on how long SCI should be followed up on in comparison with other trauma encountered. Community follow-up , availability of long term support , training of local staff and handover of capacities have been a key issue on China that has not only raised awareness in the affected area on SCI but also in other parts of the country not affected by such natural disasters .

# ABSTRACT OF SESSIONS

## Session I

---

### **Strategy for conservative management of vertebral fractures (S 01)**

Current Management of Traumatic Spinal Injuries and concerns about the interpretation of outcomes of future interventions

**W S El Masri(y)**

Consultant Surgeon in Spinal Injuries

President : International Spinal Cord Society

#### **INTRODUCTION**

Traumatic spinal cord injuries (TSCI) are life changing events. Their effects are multiple and complex requiring the expertise of a well trained and well coordinated multidisciplinary team 1. TSCI are not however catastrophic injuries unless they are mismanaged,

With simultaneous Active Physiological Conservative Management (APCM) of the injured spine, the multisystem physiological impairment and malfunction and with adequate planning, monitoring and recalibration of the management especially during the transitional period between spinal shock (areflexia) and recovery of reflexes; the majority of patients with incomplete spinal cord injury patients recover significantly to ambulate 2,3

With simultaneous equally good attention to the psychological, social, emotional, financial, vocational, environmental and economic consequences, patients who do not recover ambulation and those who do can, lead healthy, fulfilling, productive and competitive lives 2

#### **Non Orthopaedic Effects of Traumatic Spinal Injuries with Neural Tissue Damage:**

These are wide ranging and varied

- ***Physiological Instability (PI) of the Spinal Cord***

The injured spinal cord is physiologically unstable due to loss of auto-regulatory mechanisms, disruption of the blood brain barrier and a range of metabolic, cellular and cell membrane disturbances that occur following injury. This PI renders the spinal cord vulnerable and unable to defend itself

from non-mechanical complications such as hypoxia, sepsis, hypotension, hypertension, anaemia 4. These can easily occur in the neurologically impaired patient in further manifest neurological deterioration or indeed lack of neurological recovery (silent deterioration). In the absence of blood loss, the administration of vaso-pressors to patients presenting in spinal shock with bradycardia is a source of concern to the authors, since due to loss of auto-regulatory mechanisms of the spinal cord, an increase of blood pressure may result in bleeding within the cord and further detriment. What perhaps may not be appreciated is that the hypotension of spinal shock is a "low resistance" hypotension due to sympathetic areflexia causing generalised vasodilatation as opposed to the high resistance hypotension associated with blood loss.

While early mobilisation/verticalisation of the neurologically intact patient with a stable or surgically stabilised fracture is advantageous since the patient can be discharged home soon after, early mobilisation/verticalisation of a neurologically impaired patient with a physiologically unstable spinal cord, is unlikely to offer the same advantages and can be hazardous 3 (see below)

- *Generalised multi-system physiological impairment (MSPI) and malfunction (MSMf)*. The functioning of the various systems of the body is abnormal and now depends on the reflex activity of the spinal cord (SC) distal to the level of injury as well as on the intrinsic ability of the various systems of the body to function unconnected to the brain. 2,3
- *Generalised multi-system physiological impairment (MSPI) and malfunction (MSMf)*. The functioning of the various systems of the body is abnormal and now depends on the reflex activity of the spinal cord (SC) distal to the level of injury as well as on the intrinsic ability of the various systems of the body to function unconnected to the brain. 2,3
- *The reflex activity of the SC segments below the level of injury changes often unpredictably throughout the patient's life affecting function.* Rapid changes are particularly more pronounced during the transition period between spinal shock and full recovery of spinal cord reflexes which can last for a few months. Consequently predictable and unpredictable changes in the functioning of the various systems of the body occur 2,3.
- ***Intersystem effects***  
The interruption of the higher co-ordinating and moderating functions of the brain usually result in a wide range of multiple cascading inter system effects and in complications that are rarely seen in other conditions 2,3.

- **Potential of wide range of disabilities and wide range of complications :**  
Because of the impaired physiology, impaired function and the interruption of the higher co-ordinating and moderating functions of the brain, individual system malfunction becomes a source of one or more disability and a potential source for a wide range of complications of various severity ref 1. Complications following SCI increase morbidity cost of treatment and the already heavy burden to patients and family members. Some can potentially cause death others e.g pressure sores can result in high risk of permanent recurrence for life.
- The sensory impairment/loss present diagnostic challenges to clinicians since the usual anticipated symptoms and physical signs of associated injuries, pathology and/or complications are unreliable in these patients.
- The added non medical effects such as loss of independence, social, emotional, financial, vocational, environmental and economic consequences add to the burden of the patient and all those involved with his/her management.

With good comprehensive management and support by an expert multidisciplinary team, the impact on medical, physical and mental health can be markedly diminished and almost all complications can be mitigated or significantly minimised.

### **CHANGE IN THE STANDARD OF CARE OF THE INJURED SPINE**

In the last 3-4 decades many factors have combined to change the standard of care in patients with traumatic spinal cord injuries and promote surgical decompression and stabilisation.

Advances in imaging with the advent of CT & MRI scans, improvement of design and material of spinal instrumentation, improvement in anaesthetics, patients beliefs and expectations, pressures and fragmentation of funding sources, changes in Clinicians' training and allied professionals' were all factors favouring surgery .

One of the most important factors was however, a genuine belief Based on Laboratory Animal Findings that Traumatic Spinal Canal Encroachment and Cord or Cauda Equina Compression can prevent neurological recovery and/or cause further damage to neural tissue. This seems to have popularised and legitimised the global practice of Surgical Decompression and Stabilisation of the Injured Spine as first choice of treatment.

There is a wide range of interventions other than surgery that claim benefit to the neurology of the SCI individual that have been developing over the last couple of decades. Most of the outcomes have been and are being compared to surgical outcomes

### **THE RJAH OSWESTRY DILEMMA**

With the introduction of CT in 1987 followed by MRI in 1994 Oswestry had to define its Strategy as regard the management of TSCI.

The results of Conservative Management in this Orthopaedic Institution with dedicated spinal surgeons were excellent. We had confirmed the findings of Frankel et al in 1969 5 and the European and Australian groups who had subsequently established reproducibility 6. We had also observed that with Conservative management and equal attention to the Physiological Instability of the injured spinal cord and the Biomechanical Instability of the spinal column; the majority of patients with incomplete cord injuries made significant neurological recovery irrespective of the degree of canal stenosis, malalignment, anticipated canal encroachment and cord compression as seen on X rays.

Furthermore the incidence of pain following Conservative Management was less than 10% in both the short and the very long term

A decision had to be made.

### **THE PROCESS**

We trusted our judgement and observations that the great majority of patients who had the clinical prognostic indicators of recovery recovered 7, 8, 9, 10, 11. We assumed that some if not many of these patients must have had spinal canal encroachment and neural tissue compression that could not be seen on plain X Rays.

We also reviewed the literature related to the controversy around the hypothesis of the secondary injury 3,6. We also studied the literature about the Laboratory findings on experimental animals. We could not accept that the level of evidence was strong enough to be applicable to humans especially that there were relevant differences between the species.

### **LABORATORY FINDINGS**

We considered it unlikely that the 20 to 60 million years of evolution between the

laboratory (rodents, cats, dogs) and humans would have selectively spared the spinal cord from evolving. There were other factors as well:

We reflected on the effects of surgery on blood pressure, spinal cord blood flow and on the respiratory functions and stipulated they are likely to be different between quadrupeds and in humans.

We considered the difference in the duration of spinal shock measured in hours in the laboratory animal and in days to weeks in the majority of humans. We thought this is likely to add to the differences in the effects of mobilisation on neurological functions between quadrupeds and bipeds.

We considered the difficulty in assessing subtle gait abnormalities in the laboratory animal and relative ease of detecting minor gait abnormalities in humans and believed this may explain why some of the observed positive results of interventions in the laboratory animal could not be confirmed in humans.

We therefore decided, with some trepidation, to determine the significance of traumatic canal encroachment and cord compression in humans while continuing treating our patients conservatively rather than implement change of practice and carry out routine surgical decompression and stabilisation.

**CONSERVATIVE TREATMENT CONSISTED OF 4-6 WEEKS OF BED REST DURING WHICH ATTENTION IS EQUALLY GIVEN TO THE MULTISYSTEM IMPAIRMENT AND MALFUNCTION AS WELL AS TO THE NON MEDICAL EFFECTS OF THE SPINAL CORD INJURY. THIS FOLLOWED BY MOBILISATION IN A BRACE FOR A FURTHER 6 WEEKS DURING ACTIVE LOCOMOTOR REHABILITATION AND IN PARALLEL WITH THE CONTINUING TREATMENT AND SUPPORT.**

## **NEUROLOGICAL OUTCOME**

### **TRAUMATIC SPINAL CANAL ENCROACHMENT**

The first case reports to suggest that traumatic canal encroachment as demonstrated by computerised tomography does not correlate with the degree of neurological impairment, does not prevent neurological recovery and does not result in neurological deterioration of cord function were published by El Masri et al in 1992.<sup>6,12</sup> The same conclusions were made by reviewing the outcome of conservative treatment of 50 consecutive patients with between 10% to 90% canal encroachment in Frankel C, D and E groups. Patients in Frankel C&D group recovered ambulation. None of the patients in Frankel C, D and E groups deteriorated neurologically or otherwise.



This work was presented to the second Neurotrauma Symposium in Holland 1993 and the American Federation of **Spinal Surgeons** in February 1994. It was also published in abstract form El Masry et al 1993 13,14 Other groups have since published similar findings.15,16,17 There is no evidence to suggest that early or late surgical decompression achieves better or earlier neurological recovery than APCM in humans with incomplete cord or cauda equina injury.

Equally there is no evidence to suggest that surgical decompression is beneficial to humans with complete traumatic cord or cauda equina injury . In 53 consecutive patients with complete cord injury (FA) but with pin prick sensation in the zone of partial preservation will recover significant and useful motor power in the correspondent myotomes 11 . A neurological level higher than the bony level of fracture is another good prognostic indicator of zonal recovery 11.

### **TRAUMATIC SPINAL CORD COMPRESSION**

Unlike in the laboratory situation where it is observed that the longer the cord compression is unrelieved the more damage and neurological loss occurs; Traumatic Cord Compression does not appear to prevent neurological recovery in humans, with incomplete cord injuries 2,14,18,3,19 figure. Equally interesting is that traumatic cord compression is not necessarily always associated with neurological damage and maintenance of neurological free status can be maintained without surgical decompression or realignment. Fig Y

Since the installation of the MRI scanner in our institution we have been monitoring (both prospectively and retrospectively) the neurological progress of conservatively managed patients with cord compression. The preliminary results indicate that the same clinical prognostic indicators of recovery apply whether there is cord compression or not. What is perhaps not highlighted enough is that Surgical decompression does not seem to be beneficial to either the laboratory animal or to humans when the severity of the initial impact on the spinal cord is beyond a certain magnitude as recovery will not occur 20,21,22

### **TRAUMATIC BIOMECHANICAL INSTABILITY (BI) OF THE SPINAL COLUMN**

The most biomechanically unstable fractures heal within 6-12 weeks from injury when Biomechanical Stability (BS) is restored. Ligamentous injuries, however, can take much longer to heal. BI is therefore time related. Containment of the most Biomechanically Unstable injuries can be easily and safely maintained with APCM in recumbency for 4-6 weeks followed by bracing during mobilisation for a further 6 weeks. The great majority of injuries become biomechanically stable, pain free, allowing an

excellent range of movement. Mechanical damage or further damage to the spinal cord at the site of the fracture is extremely rare in recumbency.

There is no evidence to suggest that surgical stabilisation enhances the speed of healing or achieves stability earlier than with APCM except in pure ligamentous injuries with translation and without bony damage when about 50% of the patients develop prolonged BI and are likely to require surgical stabilisation.

The spinal canal has been known to remodel since the mid eighties. Often the vertebral body remodels as well with APCM.

Admittedly the incidence of kyphotic deformities is lower following surgical stabilisation than following APCM, however the greatest majority of these kyphotic deformities are painless. The discrepancy between kyphotic deformity and pain has been known for some time 6. A painless 40-50o kyphotic deformity enhances wheelchair bound patients' independence and is certainly much preferable to a stiff straight neck or back.

Admittedly the incidence of kyphotic deformities is lower following surgical stabilisation than following APCM, however the greatest majority of these kyphotic deformities are painless. The discrepancy between deformity and pain has been known for some time 3. A painless kyphotic deformity enhances wheelchair bound patients' independence and is certainly much preferable to a stiff straight neck or back.

The benefit of surgical decompression to neurological outcome and of surgical stabilisation were not the only beliefs that required challenging.

#### **SURGERY FOR: EARLY MOBILISATION (EM) - REDUCTION OF COMPLICATIONS - REDUCTION OF PERIOD OF REHABILITATION & HOSPITALISATION - FACILITATION OF NURSING:**

There was a general belief and an assertion that surgery was beneficial to achieve early mobilisation, reduce complications of recumbency, expedite rehabilitation and shorten hospitalisation time.

Although we were in agreement that Early Mobilisation is certainly advantageous to neurologically intact patients who can be discharged soon after successful surgical stabilisation, there were many reasons why this was not the case in the neurologically impaired patient.

Over six decades ago Guttman demonstrated that the complications of recumbency in SCI patients are caused by the inadequate management of the recumbent patient and are almost completely preventable.

Furthermore the physiological responses to posture differ between the neurologically intact and the neurologically impaired.

### **Posture and the Respiratory System**

Although the vital capacity the neurologically intact patient increases in the vertical position, Early mobilization before return of reflex activity of patients with complete upper thoracic and cervical cord injuries is associated with reduction of lung volumes and vital Capacity 23, 24, 25, 26, a potential drop of oxygen saturation as well as marked Postural Hypotension. These findings have been confirmed repeatedly.

The combination of hypotension, reduced vital capacity and potential reduction of oxygen saturation may not only further impair cord functions, but also imposes great limitations on the physical ability of the patient who requires energy, motivation and a sense of well being to engage in the arduous, tedious and demanding process of Rehabilitation.

Assisted coughing, which is essential to get rid of bronchial secretions in patients with paralysed abdominal muscles who are unable to expectorate, is easier and more effective in recumbency than in the vertical position. The struggle against gravity to achieve successful assisted expectoration is minimised in recumbency.

The incidence of chest infections in tetraplegic and paraplegic patients treated with APCM in the acute phase in the MCSI is less than 3%. The incidence of tetraplegic and paraplegic patients requiring short term ventilation is less than 2% when they present in the acute phase breathing spontaneously and without associated chest injuries or past history of chronic respiratory disease.

Postural hypotension is most profound during the stage of spinal shock. EM of patients with cord injury but with biomechanically stable injuries can cause temporary neurological deterioration that recovers immediately when the patient is returned to recumbency.(phys. Ins). Administration of ephedrine before verticalisation abolishes both the drop of blood pressure and the neurological loss suggesting that cord haemodynamics influence neural functions and suggesting that the physiological instability of the spinal cord needs at least equal attention to the biomechanical instability of the spinal column.

## **Posture and Pressure sores**

The risk of pressure sores over the ischial tuberosities and sacro coccygeal prominences is indeed increased when the patient is mobilised in the wheel chair particularly during the stage of spinal shock when the skin blood flow is at its poorest. The forces which in recumbency are spread across all bony prominences become concentrated on the ischial tuberosities and sacro coccygeal prominences when the patient is mobilised/verticalised.

## **Posture, Rehabilitation and Total Hospitalisation**

There is no evidence to suggest that early mobilisation in patients with SCI shortens the period of treatment of the multi system impairment and malfunction, rehabilitation and or hospitalisation. Such periods are influenced if not governed by many factors: the range of services provided by the hospital to the various effects of the SCI, the model of service provision, the subjective experience of the clinician, the system of funding, the system of social support and the ewaponsibility of the hospital to the patient following discharge from hospital.

Moreover there is no homogenicity in the definition of the end point of the episode of treatment. Furthermore there is no evidence to suggest that the period of hospitalisation during the acute stage reflects the total hospitalisation for the management of the multisystem physiological impairment and malfunction, rehabilitation and return of the patient to his/her own community.

## **PROGNOSTIC INDICATORS OF RECOVERY**

The neurological findings at 48 – 72 hours from injury are essential in predicting neurological recovery. Over 85% of tetraparetic patients who present in the first 72 hours from injury with any distal movement however isolated, little and/or patchy (FC), and over 75% of patients who present 48 – 72 hours from injury with no motor power but with preservation of pin prick sensation down to S3 (FB) will recover to walk again at 4-6 months from injury and the great majority in one year 7,8,9,10 provided they are not harmed by the treatment. In 53 consecutive patients with complete cord injury (FA) but with pin prick sensation in the zone of partial preservation will recover significant and useful motor power in the correspondent myotomes 11. A neurological level higher than the bony level of fracture is another good prognostic indicator of zonal recovery 11

## **POSSIBLE MECHANISMS OF NEUROLOGICAL DETERIORATION ASSOCIATED WITH SURGICAL INTERVENTION:**

Although surgery in skilled hands and in an ideal environment is generally safe, the true incidence of manifest neurological deterioration or lack of neurological recovery (silent deterioration) is unknown.

Mechanisms of neurological deterioration associated with surgery range from mechanical damage during handling preoperatively, per operatively or during intubation; clamping of a major feeder to stop bleeding; hypotensive or hypoxic attack during anaesthesia; post operative bleeding around the cord or cauda equina ; post operative sepsis and post operative premature failure of implant.

Close monitoring of neurology in Conservatively managed patients in our institution revealed a temporary increase in density or ascent by one or two levels at around 48-72 hours from injury in 10%-15% of patients. The great majority of of these patients recover to at least initial level or better. This we think is related to oedema of the spinal cord which subsides within 2-3 weeks from Injury 8,11.

With modest care, permanent and significant neurological deterioration in recumbency is extremely rare irrespective of the degree and severity of the biomechanical instability. Most of the significant and permanent deterioration occurs when the patient with a biomechanically unstable spine and/or a physiologically unstable spinal cord is sat up in bed or mobilised out of bed.

We believe that patients undergoing any type of treatment should be given this information

#### **RJAH OSWESTRY INDICATIONS FOR SURGERY:**

The uncontrolled epileptic , the mentally challenged and patients who are unable to comply with bed rest are likely to be benefit from surgical stabilisation as they are likely to be difficult to manage Conservatively . Patients with Biomechanical Instability from pure ligamentous injuries without bony injury are at risk of developing late instability and may opt for early surgery.

Patients who exhibit signs of neurological deterioration with evidence of further compression of neural tissues on MRI may benefit from surgical decompression.

#### **Discussions**

Patients with incomplete cord injuries make significant neurological recovery irrespective of the degree of canal stenosis, canal encroachment, malalignment and or cord compression 3,6,9,14 provided both the BI of the spinal column and the PI of the spinal cord are well contained.

The findings in the laboratory animal do not appear to be mirrored in the clinical situation. This could be related to differences between species during evolution as well as the differences in the effect of the spinal cord pathophysiology between quadrupeds and bipeds especially on the autonomic and respiratory system. In any case translation from the laboratory animal to the clinical situation requires caution 27.

We believe, based on current knowledge and level of evidence, there is no need for immediacy in surgical decompression and/or stabilisation and/or any other intervention. Surgery should not supersede the need of a thorough neurological examination, adequate enough to compare with, monitor and determine neurological outcome at later stages of injury. This should apply to any intervention not only surgery.

We also believe that should surgery be contemplated it should be carried out by the most experienced and skilled spinal surgeon in an environment where patients with such generalised physiological impairment can be looked after and supported safely.

In the absence of the best surgical skill and expertise and/or appropriate infrastructure all patients with SCI can be treated Conservatively safely in recumbency until they are referred to a spinal injury centre where they can also have expert simultaneous treatment to all the medical and non medical effects of the spinal cord injury.

## CONCLUSIONS

Conservative management of the injured spine is safe and easy to conduct provided the patient is agreeable to remain in recumbency for up to 6 weeks.

The outcomes of Conservative management are excellent and remain unchallenged by any of the wide range of interventions

Conservative Management can be conducted in any Institution as long as the patient is agreeable to remain recumbent. The multisystem physiological impairment and malfunction and the non medical effects are much more demanding and require the skills of a well coordinated multi disciplinary team of well trained and experienced staff that can only be found in dedicated SI Centres. The majority of Spinal Injury Centres also have the expertise of skilled Surgeons and can offer equally skilled Conservative and Surgical management with the added benefit of informed consent by the patient.

## Surgical management of thoracic and lumbar fractures-

### Current strategies (S02)

Patrick J. Kluger

Erbach, Germany

#### Abstract

With today's methods in spine surgery the assumption is justified that surgical management of the vertebral lesion in acute traumatic SCI does not worsen the neurological outcome.

In contrast surgical management can yield advantages, when compared to conservative management, in terms of union rate, anatomical alignment, and regarding the patient's overall management conditions (nursing, pressure sore prevention, bladder management, and early start of rehabilitation program).

However these advantages only justify the inherent risks of surgery, when the surgical method applied actually provides

1. optimal restoration of the anatomy (including the spinal canal) together with
2. maximal stability allowing early mobilisation without a brace,
3. permanent fusion only sacrificing the smallest thinkable number of motion units (ideally only those destroyed by the injury) and
4. availability 24/7.

The method's permanent availability is crucial to cover the (rare) cases of progressive paraplegia, e.g. caused by an epidural hematoma, where surgical treatment as an emergency procedure unquestionably yields better neurological results than conservative management.

To meet all these requirements, an in-house protocol should be established, taking the different fracture types as well as local conditions into consideration.

The protocol presented is based on a rather common scenario:

- Ct-scan available for fracture assessment
- Blood bank or auto-transfusion available
- IMC or ICU available
- Experienced anaesthetist's team available
- 1 surgeon on call with sound experience in doing pedicle screws at all levels T1 – S1

If these requirements are not met in a specific institution, the patient should be referred elsewhere, or not accepted for admission in the first place.

In T1 to S1, posterior open reduction and fixation should be done by means of transpedicular screws with rods (1 vertebra above and 1 below the fracture), together with restoring the spinal canal's width via inter-laminotomy or laminectomy in the lumbar spine, and via uni- or bi-lateral costo-transversectomy in the thoracic spine, occasionally combined with laminectomy. In many burst fractures a reconstruction of the spine's anterior column is needed to avoid late collapse. Which amount of late collapse has to be expected in a specific case without anterior reconstruction, and whether it will be tolerable, can be calculated from the pre- and post-op X-rays. The reconstruction via anterior approach can be done during same anaesthesia, or on a second stage within 4-6 weeks. It can be performed open or endoscopically in the thoracic spine, and via retro-peritoneal approach in the lumbar spine. The upper thoracic and the upper lumbar vertebrae not being very convenient for anterior approaches, anterior reconstructions via costo-transversectomy in segments T1 to T4 and via laminectomy in the lumbar segment L2-3 are recommended, if their need can be predicted.

If a sufficiently strong screw-rod implant has been selected and is well placed, no post-operative bracing is needed, and the patients can be mobilised as soon as their general clinical conditions allow.

### **Current Trends for the Surgical Management of Lower Cervical Spine Fractures (S 03)**

**Brian K. Kwon, MD, PhD, FRCSC**

Injuries of the lower, "subaxial" cervical spine (C3 to C7 inclusive) occur along a wide spectrum of severity, from minor soft tissue "sprains" to disastrous fracture dislocations with spinal cord injury. While cervical spine injuries occur in a small percentage of patients suffering blunt trauma (approximately 2.5%), the associated risk of quadriplegia in the setting of unstable cervical spine injuries makes it imperative to have a high index of suspicion for their presence, and to develop a sound and rationale approach to their diagnosis and management. Few other injuries have the potential for such catastrophic morbidity when missed.

This lecture will review current trends in the diagnosis and management of lower cervical spine injuries. The latest literature surrounding the diagnostic imaging of patients with suspected cervical injuries will be discussed. Then, the principles of cervical biomechanics and the concepts of cervical stability which are critical to deciding upon the definitive treatment will be reviewed. Recently described classification systems which help to guide treatment will be discussed, with example of how injury morphology and neurologic status are integrated into management decisions. Management of specific lesions of the subaxial cervical spine will be discussed.



## Session V

### CHALLENGES FOR NEURO-UROLOGICAL MANAGEMENT IN DEVELOPING COUNTRIES ( S 04)

J J Wyndaele

Neurourology is the part of medicine that takes care of problems in lower and upper urinary tract in patients with a neurologic lesion.

It is never a stand alone but should be part of a comprehensive global management in these patient. The knowledge of actual treatment has gradually increased during the last century in the Western world.

Neurourological management has found a solid basis in this newly acquired knowledge:

- Kidney function is very important but depends during evolution greatly on bladder function
- Lower urinary tract (LUT) function has as most importance factor the pressure development during filling and voiding
- Continence is of superior influence on quality of life but bladder filling and complete bladder emptying have both to be looked into
- Treatment must be optimal from the day the lesion occurs in order to safeguard the patient's future
- During follow up symptoms are not fully reliable and being continent and never having urinary tract infection is no guarantee that the LUT function is overall safe for the future

This listing shows that the general principles are the same everywhere and should not be a special problem for countries just starting to develop this part of medical care.

The practical implementation of the care consists of different parts

1. in acute neuropathy the treatment starts with artificial bladder drainage
2. diagnosis of the exact nature of the LUT neurological deficit in an individual patient and what this represents for the voiding-continence function
3. treatment options which are by definition preferably conservative in first instance
4. follow up

Challenges in general for developing countries may be multiple : financial, knowledge, health care structure and policy, human and technical resources, but also as in all places around the world personal and society convictions, social ethics, general attitude towards sickness and more.

Transmitted as practical approach into the different parts of neuro-urological care, this may look like :

1. period of artificial bladder drainage. The use of a transurethral catheter (IDC) is most generally applied. Some guidelines exist on what is the best care for IDC, but they are not uniform especially in practical details. But the general principles should be followed everywhere and are easy to follow too.
2. Period of diagnosis. Diagnosis is made by gathering general information, clinical information and data from specific tests. The former two can be easily done everywhere if sufficient training and expertise has been built up. The ISCOS core and extended data bases can be of great help. The AIS and added autonomic function descriptions help to standardize.

Technical data depend on availability of the equipment needed.

Urodynamic testing is considered of very great importance by all working groups internationally. The equipment should not be very complicated in the beginning and thus will be not very expensive. What can be deducted from LUT function with a one channel, one dollar /test equipment is impressive if the person who performs the test has a proper knowledge and good experience. Once this has been achieved one can try to get a more elaborate equipment with two, four, 6 channels. With a growing number of channels a growing knowledge of pitfalls and limitations of the test are mandatory. To perform a urodynamic test no urologist nor doctor degree is needed, but the results have to be part of the whole information gathered in the different examinations as clinical, history etc.

Other tests as ultrasonography or radiology, cystoscopy and electrodiagnostic tests need additional knowledge and expertise. They are not cheap and proper indications are necessary.

Laboratory tests are part of every diagnosis.

3. Treatment is by definition conservative. Intermittent catheterization and self catheterization have gained great popularity as the results are good also in the longterm and application is not difficult. Drugs are regularly needed especially for bladder relaxation. All available drugs are in a way effective and a proper use of the available drugs in the correct individual dose will help to balance between efficacy and side effects. More invasive techniques may be needed for more rare specific cases. Botulinum toxin injections, surgery are, for those who learn about the trade, naturally attractive. They have indications but it would be wrong to think that they are needed in most patients as in the vast majority a very acceptable result can be achieved with much less aggressive means.
4. Follow up has to be lifelong. Though neuro-urology has lost his title role between the causes of death after spinal cord lesion, urinary complications are still important as causes for readmission, negative players in quality of life. To structure a proper follow up is a challenge as patients will have returned

into society, might lack the means or may lose the understanding how important follow up is,

It is very clear that in all parts of management described above, education is the mainstay. Education, training, exchange of experiences, shared solutions for encountered problems are all solid bases of progress in neuro-urology. Together we make the future.

## **Innovative Techniques for Cost Effective Management of Neurogenic Bladder in Developing Countries ( S 05)**

**Dr G Singh**

The primary goal in the management of the neuropathic bladder is to protect the upper tracts and reduce renal complications. Secondary goals include promotion of continence and improving quality of life.

Cost is an issue not just in the developing world but also known in the developed world and we are looking for innovative techniques; and how cost could be minimised without compromising on the quality of bladder management. Management can be divided into, immediate management, early management, intermediate and long term management. To ensure a safe bladder we will look at the strengths and the weaknesses as applicable to the developing world and options available for health care personnel managing the neuropathic bladder; and we will also look at the opportunities available to optimise the management choices for patients.

Evaluation including clinical and radiological evaluation with reference to cost effectiveness and need and availability in the developing world merits discussion and I hope this will be an interactive session with audience participation.

## **Neurogenic Bladder Evaluation to Develop Management Strategies and Prevent Complications Pertinent To Developing Countries.(S 06)**

**Inder Perkash, MD, FRCS, FACS**

- Introduction: The bladder has only two essential functions. It stores and periodically empties liquid waste. Yet it is unique as a visceral organ, allowing integrated volitional and autonomous control of continence and voiding. Normal function tests the integrity of the nervous system at all levels, extending from the neuroepithelium of the bladder wall to the frontal cortex of the brain. Thus, dysfunction is common with impairment of either the central or peripheral nervous system.
- Central Control: Intracerebral and intrathecal injections of the drugs indicate that

the Micturition reflex pathways may pass through multiple relay stations in the brain stem and be modulated by inputs from various centers in the brain. The cholinergic agonists are known to act on centers in Pons and Medulla to facilitate Micturition (1). Microinjections and electrical stimulation at the Locus Coeruleus facilitate Micturition. The findings of recent functional MRI studies indicate a critical role for the Cingular Gyrus in bladder control, while also suggesting potential involvement of other nearby WM tracts such as anterior corona radiate(2).

- Neurologic Outcome following Injury: Lesions above Pontine Micturition Center (MC) will have detrusor hyperreflexia. Spinal Lesions above T5-6 and below MC will have autonomic dysreflexia (AD) and detrusor sphincter dyssnergia (DSD ). Lesions below the Micturition center and above the conus will have a reflex Bladder (DSD). Cauda Equina Lesions will lead to an areflexic bladder depending upon the degree of lesion and will manifest with asymmetrical lesions in the lower extremities. On the other hand conus lesions are associated with an areflexic bladder, atonic urethral and anal sphincters and bilateral involvement of toe planter flexors which are weak or absent.
- Management Strategies to Prevent Complications: After reviewing the site of neurologic lesion, the type and degree of neurogenic bladder dysfunction is evaluated. A neuro-uologic work up includes simple or complex urodynamic testing to help diagnose the degree of bladder involvement and plan management. It is aimed to provide a continent system with low voiding pressures and controlled IC voiding. In between IC these patients are continent due to DSD. High voiding pressures over 50 cm water can lead to vesico- urethral reflux, repeated pyelonephritis and stone disease...

Initial management invariably needs an indwelling catheter with close drainage system to provide bladder drainage, monitor fluid intake and output, and prevent undue overdistension of the bladder and to reduce urinary tract infection (UTI). In some patients permanent suprapubic cystostomy or an indwelling Foley catheter is preferred who cannot use an external collecting device (condom drainage) due to skin problems or have a small phallus and or very obese. This entails simple management in countries with limited resources. In females also IC is the first choice failing which an indwelling Foley catheter or suprapubic tube drainage is instituted. Proper cleaning of collecting devices with 0.6% bleach can remove most of the contamination. Compared to IC both suprapubic catheter and Foley indwelling drainage are associated with a significantly higher incidence of renal and bladder stone disease and also drop in renal function when followed for a longer period (3). Other complications include urinary strictures; false passages (4) in the urethra, urethral diverticulum and even urethral fistulae have been reported. Many of these complications are preventable using adequate lubrication, straightening of the penis to maximal length and applying minimal force during the introduction of the catheters.

After the shock phase is over, or even earlier when patient is stable, intermittent catheterization is started preferably using sterile technique in the hospital to prevent iatrogenic infection. Patients may also need to limit fluid intake and take anticholinergic drugs to achieve continence and lower resting bladder pressures. Accomplishment of continence is vital more so in developing countries with poorly available collecting devices. Patients are monitored for the rise in blood pressure to predict, prevent and manage autonomic dysreflexia in lesions above thoracic 5-6 level. In paraplegics, self IC, using clean technique is instituted to develop self reliance for their long-term care. Catheter can be boiled and kept in a clean box and used repeatedly. Minimum IC is needed at least 3 times daily to adequately empty the bladder. There is data to show that 3 times daily IC has lower incidence of UTI.

Persons with Cauda equina and conus lesions may be able to void with crede' / valsalva with a titrated dose of alpha blockers since alpha adrenergic activity may be intact in such patients. External condom drainage can also be used for the reflex bladder with the use of alpha blockers and even combined with small dose of anticholinergic provided frequent urodynamic monitoring is available to make sure that their voiding pressures are below 50 cm water. In patients with detrusor hyperreflexia where bladder resting and voiding pressures are not easily controlled with anticholinergics, intravesical injections of botox have been found beneficial. Patients are periodically followed for UTI monitoring and assessment of renal function.

Tetraplegics with poor hand function can benefit with transurethral sphincterotomy which also ameliorates AD (5).

## Session VII

---

### **WHO's role in enhancing the quality of life for persons with disabilities through national, regional and global efforts and the International Perspectives on Spinal Cord Injury as a case in point (S 23)**

*Alana Officer, Coordinator Disability and Rehabilitation, Department of Violence and Injury Prevention and Disability, World Health Organization*

*Jerome Bickenbach, IPSCI Editor in Chief, Swiss Paraplegic Research*

WHO has set itself the task of raising awareness about the magnitude and consequences of disability around the globe by facilitating the collection, analysis and dissemination of health and disability-related data. Building on strong evidence-base, WHO supports, promotes and strengthens health and rehabilitation services for persons with disabilities and their families relying on proven strategies such as community based rehabilitation; facilitates the development, production, distribution and servicing of assistive technology suitable to all persons with disabilities; as well as capacity building efforts among health and rehabilitation policy makers and service providers. The soon to be launched World Report on Disability brings together a wealth of scientific information on disability and the lived experience of disabilities in all regions of the world. In all of these activities WHO hopes to enhance the rights and opportunities for people with disabilities by means of joint efforts by multisectoral networks and partnerships. To assure that policies are useful, resource usage efficient and sustainable, WHO relies on proven implementation measures and monitoring mechanisms.

The International Perspectives on Spinal Cord Injury (IPSCI), a joint project of ISCoS and WHO relies on the same inspiration and methodology of cooperation between stakeholders in spinal cord injury (SCI) research, services and social and health systems, as well as assembling the best evidence-base available. IPSCI is a reflection of the dedication of all those researchers, service providers and advocates who work to enhance the rights to inclusion and full participation in society for persons with spinal cord injuries. IPSCI will speak to the full spectrum of SCI-related issues, from medical and rehabilitation clinical interventions, to prevention, health systems, assistive technology, environmental modifications and strategies for enhancing full participation of persons with SCI in family life, education, employment and the community. An enormous endeavour, made possible through the collaboration of

WHO, the membership of ISCoS and other professionals, IPSCI will present to its intended audience of policy-makers, service providers, researchers and persons with SCI themselves, information and recommendations that reflect both the best science and practice, and the moral compass of the United Nations Convention of the Rights of Persons with Disabilities.

## Session VIII

---

### **Road Traffic Accidents – Indian Policy Issues (S 07)**

**Dr. A. K. Mukherjee**

India is in a transitional phase due to rapid socioeconomic changes. As a sequel to these developments road traffic accidents are on the increase and have become a major public health hazard. The fall out of the accident has a significant impact on national economy of the country. At this juncture India needs to have very strong policy related to prevention of road traffic accidents. This policy should focus on effective development of roads, standardization of vehicles, education of people and introduce the necessary legislation to control the system. India is a federal state wherein both transport and health are state subjects. However, it is necessary for a strong central legislation. The author will present various spectrums of road traffic injury problems, availability of existing mechanism and an analysis of the National Road Safety Draft Bill which is at present under consideration by the parliament.

### **The problem: Overview of RTC in South Asia with reference to SCI ( S 08)**

**Dr Michael Fitzharris**

The status of road crashes as a leading global public health priority is well established. Worldwide, road traffic crashes result in the death of over one million citizens per annum with estimates suggesting that the number injured may be as high as 50 million per annum. Injuries disproportionately affect the young, particularly males, and those from developing countries. Countries in South East Asia classified as low income by The World Bank – which includes India, with 6% of the world's vehicles and 21% of the global population account for 19% of global road deaths. In 2008, approximately 370,000 citizens were killed in South East Asia and this is predicted to increase by 68% to 620,000 citizens by 2030. This increase is expected to be driven by a combination of rapid motorisation which is a feature of economic development, a predominance of powered two-wheelers, a notable number of buses and heavy vehicles used for the transportation of people and goods, and relatively constrained road infrastructure. These factors combine to place individuals at high crash risk, and once involved in a crash, a relatively higher risk of SCI compared to high income countries given the mechanism of injury is frequently associated with falls from vehicles – either from height or from powered two wheelers. While the incidence of spinal cord injury (SCI) is low, this proportion translates to a significant number of people sustaining severe injuries.



This presentation will outline the general crash problem in South East Asia and in doing so will examine the relationship of crashes to economic development, the link to poverty and how road safety can aid in the achievement of the Millennium Development Goals. Finally the presentation will outline the principles of the UN Decade of Action with a focus on actions in India and the region.

## **RTC IN INDIA: PREVENTION STRATEGIES ( S 09)**

**Prof Dinesh Mohan**

The presentation reports on the traffic safety situation in India, and identifies countermeasures for areas in which the total harm caused by crashes can be substantially and readily reduced. Fatality rates have increased both on highways and in urban areas during the past few years. Theoretical models suggest that the number of fatalities in India is not likely to start to decline for many years to come unless new policies are implemented. Based on the present analysis, the following six areas are identified as having potential for substantially reducing fatalities in India: (1) pedestrians and other non-motorists in urban areas, (2) pedestrians, other non-motorists, and slow vehicles on highways, (3) motorcycles and small cars in urban areas, (4) over-involvement of trucks and buses, (5) night time driving, and (6) wrong-way drivers on divided highways. Several promising countermeasures for each of these six areas are identified.

## **S 10-NA**

### **Spinal Cord Injury due to Objects Falling from Heights onto People (S 11)**

**Dr George Tharlon**

Spinal cord injury (SCI) occurs in a variety of different ways. The commonest cause is fall from heights (50%) and by traffic accidents (25%). Objects falling onto people causing injuries are less common(20%). PMR department at CMC Vellore treats and rehabilitates more than 500 patients with SCI every year. Following rehabilitation, patients who live within 100 kms from the institution are followed up by a multidisciplinary team through home visits. Currently there are more than 400 patients in this follow up area. We present here a few modes of SCI due to objects falling from heights, based on our experience.

Bull fights which is a popular rural sport in our part of the country, contact sports(Kabadi) in rural settings without protection, cutting trees without appropriate equipment with scant regard to safety, crumbling of mud walls of houses especially during the monsoon season, unsatisfactory housing constructions like walls, houses

and public buildings cause harm to life and spine every year. Mining injuries often result in SCI as mine wall cave in. Further, illegal mining and use of abandoned mines adds to the burden. Working under vehicles for repair, often leads to the collapse of the stationary vehicle or machinery onto the person underneath causing severe injuries including SCI. Improper loading of materials or bags onto lorries, trucks, tractors, use of head load as a means of transport instead of wheel barrows or trolleys continue to be a constant source of SCI. Crowded public places, stampedes, carrying water on huge water cans by women and even children lead to injuries when they slip and fall and the weight topples on them.

Comprehensive rehabilitation by multidisciplinary team improves the quality of life of persons with SCI. Prevention needs focus. Awareness of safety measures at home, school, road and civic sense for each other's safety, should start at an early stage through media, school education and by legislation. Safety devices like helmets, harness, safety nets, early management should be available easily. Constant monitoring of injury prevention strategies, improving data base for SCI in the country, ongoing support to patients with SCI, working with the Government agencies for implementing safety measures and institution of technology to improve safety will help to ameliorate this burden on the person, family and the nation.

## **LOW FALLS AND SPINAL CORD INJURY: ASPECTS OF PREVENTION.( S 12)**

**Dr Rajendra Sharma**

World Health Organization's definition: falls are "an event which results in a person coming to rest inadvertently on the ground or floor or other lower level". Falls are vertical deceleration injuries. A fall from more than 20 feet (6.1M); a clinically important risk, above which major trauma is considered (ATLS). Height of fall is a good predictor of mortality; however, the height of fall is a poor predictor of injury severity. All Falls from less than 20 feet are termed LOW FALLS.

A fall can be explained by an epidemiological model and by using a Haddon Matrix. Viewing a fall as an injury event rather than as an accidental event helps in better analysis and planning for prevention of falls. The host factors are discussed further under sub headings of age, sex, socioeconomic status, nature of work and risk areas related to work. The environmental factors are discussed.

The strategies for injury prevention are discussed under following headings with examples and illustrations:

1. Engineering: includes making products safer for people.
2. Environmental modifications: aimed at reducing the likelihood that individuals will have an injury by reducing risks in the environment.

3. **Enforcement:** Legal and police measures aimed at ensuring that certain behaviors and norms are maintained in the population. Covers enforcement of laws directed at creating safe environments & with ensuring the production and distribution of safe products.
4. **Education:** changing attitudes, beliefs and behaviors in the general population, targeting individuals who are at higher risk of having an injury or producing an injury.
5. **Evaluation:** determining which interventions, programmes and policies work best for injury prevention. Informs researchers and policy-makers as to what are the best course of action for prevention and control of injuries.

"Children can't fly" project in 1972 by New York Public Health Dept. is a good example of combination of education, environmental modification and enforcement strategies working together.

### **Falls from a height (Prevention Symposium) ( S 13)**

**Mrinal Joshi,**

Spinal cord injury is one of the most devastating traumas resulting in reduced survival and diminished quality of life. The incidence and cause is influenced by socio-economic, geographical, demographic & political scenario of the region.

A retrospective analysis for cause of spinal injury was done at patient's data admitted in Spinal Unit at Dept of Rehabilitation Medicine, Rehabilitation Research Centre, SMS Medical College & Hospital, Jaipur during the period 2000 to 2008.

A total of 2696 patient's data were evaluated with spinal cord injury admitted during this period, 1410 (52.2%) had cervical spine injury and 1286 (47.7%) had dorsolumbar injury. Males were more common than females and most of them were aged between twenty and forty nine years. The monthly income average was only Rs. 3000 (US \$ 75) with average family dependency of five.

In more than fifty percent, the cause of trauma was fall from height and in rural settings fall from tree was the commonest, whereas in developed countries road traffic accident remains the most common underlying cause for spinal injury.

For prevention of such incidences an awareness drive should be initiated to increase the height of parapet, side of the well, closing down of dry well and educating the children and adults not to climb trees without proper precautions. The administrative authorities of rural & urban areas along with health officials should take an initiative to educate and initiate a drive to reduce the incidences

## Falls in the “informal” construction sector in Vietnam (S 14)

Eric Weerts

### Background

Comprehensive SCI care in Vietnam has been available since 2004 through the Ministry of Health policy in cooperation with Handicap International Belgium . It has aimed to set up a network of SCI centers catering to the increasing number of spinal injuries due to traffic accidents, domestic falls and construction activities.

Based on extrapolation of information gathered from literature and MOH statistics, Spinal Cord Injury occurrence in Vietnam suggest a yearly incidence rate between 900 and 1200 new cases each year and a prevalence in the population of up to 120 persons/ million habitants . Before 2004 , most of the accidents were caused through traffic (motorcycle accidents) , domestic falls from heights, labour accidents and diseases. These approximate proportions are in a shifting pattern that concentrates the burden of care and outcomes on a SCI population that is mainly rural based, over 80 %, in active working age and main economic income provider for his dependants

### Methodology of data collection

Although no national registry is available in Vietnam and registration of labour related accidents is not under a single mandate in Vietnam, data sources, from MOH through data collection done at the bedside of SCI patients in 7 SCI centers in the country allows the gathering of narrative information on the circumstances and causes surrounding and leading up to the accident of the patients that survive the first weeks after their accident.

Similarly, at the National Rehabilitation Center of Bach Mai Hospital data collections trials were done using semi structured questionnaire elements, SCI data sets and a narrative to feed into database systems for analysis .

### Findings and results

The main points of concern in this sample of SCI persons that declared their injury as an event happening during paid work vs event occurring during domestic activities showed that their social and economic background was not very different. Moreover, the injuries that occur in the “ informal ” sector of construction and infrastructure maintenance are difficult to define from the viewpoint of the interviewer. Local customs and practices favor in some cases the circumstances of accident to be declared wrongfully for legal or financial compensation reasons. This situation makes it difficult to orient prevention programs to the right target of persons at risk. Moreover,

certain groups of laborers receive less prevention and protection from accidents than others.

## Conclusion

There is a need to create additional questions in the data collection tools that could better pinpoint the circumstances of these accidents in order to highlight the plight to the responsible authorities to take better action in the field of prevention for informal workers and defense of SCI victims to obtain better and sustainable compensation after their accident.

## Quadriplegia due to fall while carrying heavy load on head: A problem in Bangladesh(S 15)

Dr Md Fazlul Hoque

**Objectives:** To find out the occurrence of quadriplegia due to fall while carrying heavy load on head in Bangladesh and to identify the mechanism of injury.

**Setting:** Centre for the Rehabilitation of the Paralyzed (CRP), Dhaka, Bangladesh.

**Method:** This observational study was conducted on 369 traumatic cervical spinal cord injuries (SCI) patients who were admitted in the Centre for the Rehabilitation of the Paralyzed (CRP), Dhaka, Bangladesh between January 1999 and December 2001. Relevant information including age, gender, occupation, neurological status, type of bony injuries and x-ray findings were noted down in pre-structured questionnaire on admission.

**Results:** The most common cause of quadriplegia was fall while carrying a heavy load on the head. This accounted (32%), other causes included road traffic accident (23%), falling from a height (22%), fall of a heavy object onto the head or neck (14%), bull attack (6%) and diving into shallow water (3%). The most common neurological as well as skeletal levels are C5-C6. So far the mechanism of injury is concerned; hyper flexion (61%) predominated over hyperextension (36%).

"Stem cell therapy for human SCI – fact or fiction." John Steeves, ICORD, UBC and Vancouver Coastal Health, Vancouver, Canada

A brief primer on the characteristics and sources of stem and progenitor cells will be provided. The challenges for translation from bench to bedside will be reviewed. Finally, the current status of select cell transplant applications as a treatment strategy for human neurological disorders, including spinal cord injury, will be reviewed. Discussion will highlight some of the confounding factors that can alter the accurate interpretation of clinical trial outcomes.

## **Wheelbarrow Program: An alternative load transport to the head ( S 16)**

**Mst. Reshma Parvin Nuri**

Spinal cord injury (SCI) is a devastating condition often affecting young and healthy individuals around the world (Ackery, Tator, Krassioukov, 2004). The cervical spine is a very flexible and is at risk of injury from strong, forceful movements. Falls while carrying a heavy load on the head is a common cause of cervical spinal cord injury in Bangladesh. These often results in permanent paralysis or death for the individuals concerned.

No national record of the incidence of traumatic tetraplegia is presently held in Bangladesh, but statistics regarding admission to The Centre for the Rehabilitation of the Paralysed (CRP) for rehabilitation of these patients are available. This is the only established spinal injury centre in Bangladesh. Between 2004 and 2009, 111 cases of traumatic tetraplegia (25% of overall tetraplegia) due to carrying heavy load on head were admitted for rehabilitation. Most of the cases were farmers or day labourers and their injuries were sustained when carrying weights of over 80kg. It is highly likely that the number of injuries is far higher as a large number of patients have no access to rehabilitation services. The number of patients being admitted to CRP with these devastating injuries is steadily increasing. Considering this problem CRP is working to stop the practice of carrying a heavy load on the head. For that reason CRP has made a wheelbarrow and tries to introduce this wheelbarrow to the workplace by raising awareness among employers and employees. The cost of the wheelbarrow is 5000 taka. This wheelbarrow can carry load three times more. The tire is pneumatic and wheel is wide for that reason it is equally applicable for muddy road.

CRP not only produces the wheelbarrow but also try to introduce this wheelbarrow all over the Bangladesh by creating awareness among the employers and employees. For that reason CRP has made a documentary. The goal is to change dangerous practices in Bangladesh namely the practice of carrying heavy loads on the head.

The first part of this documentary focuses on the lifestyle of urban and rural poor people in Bangladesh, who are involved in high risk activities such as carrying heavy head loads while they are walking on slippery and muddy roads or on a gangplank.

The second part of this documentary focuses on Abdul Mutaleb, a young man carrying a heavy head load which shifts and the consequences of this. Finally this film looks at an alternative method of carrying heavy head loads – a wheelbarrow.

## Session IX

---

### **"Stem cell therapy for human SCI – fact or fiction." ( S 17)**

Dr John Steeves

A brief primer on the characteristics and sources of stem and progenitor cells will be provided. The challenges for translation from bench to bedside will be reviewed. Finally, the current status of select cell transplant applications as a treatment strategy for human neurological disorders, including spinal cord injury, will be reviewed. Discussion will highlight some of the confounding factors that can alter the accurate interpretation of clinical trial outcomes.

**S 18-20-NA**

## Session XI

---

### **Dedicated Centres for SCI Management: Are They Cost-Effective in Developing World Scenario? (S 27)**

**Apichana Kovindha, M.D**

**Background:** In developed countries, dedicated or specialist centres for SCI management have been designed to provide a total care or comprehensive management for SCI patients from acute to rehabilitation phase and long-term care.

**Objective:** to find out whether dedicated centres for SCI management is cost-effective in developing countries.

**Methods:** Searched both published and unpublished studies/data from developed and developing countries – Bangladesh and Thailand

**Results:** No study on cost-effectiveness analysis of SCI management in developing countries was identified. Centre for Rehabilitation of the Paralyzed (CRP) in Bangladesh and Rehabilitation ward for SCI patients at Maharaj Hospital, Chiang Mai, Thailand, may be a good example of a dedicated unit/centre for SCI where facilities are basic and locally-made. Results showed lower rates of complications during admission and after discharge, shorter in-patient length of stay, more independence in self-care activities and less burden of family. These indirectly reflected effectiveness.

**Conclusion:** In developing countries dedicated centre/units for SCI management do exist and some have outcomes reflecting effectiveness and benefit to SCI persons. Whether they are cost-effective is inconclusive.

### **Overview of cost effective measures in management of SCI (S 28)**

**Dr Douglas J. Brown**

Few studies have documented the overall cost of SCI to a community or nation. Therefore the cost effectiveness of prevention and of treatment are not usually based on evidence. Never-the-less the cost effectiveness of prevention versus life long treatment have been determined in some countries and the life long costs have been calculated in Australia in a recent Access Economics report.

Medical costs only represent a small part of the financial burden of SCI. There is no doubt that in most



countries, spinal cord injury results in a lower income for the patient and his family. The social costs must therefore be part of the cost analysis of SCI. The monetary cost to society as a whole has not been calculated in most instances and, therefore, the effectiveness of management has not been adequately evaluated. It is imperative that those working in the spinal cord injuries drive the data collection that will enable more cost effective prevention and management strategies to be put in place to the benefit of the patient and of society as a whole.

### **ASCON – Progress and future strategic priorities (S 21)**

**Stephen Muldoon**

#### **Purpose:**

To review and learn from the progress of ASCoN and further develop its Strategic Plan

#### **Methodology:**

Review of materials and documents related to spinal cord injury (SCI) management in Asia and ASCoN. Questionnaire survey on impact of ASCoN.

Discussion with ASCoN Executive Committee and Service Providers from Bangladesh, China, India, Malaysia, Nepal, Sri Lanka, Thailand and Vietnam.

Field visits to ASCoN member organisations.

#### **Results:**

**ASCoN has grown steadily from a networking forum into a major knowledge and information resource agency.**

The ASCoN model is highly relevant as it focuses on the practical development of services and the utilisation of resources and personnel from neighbouring countries.

The impact of ASCoN is impressive in terms of Membership; Networking; Information exchange; Awareness raising; Service development; Service quality; Capacity building; Publication of guidelines related to comprehensive rehabilitation management appropriate to Asia; and Upgrading skills of members.

While the study identified that much progress has been made in a relatively short period of time by ASCoN, and there has been an increase in both the quality and coverage of services in different parts of Asia, **gaps in SCI management still remain. These gaps include:** Service quality and Capacity; Rehabilitation; Training; Overall approach to SCI management; Research; Materials development; Policy and Communication.

#### **Conclusions:**

ASCoN is an appropriate, cost effective model for promoting service and human resource development for people with SCI in Asia.

ASCoN has an important role to play to meet the needs of the growing numbers of people with SCI in Asia.

This study clarifies future areas of priority on which ASCoN can focus over the next 5-year period.

## **A concept for creating trained manpower in Developing Countries for the care of Spinal Cord Injury patients ( S 22)**

Dr. Capt D.K.Sinha. M.S., M.Ch., Ph.D Orthopaedics

**INTRODUCTION:** - Sir Ludwic Guttmann (1952) said that *"To die as a crippled man with bed sores and urinary tract infection is not the destiny of SCI patients. They need a comprehensive Spinal Care.* Sir Jorge Bedbrook, (1958) Australia, did show that the money spent for the prevention of spinal cord injury is far less than the money spent on care of the spinal cord injury patients in the hospitals. Prevention could reduce the total number of spinal cord injury patients by 30%. In U.S.A. in the 1970s, most of the patients arrived at emergency room with complete lesions. In 1980 when they were evacuated by air and with the help of trained para-medical staff, most of the lesion, at the time of admission was found to be incomplete - a reversal of 1970's data. The experience in USA, UK and Australia proved that a cost-effective Post Hospital Care is an essential part of

Thus, the concept of Total Care of Spinal Cord Injury includes

- 1) Pre Accident Care – Awareness of the community about prevention of Spinal Cord Injury injury.
- 2) Pre-Hospital Care - The early identification and safe transportation, by trained personal
- 3) Hospital Care - Medical Care in a comprehensive unit..
- 4) Post-hospital care - After Care or the Extended Car is essential to keep patients out of complications.
- 5) Social Care – To give a respectful place in the society, they must be rehabilitated financially.

### **ASIAN SCENARIO**

- 1) The commonest age group is 20 to 40 years the most active age group.
- 2) 70% of them are daily wage earner, 19% of them were females working in their homes.
- 3) 60% will remain paralyzed and dependant for ever
- 4) 70% of them were poor and unprivileged.
- 5) 22% are injured as a part of their professional hazard.

- 6) 90% were carried to hospital by most unconventional way, making the injury unrecoverable.
- 7) If not all, most of the causes are preventable.

In India, every year 20,000 new victims are added to the list of paralysed patients.

**GROUND REALITIES:-** Spinal Cord Injury is common in the villages and persons of lower economic strata who falls from the palm tree, bare roof, high-rise buildings' from the roof of buses and trains or they fall down while carrying heavy weight or hit in the back by caving roofs of mines or river bed. Bystanders or the good neighbours, carry them in whatever postures it becomes easier to carry, in any available vehicle to the treating hospital. Many incomplete injury patients are converted into complete injury. Due to unsafe transportation, many complication starts before the patient reaches to the treating hospital

Hospitals have limited resources and manpower. These patients, who need personalized 24 hours care for their survival, does not get due care by over worked paramedical staff. By the time, care reaches up to them they have already developed deep pressure sores, urinary tract or respiratory tract infections.

As the Extended care system does not exist, patients are sent to the family. The family members are daily wage earners and not trained to identify the earliest signs of complication. The complications deteriorate very fast and become fatal.

## **Aims of the study**

### **PROBLEM AREAS TO BE SOLVED**

- How to develop the awareness up to village level?
- How to assure a safe transportation of SCI victims?
- How to create enough manpower in the hospitals to provide basic nursing care and treat them without complication?
- How to provide Post-Hospital care to these SCI patients at village level?
- How to provide training to our medical staffs and students?

**MATERIAL:** - We, at Patna Medical College Hospital, Patna analysed the whole scenario of the management of spinal cord injury patients and could realise that the availability of motivated and trained manpower from the village to hospital, (i.e., from the site of accident to the place of treatment) is the key factor. So our primary aim was to identify a source of free and motivated manpower from the village it self.

### **Source of Free and Motivated Manpower**

- In this part of the world, the relatives and the family love to stay with the patient at the hospital till

they are discharged. The crowd of any government hospital is due to these free manpower roaming about and utilizing the facilities of the hospital like electricity, water and space. Often they create administrative problems. But the basic intention of this unused manpower remains to help his ailing patient.

**METHOD:** - These untrained village population was trained phase wise into a conscious attendant. For each patient an active, co-operative and intelligent individual is identified. He is named as Target Attendant (TA).

#### **Phase-I : Conversion of simple attendant into a conscious attendant**

- TA remained with our medical team during the application of traction, catheterisation, Ryles tube application, IV line maintenance, etc. TA was made to observe everything with proper explanation. TA gradually became conscious about the need of frequent changes of posture, care of catheters, use of oxygen etc.
- When the patient was out of critical stage, gradually the basic management of the patient was taken over by the TA. During all these stages, TA remained in direct observation of our medical team and was assisted by other attendants already trained. The patient got personalised care.
- By the end of 2-3 weeks, a simple attendant became a Conscious Attendant (CA).

#### **Phase-II : Training of basic anatomy and physiology**

- These CAs were brought together to our training rooms and were educated about the basic anatomy and physiology which were visible to them like skeletal structure, spinal cord, bladder, urethra through slides, model, cadaver etc. By third week they knew as to why the patient did not feel below the lesion, why the body did not move, how the bladder was catheterised and how to prevent pressure sores and what improvement was possible.

#### **Phase-III : Developing a team**

- The attendants worked as a team. If any of the attendants failed to understand his responsibility, other attendants present in the ward immediately helped him. In our spinal cord injury section consisting of 60 beds, always a team of 50 to 60 'conscious attendants' were available and every patient was looked after round the clock without fail.

### Phase-III : Developing a team -the ripple effect

- When a new patient with TA was admitted, CAs educated them gradually about the condition of patient and by 2nd or 3rd week, the new attendant took over the basic care of the patient

### Phase-V : Safe Carriage

C.A.s were trained about the safe transfer of SCI patients. They were taught to identify SCI after an accident. They were taught to prevent any further movement of the spine and to use the available resources e.g. bamboo bed or wooden plank to carry the patient safely

### Phase-VI : Concept of extended care :

Attendants were trained about the extended-care-at-home, the complications expected and management there of. As these conscious attendants had looked after the patient throughout the hospital stay, any improvement or recovery was ascribed as their personal achievement. They took the patient back home confidently, and looked after him for the rest of their life.

### Phase-VII : Satellite Spinal Centre

- These conscious attendants were motivated to go back to the village, propagate the idea of prevention, safe carriage and role of the society to rehabilitate the patient. Educated patients proved to be more helpful in spreading the consciousness of the society

## **OBSERVATIONS**

### **How effective was Patna Model?**

	<b>BEFORE 1991</b>	<b>At 2009</b>
1. Mortality	More than 40%	Less than 12%
2. Bed Sore	More than 80%	Less than 15%
3. Trained Bladder	Less than 20%	More than 70%
4. U T I	More than 60%	Less than 20%
5. R T I	More than 60%	Less than 20%
6. Post Hospital follow up	Less than 10%	An average 35% reported regularly for Follow up with trained attendant
7. Identified and safely	nil	Nearly 20% patients were

- From the hospital records we could collect the status of the spinal cord injury patients before starting the use of attendants for the basic care of the patients. This data was compared against the complication ratio of the patient after the present project.

Relation of Attendants and the patients:- Spouses, parents and children constituted 80% of the attendants and this relation remained faithful to the patients.

Conscious Attendants and their educational status:-

•	EDUCATIONAL STATUS	PERCENTAGE
•	1. Illiterate	32
•	2. Literate	36
•	3. Formal Education	20
•	4. Educated	12

As the spinal cord injury is most common in villages and in daily wage earners, most of the relatives were either illiterate or just literate enough to read and write few words. 20% had some school education and only 12% were educated more than matriculation. Education did not play significant role in providing Basic Care to the patients

At the time of discharge, a pre-addressed post card was given. They were advised to write back to us after one month.

We wanted to analyze that post-discharge how many attendants remained receptive to the training and cared to give us feed back. We received letters from 56% of discharged cases. If we compare the number of illiterate person, which constituted 32% of the attendants and if we also assume that literate, formally educated only answered then only 25% of the conscious attendant failed to maintain contact.

### **BENEFITS OF PATNA MODEL**

- The Morbidity and mortality decreased.
- Bladder training and ISC could be established earlier.
- The community feeling developed among the attendants and the patients. The ward, instead of stinking with smell of urine and infected pressure sore, looked clean and tidy.
- Physiotherapy could be started at the earliest
- Follow ups were more regular with trained attendants
- Fresh Spinal Cord Injury Patients were identified at the site of accident in the village and was transported safely to hospital.
- All these changes could be brought by the villagers who never had handled any patient. 68% of them were not formally educated. They not only took over the general nursing care effectively but could spare the trained nurses for more specialized care.



- **CONCLUSION** Patna Medical College Model is adaptable, flexible and effective method to increase the awareness about SCI, its prevention, safe transport, post hospital care at village level at no extra cost to the government.

## **CRP model of SCI management ( S 23)**

**Dr Razzak/ Dr Sohrab Hussain**

### **Introduction:**

Spinal Cord Injury is a devastating and catastrophic condition world wide. It has a major economic and social impact.

Spinal Cord Injury needs a specialized, comprehensive and multidisciplinary management to reduce its effect in some extent.

In Bangladesh about 75% resulted from traumatic causes, 25% non-traumatic.

- Fall from a height (43%)
- Fall while carrying a heavy load on head (20%)
- Road traffic accident (18%)
- Fall of heavy object on head and back (9%)
- Others (10%)

CRP is only one rehabilitation centre in Bangladesh though SCI patient has acute management available in a Government hospital named NITOR, placed in the capital city of this country.

The Centre for the Rehabilitation of the Paralysed, commonly known as CRP, was founded in 1979 by a British physiotherapist, Valerie Taylor with 4 Bangladeshi people. Miss Taylor came to Bangladesh (then known as East Pakistan) in 1969 as a volunteer physiotherapist, and was appalled at the lack of facilities for the disabled and the often poor diagnosis.

The situation for the disabled was worsened in the aftermath of the 1971 Independence War, after which Bangladesh won its independence from Pakistan. The premises were two cement storerooms in the grounds of a Dhaka hospital. The capacity soon grew from 4 patients to about 50.

After 1990 CRP found its own land and expand it with 100 bed and 630 staffs including several project for poor disabled People.

### **Referral and Admission:**

Any patient from any place of Bangladesh is received for getting admission in CRP. Priority is given for acute patients and patient with big sores.

Admission procedure is available for 24 hours. Initially member of MDT assesses a patient after admission.

In Bangladesh sometimes referral takes longer time due to lack of awareness about SCI patient management and a bout services of CRP.

### **Services available in CRP for SCI patients:**

Hospital management (in patient unit)

-Acute

-Stabilization

-Rehabilitation

-Re-integration

(Including physiotherapy, Occupational therapy, medical and surgical, nursing facilities)

Pathology and Radiology service

Social Welfare service

Counseling service including Peer counseling

Sports facilities

Wheel chair training facilities

Prosthetic and Orthotic Service

Metal and Wood workshop

Vocational training-

Follow up Home visit

Rehabilitation service for out patient

### **Management:**

The treatment approach involves the entire multidisciplinary team.

Every day early morning arrange a short case conference where all MDT members share about patient according to priority and discussion held for major complications e.g. -fever, diarrhea, pressure sore management, pain management etc.

Decision from case conference and small MDT are implemented through the week as well as individual professionals are informed. Patient progress with each discipline is

communicated through documentations and above meetings. Also weeklyRound is conducted by the MDT senior members.

Individuals professionals assess and treat the patient separately with own discipline specific goals.

In addition, team members share assessments and have common overall goals

The goals of each discipline are coordinated into a unified plan through the interaction of the team and also the patient is considered an active team member

Overall SCI patient's treatment phase divided into 4 stages. Usually a person with SCL stays an average of 16 weeks. In primary stage it is 14 weeks in the hospital under the care of multidisciplinary team. During this time comprehensive medical intervention are provided. Once the medical conditions are stabilizing attention is given to prevent complications such as pressure sore, UTI, RTI, DVT, Contracture etc. This are done by this care is continued through career/ family members which are trained by health education during this stage. Half hourly turning /lifting takes place to prevent pressure sores and self-intermittent catheterization are conducted as required.

#### **Conclusion:**

CRP extends day by day. It has strongest enough with its several sub centers. Where CRP could fulfill its mission and vision to include the disabled people in mainstream of society. As CRP has its Academic institute to complete Physiotherapy, Occupational therapy, nursing B.Sc course. Also it has training facilities for social worker and community health workers.

The future health professionals enriched CRP as well as Bangladesh to continue a very successful rehabilitation services for SCI people all over the country.

## **S 24-NA**

### **Challenges in setting up and SCI network in Vietnam (S 25)**

**Eric Weerts**

#### **Back ground**

In Vietnam , SCI accidents occur mainly in the field of RTA , falls at home and construction sector. Under the MOH of Vietnam SCI care has seen its development shift from a centralized based approach where care was available in Central hospitals towards decentralized approach promoting SCI care geographically accessible to the 80% of SCI patients that live in the provinces .

## Methodology

To implement such a shift, it was first essential to set up pilot experiences to show that SCI care is possible, culturally adjusted to the needs of the beneficiaries in Vietnam and can be integrated into the best available rehabilitation network in the country: VINAREHA and 30+ Physical Rehabilitation centers spread throughout the country.

A first phase set up of 50 beds catering to the economic metropolis of the country showed effectiveness of the care, potential for financial sustainability and know how and human resources that could duplicate the care at provincial level. This was subsequently tested on 3 Southern provinces with a total capacity of an additional 30 beds. This allowed also to better cater to the needs of the patients from provinces (80% of the caseload) and address their economic integration challenges. This development was monitored by the National Rehabilitation center and found successful to duplicate at national level (using experiences in the South) by improving the medical quality of the care and integrating SCI pathology in the CBR outreach campaigns to address the integration needs.

## Challenges and solutions

Poverty and disability links could still be observed with the beneficiaries. Treatment strategies available needed to be adapted to the economic situation of the patients. Selection of centers where duplication was possible was a long process due to the lack of knowledge on how SCI needed to be addressed. Some of them could be easily overcome thanks to international networking and exchange.

## Conclusion

Setting up a national network of SCI care in Vietnam needed first external efforts through demonstration projects and clear formulations of indicators of success of treatment. The role of MOH – Vietnam has been essential in addressing the need for equity and accessibility of care. Continuing education and exchange are still needed to achieve the objective of a national coverage of SCI needs, complete the social orientation for the patients after discharge and upgrading the know how of the network members in Vietnam. It presents an excellent resource for other countries in the region.

## Nepal: Experience of setting up the first spinal-injury centre in the country (S 26)

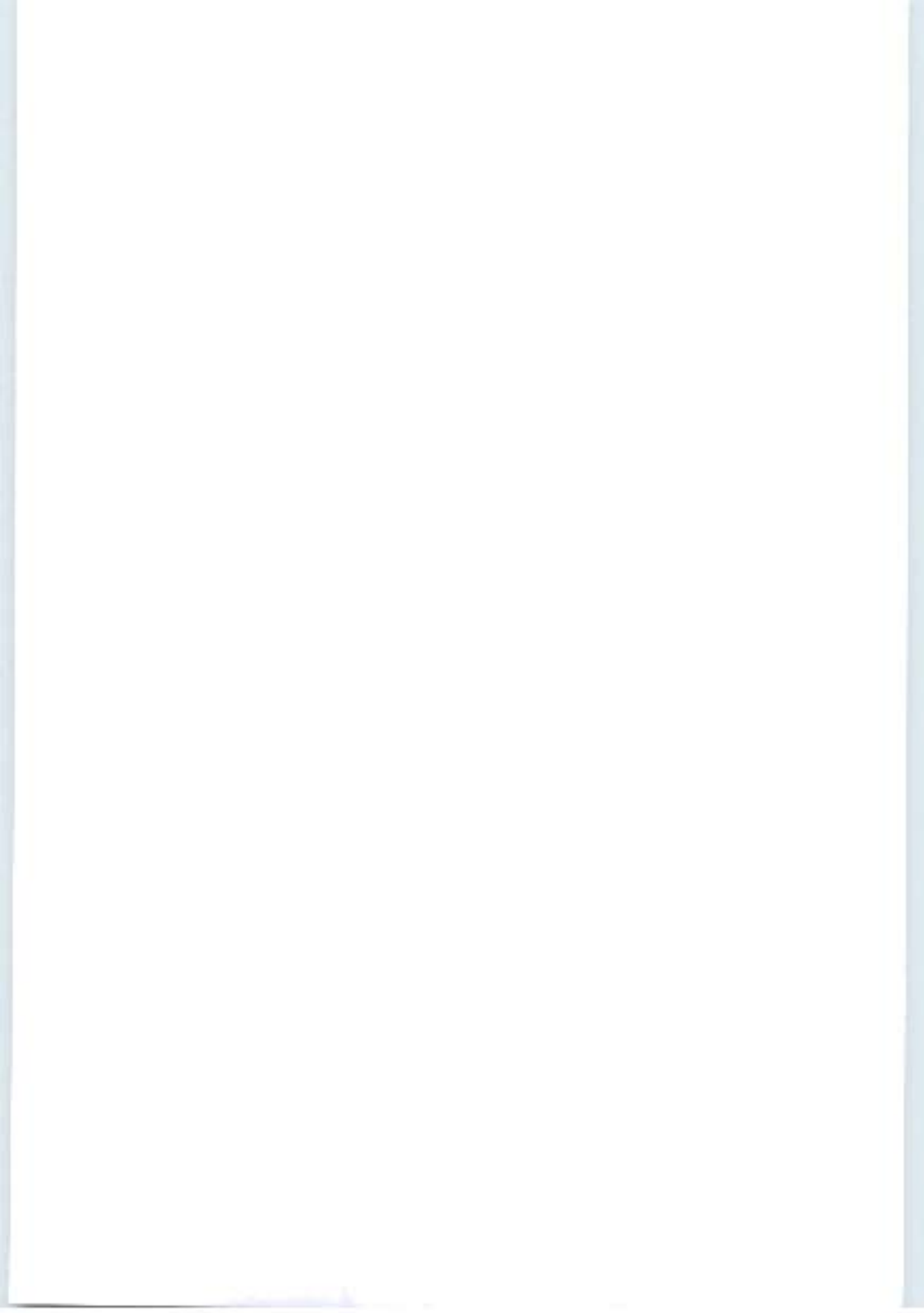
Kanak Mani Dixit, SIRC, Nepal

As a country that has faced relentless political turmoil over the past few decades, Nepal has yet to see adequate concentration on making basic health services available to the people at large. It is little wonder, then, that spinal-injury rehabilitation has failed to receive priority, particularly in a society where the journey from accident and discovery to rescue and treatment/surgery remains full of danger and uncertainty. It was only when a Kathmandu journalist met with a 'cord-sparing' incident during the monsoon of 2001 – and survived and recovered through a series of fortuitous circumstances – that a group of concerned friends came together to set up a rehabilitation centre dedicated to spinal injury. Inaugurated in April 2002 by the late Sir Edmund Hillary, the Spinal Injury Rehabilitation Centre (SIRC) has since focused on a mission of providing care and training such that patients are empowered "with skills and knowledge necessary to remain active and able".

All countries and situations are unique, and in Nepal we have found the transport of victims (on the backs of porters, cramped buses to rudimentary ambulances over bad roads) to be a particular challenge. Most critically, the jostling of accident victims by well-meaning samaritans is something that must be countered through public information. Even as the 'traditional' causes of spinal injury are being addressed (eg, fall from heights while collecting tree-fodder), Nepal is experiencing an exponential rise in 'modern-day' causes as well, from highway accidents to incidents at construction and industrial sites. To meet these challenges, SIRC's goals are to improve our services through enhancing the skills of our staff members, and to evolve as a training centre on spinal injury rehabilitation. At the same time, we seek now to spread public information on spinal-injury throughout the country, and to promote spinal injury care in hospitals in various parts.

In the course of constantly seeking to improve the service it provides, SIRC has found that allowing a family member to remain with the patient gives a boost to the rehabilitation effort, while simultaneously improving the general atmosphere of our facility. We have discovered recently that the 1:18-grade ramp in our new, purpose-built centre in Saanga, Kavre District, has added to the motivation level of the mobile patients, who are now able to wheel themselves around the grounds. Meanwhile, we have come to realise the impracticality to proposing to many of our patients a return to the village setting, where it is not possible to use wheelchairs in or around the household.

**ABSTRACTS OF  
ISCOS  
ORAL PRESENTATION**



## Session I

---

### O01

**Abstract #: 146.00**

**Authors:** Dr. Vivek Mittal, Dr. Harvinder Chhabra, Dr. Gururaj Sangondimath

**Title:** Acute outcomes of cervical spine injuries in the elderly

**Study Design:** Retrospective database review of all traumatic cervical spine injuries in patients of and above 65 years of age at single center.

**Summary of Background Data:** Elderly patients with cervical spine injuries have historically suffered from high morbidity and mortality rates treated either conservatively or operatively.

**Methods:** Twenty four patients between 2002 and 2010, more than 65 years of age were identified and hospitalization records reviewed. Patients were divided by age into young (65- 74 years) and old (75 or more) elderly groups. Sex distribution, mechanism, injury type, ICU stay duration, radiographic findings, neurological deficit, comorbidities, type of management and mortality and complications rates were studied.

**Results:** 16 patients were young elderly and 8 old elderly. 22 were males. 8 had suffered road traffic accident, 16 had a fall. C5-6 and C6-7 were the most common injured levels. 15 patients were complete. Majority of the patients had comorbid medical conditions. 17 patients underwent surgery. Pulmonary complications were the most frequent. 5 patients died while in hospital.

**Conclusions:** This study highlights the fact of high morbidity and mortality rates in geriatric patients with cervical spine injuries.

### O02

**Abstract #: 70.00**

**Authors:** Dr. Amrithlal Mascarenhas, Dr Pradeep Singh, Dr Harvinder Chhabra

**Title:** A prospective randomised study on the outcome of three different surgical methods of management in thoracolumbar burst fractures with neurological deficit.

**Purpose:** There is no prospective-randomised study in literature comparing the results



of posterior fixation, anterior fixation and combined anterior-posterior fixation in thoracolumbar burst fractures having neurological deficit.

**Materials and Methods:** Single-level AO-A3 fractures of thoracolumbar junction with neurologic deficit participated in our prospective-randomized study.

Patients were divided into two broad treatment groups based on the load-sharing classification and subsequently randomised. Clinico-radiological follow-up was at 3,6,12 and 24 months. Bridwell-criteria and Tan-criteria were used to assess fusion.

**Results:** These are the early results of an ongoing study with follow-up of 6-24 months. Of the 29 cases anterior-surgery was done in 11, posterior-surgery in 4 and combined-surgery in 14 cases. Average preoperative, postoperative and follow-up Cobb-angle was  $17.1\text{Å}\pm 6.97$ ,  $7.55\text{Å}\pm 6.17$  and  $16.76\text{Å}\pm 10.05$  degrees. The average preoperative and follow-up canal-compromise was  $51.91\text{Å}\pm 21.09$  and  $8.86\text{Å}\pm 8.33$ . Spinal Cord Independence measure improved from  $67.83\text{Å}\pm 16.98$  to  $76.9\text{Å}\pm 18.35$ . Improvement in neurology by 0-3 ASIA-grades noted. The average VAS score was 7.3 at presentation and 0.69 at follow-up. Duration and blood loss was least in posterior surgery. Two cases developed incisional hernias following anterior approach.

**Conclusion:** Anterior-surgery promotes neurological recovery with least correction loss but more complications. No technique can maintain the postoperative correction of kyphosis. No correlation between kyphosis and pain-functional ability noted. Combined surgery has no additional benefit.

### O03

**Abstract #: 102.00**

**Authors:** Dr. Ramaswamy Pankajam Hariharan, Mr. Jamil Firas, Mr. Wajid Raza

**Title:** Spinal epidural abscess: experience from a regional spinal injuries centre

**Purpose of the study:** Highlight the importance of early recognition/diagnosis of Spinal Epidural Abscess presenting as Back pain.

**Methods:** Retrospective analysis of clinical data from medical records of 19 patients admitted to a Regional spinal injuries centre in UK, between Oct 2006 and March 2010.

Information collected included age, sex, risk factors, Neurology at presentation & discharge, time between onset of symptoms and intervention, site of the abscess and management.

**Results:** Review of 19 patients revealed 84% of pts. between 30-70 yrs of age and 74% men. 74% had some kind of risk factors and the remaining did not have any documented. Majority [89%] had incomplete lesions [ASIA B, C, D] and except 1 patient, remaining [95%] had surgical intervention. In 68% SEA was located posterior and in the 2 patients with Tuberculosis it was anterior. Time between onset of symptoms and intervention varied from few hours to maximum of 2 weeks [21%].

**Conclusions:** This study highlights the importance of having high index of suspicion when somebody, especially middle aged, presents with back/interscapular pain.

Triad of Back pain, Fever & neurological deficits, suspect SEA

The problem with SEA lies not in the treatment but on early recognition and diagnosis.

## Session II

---

### O04

#### Abstract #: 183.00

Authors: Dr. Pia Moeller Faaborg, Mr. Peter Christensen, Dr. Mona Rosenkilde, Professor Søren Laurberg, Dr. Klaus Krogh

**Title:** Do gastrointestinal transit times and colonic dimensions change with time since SCI?

**Purpose:** To determine whether gastrointestinal transit times (GITT) and colonic dimensions change during the first or subsequent decades after spinal cord injury (SCI).

**Methods:** GITT and colonic dimensions were evaluated by means of radio-opaque markers and abdominal x-rays. Group A (n=12) was investigated one year after SCI and again 13 (range 11-14) years later. Group B (n=10) was studied 19 (range 9-36) years post injury and again 12 (range 11-12) years later. All had been treated with conservative bowel management.

**Results:** In group A, the median GITT one year post-injury was 4.3 (range 1.1-6.5) days and 13 years later it was 2.9 (range 1.3-6.5) days,  $p=0.62$ . In group B, the median GITT 19 years post-injury was 2.4 (range 0.6-5.9) days and 12 years later it was 3.5 (range 1.9-5.5) days,  $p=0.28$ . None of the two groups experienced a significant change in the diameter of the caecum/ascending colon, transverse colon, descending colon or the sigmoid during long-term follow-up. Megacolon was present in 4 patients at base-line and in 5 at follow-up.

**Conclusion:** Gastrointestinal transit times and colonic dimensions did not change, neither during the first decade nor long after SCI.

### O05

#### Abstract #: 57.00

Authors: Prof. Lisa Harvey, Dr Che Fornusek, Prof Glen Davis, Jocelyn L Bowden, Nick Pontifex, Joanne Gllnsky, James Middleton, Simon C Gandevia

**Title:** Electrical stimulation combined with progressive resistance training increases strength in people with SCI

The purpose of this study was to determine the effectiveness of electrical stimulation (ES) superimposed on progressive resistance training for increasing voluntary strength in the quadriceps muscles of people with spinal cord injuries (SCI). A randomised controlled trial was undertaken in which 20 people with established SCI and neurologically-induced weakness of the quadriceps muscles were randomised between experimental and control groups.

Participants in the experimental group received ES superimposed on progressive resistance training to the quadriceps muscles of one leg three times a week for eight weeks.

Participants in the control group received no intervention. Assessments occurred at the beginning and at the end of the eight-week period. The four primary outcomes were voluntary strength (Nm) and endurance (fatigue ratio) as well as the performance and satisfaction items of the Canadian

Occupational Performance Measure (COPM; points). The between-group mean differences (95% confidence interval) for voluntary strength and endurance were 14 Nm (1 to 27;  $p = 0.034$ ) and 0.1 (-0.1 to 0.3;  $p = 0.221$ ), respectively. The between-group median differences (95% confidence interval) for the performance and satisfaction items of the COPM were 1.7 points (-0.2 to 3.2;  $p = 0.103$ ) and 1.4 points (-0.1 to 4.6;  $p = 0.058$ ), respectively. ES superimposed on progressive resistance training improves voluntary strength, although there is uncertainty about whether the size of the treatment effect is clinically important. The relative effectiveness of ES and progressive resistance training is yet to be determined.

**Sponsorship:** NSW Office for Science and Medical Research.

## O06

**Abstract #:** 49.00

**Authors:** Prof. Amiram Catz, Mr. Tal Galili, Ms. Tami Polliack, Dr. Vadim Bluvshstein, Ms. Malka Itzkovich, Prof. Jacob Hart, Prof Yoav Benjamini

**Title:** Non linear formulas for the spinal cord injury ability realization measurements index (SCI-ARMI)

**Background:** SCI-ARMI assesses rehabilitation potential and efficacy based on linear relationship between SCIM III and AIS motor scores (AMS).

**Objective:** Develop new SCIA-RMI formulas, not necessarily linear and not sensitive to the number of SCI patients available for AMS.

**Methods:** SCIM III and AMS of 185 Israeli SCI patients were monitored. A method was developed to estimate the 95-percentile of SCIM III values for patients with given AMS. The method allows linear, quadratic, or nonparametric relationship between the two, and a check of their quality. SCIM95 equations specify the SCIM III score that 95% of patients with similar AMS can achieve (only 5% of them can achieve higher).

**Results:** For the study group, quadratic formulas for SCIM95 were found to be appropriate for calculation of the total SCIARMI score and of the scores for self-care, respiration and sphincter management, and mobility.

**Conclusions:** The new formulas improve the accuracy of calculated ability realization for any AMS. The new statistical procedure will be used for upcoming data analysis of a larger scale international SCIARMI study.

## O07

### Abstract #: 107.00

**Authors:** Mr. Joost J. van Middendorp, Dr. Allard J.F. Hosman, Mr. Martin H. Pouw, Dr. A. Rogier Donders, Dr. Alexander C.H. Geurts, Dr. Armin Curt, Dr. Hendrik Van de Meent

**Title:** To walk or not to walk? Introduction of a validated clinical prediction rule and grading system for independent ambulation outcomes in traumatic SCI: a European multicenter study

**Objective:** To develop and validate a clinical prediction rule based on neurological findings in the acute phase of traumatic SCI predicting chronic phase ambulation outcome.

**Design, Setting, and Patients:** In a prospective European multicenter study 640 adult acute traumatic SCI patients were included. A prediction rule was developed on the basis of regression coefficients of age and four neurological predictors derived from the International standards in a multivariate logistic regression model. Model performances were quantified with respect to discrimination (area under receiver operating characteristics curve, AUC). An additional temporal validation was performed.

**Outcome Measure:** The ability to walk independently 1-year post-injury.

**Results :** A combination of age, MRC scores of key muscles innervated by myotomes L3 and S1, and light touch sensory scores of dermatomes L3 and S1 showed an excellent discriminating ability in distinguishing independent from dependent and non-walkers (AUC:0.956,  $P < 0.001$ , 95% CI:0.936 - 0.976)

Temporal validation confirmed the excellent discriminating ability (AUC:0.967,  $P < 0.001$ , 95% CI:0.939 - 0.995).

**Conclusions:** Based on age and four simple neurological tests, a clinical prediction rule for acute traumatic SCI patients accurately predicts chronic phase ambulation outcome. Until clinically effective therapies become available, this rule could be used to counsel individual patients and formulate individual rehabilitation programs.

## O08

### **Abstract #: 251.00**

**Authors:** Mrs. Sacha van Langeveld, Marcel W. Post, Floris W. van Asbeck, Mel Gregory, Annette Halvorsen, Hennie Rijken, Jacqueline Leenders, Karin Postma, Eline Lindeman

**Title:** Comparing contents and quantity of therapy for patients with a SCI in postacute rehabilitation in Australia, Norway and the Netherlands

**Purpose:** To present differences and similarities in therapy to improve mobility and self-care for patients with SCI in postacute rehabilitation in different countries.

**Method:** Seventy-three physical, occupational and sports therapists in the Netherlands, Australia, and Norway documented all therapy for patients with a recent SCI in during 4 consecutive weeks. To describe specific contents and quantity of treatments therapists used the Spinal Cord Injury-Interventions Classification System (SCI-ICS). The SCI-ICS is a multidisciplinary tool comprising 3 levels (body functions, basic activities, and complex activities), 25 categories and a total of 139 interventions.

**Results:** Seventy-three therapists recorded 2526 treatments of 79 patients with SCI (Netherlands 48, Australia 20, and Norway 11). Most therapy time was spent on 'Muscle Power' (all countries), 'Muscle length' (Norway), 'Walking' (Netherlands), and 'Transfers' (Australia). The mean time in minutes per treatment (Netherlands, 28; Australia, 43; and Norway, 39), and the total time per patient per week in hours (Netherlands, 4.3; Australia, 5.8; and Norway, 6.2) differed significantly.

## O09

### **Abstract #: 50.00**

**Authors:** Dr. Lawrence Vogel, Dr. Peter Sturm, Jennifer Schottler

**Title:** SCI in children injured at five years of age and younger

## O12

### Abstract #: 77.00

**Authors:** Dr. Amish Sanghvi, Dr. Harvinder Singh Chhabra

**Title:** Thoracic myelopathy due to ossification of ligamentum flavum: predictors of surgical outcome

**Introduction:** Despite good posterior decompression of thoracic myelopathy due to ossification of ligamentum flavum(OLF), recovery rate(RR) varies widely.

**Methods:** Retrospective analysis of various clinical and magnetic resonance imaging(MRI) parameters with postoperative recovery in 25 patients who underwent decompressive laminectomy for thoracic myelopathy due to OLF with mean postoperative followup of 30.3 months. Patients were assessed using JOA scale and RR was calculated.

**Results:** With Pearson correlation, RR significantly correlated with preoperative duration of symptoms, JOA score, sensory JOA score, canal grade, dural canal-body ratio(DCBR), intramedullary signal size(ISS), and intramedullary signal type(IST) on MRI. Two types of signals were identified; normal in T1/hyperintense in T2 representing cord edema and hypointense in T1/hyperintense in T2 representing cystic changes. Presence or absence of signal changes didn't correlate with RR; but whenever present,  $ISS > 15\text{mm}$  significantly compromised recovery. Multiple regression analysis(MRA) identified preoperative duration of symptoms and preoperative ISS as significant predictors of postoperative outcome. Based on MRA, we formulated a multiple regression equation to predict RR as: Predicted  $RR = 83.4 + (0.1\checkmark - \text{Age in years}) - (0.7\checkmark - \text{preoperative duration of symptoms in months}) + (1.5\checkmark - \text{preoperative JOA score}) + (0.2\checkmark - \text{preoperative canal grade in percentage}) - (2.5\checkmark - \text{ISS in mm}) - (1.5\checkmark - \text{IST in grade})$ .

**Conclusion:** Predictors of postoperative recovery are preoperative duration of symptoms and ISS. Postoperative recovery can be predicted by formulated equation.

## O13

### Abstract #: 214.00

**Authors:** Dr. Yuying Chen, Dr. Oblanuju Okonkwo, Dr. Yue Cao, Dr. Michael DeVivo

**Title:** Racial/ethnic disparities in mortality and causes of death in persons with SCI

**Objective:** Examine racial/ethnic differences in mortality and causes of death among persons with spinal cord injury (SCI).

**Methods:** We followed 44,878 persons (67.4% non-Hispanic white [NHW], 19.6% non-Hispanic black [NHB], 9.9% Hispanic, 1.6% Asian American [AA], 0.9% Native American [NA], and 0.5% other), who received care at one of the SCI Model Systems and Shriner's Hospitals since 1973, to determine vital status by direct contacts and search of the Social Security Death Index. Primary cause of death was obtained from the National Death Index and state vital records.

**Results:** Of 56,1370 person-years of follow-up, 10,458 individuals were identified deceased. Compared to NHW, mortality was significantly higher for NHB (odds ratio [OR]=1.19), but lower for Hispanics (OR=0.80) and AA (OR=0.64), after adjusting for confounding factors. The leading cause of death was respiratory diseases (21.1%) regardless of race/ethnicity. Cancer and infection diseases accounted equally for the deaths in NHW (10.0% and 10.0%, respectively), while infectious diseases were problematic in NHB (15.7%), NA (14.2%), and AA (16.2%). Stroke was a common cause of death in AA (10.8%), while accidents accounted for about 9.0% of deaths in Hispanics and NA.

**Conclusion:** More efforts needed to promote better health in NHB.

## O14

### Abstract #: 116.00

**Authors:** Dr. Hyun-Yoon Ko, Dr. Wan Kim, Dr. Hyun Joo Sohn

#### **Title: Related factors with post-traumatic syringomyelia**

**Objective:** To evaluate related factors with post-traumatic syringomyelia (PTS) in patients with SCI.

**Materials and Method:** A total of 502 traumatic cervical and thoracic SCI within 5 years after injury were retrospectively investigated. To evaluate related factors contributing to the development of PTS, the relationship between PTS and several factors including neurological level of injury, severity of initial SCI, spinal surgery on the spinal injuries, and extents of the spinal canal encroachment was analyzed. The ratio of the narrowest antero-posterior diameter of the spinal canal and the spinal reserve capacity of the cases with PTS in magnetic resonance image for the spinal canal encroachment were measured.

**Result:** Of these 502 patients, there were 37 patients (mean age 44.6 years, male 31, female 6) who had been diagnosed as PTS. Overall incidence of PTS was 7.3% within 5 years after injury. However, the development of PTS did not have a significant relationship with the severity and the level of the injury, spinal surgery performed after the injury and extent of the spinal canal encroachment ( $p>0.05$ ).



**Conclusion:** This study showed that the proposed factors related with PTS did not contribute to the development of PTS after SCI.

## **O15**

**Abstract #: 100.00**

**Authors:** Prof. Hyung-Ik Shin, Prof Shi-Uk Lee

**Title:** When to discuss future walking ability of persons with acute SCI - the patient's perspectives

**Purpose:** Explaining the poor prognosis for walking ability following a neurologically complete spinal cord injury (SCI) is most difficult tasks for the spinal cord medicine specialist. We investigated the patients perspectives on the timing of breaking the bad news.

**Methods:** Postal questionnaires were applied to 600 persons with chronic SCI. The responses received from 304 persons with complete SCI (paraplegia 244 persons, tetraplegia 60 persons) were analyzed to investigate their opinions on the appropriate timing of explanation about the poor prognosis for walking ability in acute stage after SCI.

**Results:** The responses were as follow: 172 persons (56.6%) sooner is better, 44 persons (14.5%) on admission to rehabilitation unit, 37 persons (12.2%) within 2 or 3 weeks from the beginning of active rehabilitation, 24 persons (7.8%) not in acute care setting, 27 persons (8.9%) do not know. Age, gender, severity were not related to the responses. Out of accordance with their opinions, only 75 persons (25%) were actually informed of their prognosis within 1 month after SCI.

**Conclusions:** The perspectives of persons with SCI on the timing of breaking the bad news were quite diverse. These suggest that individual approaches considering personal and environmental factors are mandatory.

## Session III

---

### O16

**Abstract #: 138.00**

**Authors:** Mr. Martin Pouw, Mr. Joost van Middendorp, Dr. Henk van de Meent

**Title:** Diagnostic criteria for the traumatic central cord syndrome. A questionnaire survey of spine specialists and a systematic review of clinical descriptors and scores

**Study Design:** Questionnaire survey and literature review.

**Objectives:** To evaluate the need for introducing quantitative diagnostic criteria for traumatic central cord syndrome(TCCS).

**Methods:** An 8-item online survey questionnaire was sent to surgeon members of AOSpine International.

**Results:** Nine studies reporting on 312 TCCS subjects showed a mean difference of 10 motor points between upper extremities(UE) and lower extremities(LE). The survey was completed by 156 surgeons from 41 countries. Most responders (75%) described greater impairment of UE than of lower LE in their own TCCS definitions. Sensory deficit (39%) and bladder dysfunction (24%) were reported less frequently. Initially, any difference in motor strength between UE and LE was considered most frequently (23%) as a 'disproportionate' difference in power. The majority (61%) considered a difference of at least 10 motor points in favor of the LE as an acceptable cut-off criterion for a diagnosis of TCCS. Most of the participants (40%) felt that applying a single criterion to diagnose TCCS is insufficient for research purposes.

**Conclusions:** A wide variety of definitions of TCCS are employed by physicians involved in spinal trauma care. We consider a difference of at least 10 motor score points between upper and lower extremity power a clear diagnostic criterion for clinical research purposes.

### O17

**Abstract #: 236.00**

**Authors:** John B Furness, Dorota Ferens, Mark D Habgood, Jeremy D Gale, Katsuyo Ohashi-Doi, Norman R Saunders, Douglas J Brown

**Title:** Emptying the bowel in SCI patients by pharmacotherapeutic activation of lumbo-

sacral defecation centres: proof of principle inability to empty the bowel effectively is a significant problem for SCI patients. Because most spinal injuries occur at higher levels, the defecation control centres at L6-S1 are commonly spared. We recently described stimulation of defecation by centrally-penetrant ghrelin receptor agonists, resulting in co-ordinated emptying of the large intestine in experimental animals (Shimizu et al., *J. Physiol.* 576:329-338, 2006; Shafton et al., *Neurogastroenterology Motility* 21:71-77, 2009). The current study compared the ability of the ghrelin receptor agonist, capromorelin, to trigger bowel emptying in normal and spinally injured rats. Lower thoracic (T10) injuries were made using a computer-controlled impactor in anaesthetised rats. Responses to capromorelin were investigated 6-8 weeks later. Histology revealed complete loss of spinal grey matter and 95% of white matter restricted to T10. Capromorelin (4 mg/kg, i.v.) caused strong contractions, associated with propulsion of colonic content, soon after administration and continuing for 20 min. Responses were blocked by administration of the ganglion blocker, hexamethonium, or cutting the sacral nerves. Capromorelin was equally effective or more effective after SCI in mature rats. It is concluded that capromorelin can activate defecation centres in spinally injured animals to trigger emptying of the large bowel. Supported by the Victorian Neurotrauma Initiative.

## O18

### Abstract #: 89.00

**Authors:** Dr. Thiru Annaswamy, Tejas Ozarkar, Dr. Lance Goetz, Dr. Tomoya Sakai, Dr. Maria Fides Pacheco

#### **Title:** Reliability and repeatability of the Hoffman sign

**Purpose:** To determine the interrater, intrarater, and intrasubject reliability of the Hoffmann sign.

**Methods:** This cross-sectional, observational study included spinal cord injured (SCI) and non-SCI patients. Exclusion criteria: finger amputation, relapsing remitting multiple sclerosis, any acute central neurological illness or injury. IRB approval was obtained.

Hoffmann sign was elicited using a pre-determined, standardized technique by one primary and three secondary investigators. A positive sign was any reflexive flexion of the distal phalanx of the thumb or any finger. One primary and one secondary examiner tested both hands of each subject twice, with up to ten repetitions per trial. Repeat testing was done in the same fashion on each subject on another day.

**Results:** Out of 53 recruited subjects, 47 completed the study. All kappa values were obtained with  $p < 0.01$ . Interrater reliability, calculated between investigator pairs per

hand per subject per trial was 0.65 (189 pairs). Intrarater reliability, calculated between the two trials per hand per investigator per session was 0.89 (380 pairs). Intrasubject reliability, determined across the two sessions per hand, per investigator, was 0.80 (178 pairs).

**Conclusions:** The Hoffmann sign has excellent interrater, intrarater and intrasubject reliability when tested using pre-determined, standardized technique, across a diverse subject population.

## O19

**Abstract #: 187.00**

**Authors:** Dr. Anthony Gells, Pr Jean Pierre Daures, Pr Brigitte Perrouin-Verbe, Pr Jacques Pelissier, Dr Charles Fattal

**Title:** Evaluating self-reported pressure ulcer prevention measures in SCI with the revised skin management needs assessment checklist: psychometric properties

**Introduction:** Pressure ulcer is one of the most common complications after a spinal cord injury. PU behavioral risk factors can benefit from prevention strategies based on therapeutic education. SMnac is an assessment scale for prevention practices and knowledge of persons with spinal cord injury. It includes 12 items and has been previously validated into the English Language.

**Objective:** Transcultural adaptation and validation of the French version

**Methods:** Scale translation with the back-translation method, transcultural adaptation and acceptability study, multicenter reproducibility and validity study.

## Session V

---

## O22

**Abstract #: 97.00**

**Authors:** Dr. Mauro Menarini, Dr. Gabriele Bazzocchi, , Dr. Patrizia Brigidi, Dr. Federica Cruciani, Dr. Erica Poletti

**Title:** Bladder colonization by probiotic lactobacillus casei DG (LcDG) in SCI patients for preventing urinary tract infections

Probiotics are effective in disorders due to bacterial microflora unbalance. LUTs infections are common in SCI patients performing bladder intermittent catheterization

## **Title: Wheelchair and upright physical activity after SCI**

**Purpose:** Maintaining physical activity levels is important for health following Spinal Cord Injury (SCI). The purpose of this study was to monitor the physical activity levels of patients in the rehabilitation and home setting.

**Methods:** Upright activity of 20 patients with SCI [14 male; 45±14 years; C4-L3; ASIA A-D] was measured using an accelerometer placed on the anterior thigh; wheelchair activity was measured using an accelerometer attached to the rear wheel of their wheelchair. Physical activity was recorded for a week during rehabilitation, six weeks and six months following discharge.

**Results:** In the rehabilitation setting patients achieved an average of 842 steps/day, (maximum 5,538 steps), were upright for an average of 1.02 hours/day, (maximum 4.98 hours), and propelled their wheelchair for an average of 1.4 hours/day (maximum of 5.3 hours). All physical activity outcome measures increased following discharge to the home setting, and tended to continue to increase at six months (Table 1).

**Conclusion:** This novel technique can quantify physical activity levels in this population, and may be used to monitor and inform rehabilitation.

Funding was received from Glasgow Caledonian University.

### **O21**

**Authors:** Mrs. Anna Bjerkefors

## Session V

---

O22

**Abstract #: 97.00**

**Authors:** Dr. Mauro Menarini, Dr. Gabriele Bazzocchi, , Dr. Patrizia Brigidi, Dr. Federica Cruciani, Dr. Erica Poletti

**Title:** Bladder colonization by probiotic lactobacillus casei DG (LcDG) in SCI patients for preventing urinary tract infections

Probiotics are effective in disorders due to bacterial microflora unbalance. LUTs infections are common in SCI patients performing bladder intermittent catheterization (BIC). We wanted to investigate if a well known and largely employed probiotic strain (Lactobacillus casei DG) was able to colonize human bladder "in vivo" having demonstrated that its growth is not influenced by high concentrations of urine "in vitro". Ten posttraumatic paraplegic males (mean age 36±9 years), using BIC from at least 6 months, with at least one LUTs infection in the previous 3 months were recruited. They injected 4 ml of a solution containing 4 billions of LcDG before extracting catheter after the last daily bladder voiding for 8 consecutive evenings. Urine samples were taken before, during treatment and for 3 days later and cultured in two media, NA for total count and MRS specific for Lactic bacteria; their concentration increased from the basal  $3\pm 1.5$  LogCFU to  $7.7\pm 0.9$  and  $7.5\pm 1$  at 4th and 8th day ( $p<.02$ , Student's T-Test) and they were still present after 3 days. No LUTs infection occurred in all the patients during a 3-month follow-up. Probiotic LcDG colonize bladder although the frequent daily voiding: it seems to prevent infections in SCI pts performing BIC.

O23

**Abstract #: 210.00**

**Authors:** Dr Giovanni Mosiello, Dr Maria Paola Pascali, Mrs Francesca Musciagna, Mrs Giuseppina Di Serio, Mrs Sabrina Rossi, Dr Mario De Gennaro

**Title:** Training children in clean intermittent catheterization using playing cards: a real advantage in different social cultural scenarios and with different languages: preliminary experience

Clean intermittent catheterization (CIC) is the mainstay in the treatment of patients with neurogenic bladder (NB). Actually parents of children with NB were suddenly trained and they have care of their children until 7-8 years of age, when children frequently showed sufficient dexterity to take care of themselves. The training period

is a critical point in the management of NB because may be affected by the single emotional ,cultural psychological status. In order to facilitate it, the use of audiovisual material was advocated. Recently specific playing pee cards ( Coloplast, Denmark) were introduced. 2 children , aged 6-10 years were trained to CIC using cards and 2 without. Results were evaluated using a specific elaborated questionnaire.The preliminary experience showed as cards :1) transformed it in a playing moment, 2) helped children to memorize the correct sequence of a correct CIC , 3) relatives to communicate with their child, 4) trainees to establish a correct and direct relationship especially in presence of different culture and languages, as was demonstrated in other 2 patients in a developing country.In conclusion these cards seem very useful to overcome many barriers and to facilitate the training moment for CIC.

## O24

**Abstract #: 124.00**

**Authors: Dr. Elena andretta, Dr giuliana campus, Dr cristina zuliani**

### **Title: Detrusorial injections of botulinum toxin in overactive bladder due to multiple sclerosis: a 10 year experience**

We report our experience with detrusorial injections of botulinum toxin (ITox) in overactive bladder (OB) due to multiple sclerosis.

From 2000 15 subjects (12 females; mean age 46 years) underwent ITox. Twelve patients used clean intermittent catheterisation (CIC). All subjects kept voiding diaries. Urinary urgency and quality of life (QoL) were evaluated by visual analogical scales (Urgency: 1=no 5=serious; QoL: 1=very poor 5=excellent). Botox 300 IU were used.

We controlled patients at 15 days and subsequently as needed. All patients reported significant reduction of urgency (mean from 4.4 to 1.4) and in pads used (from 3.2 to 0.5/day) while the bladder capacity improved (mean 150 ml) like the QoL (from 1.3 to 4.2).

5 subjects, whose post-void residual (PVR) was superior to voided volume (VV), became unable to void while 3 patients, with PVR inferior to VV, conserved the ability to void. Three women maintained spontaneous micturitions without PVR, .

ITox effects lasted on average 8.4 months; 9 patients repeated them successfully (average 3.9 times).

ITox are effective in OB due to MS. Some incomplete urinary retentions become complete - whenever pre-treatment PVR was superior to VV - but some subjects conserve the ability to void.

## O25

### Abstract #: 175.00

**Authors:** Dr Cornelia Putz, H Plewa, M Zimmermann-Stenzel, K Möhring, C. H. Fürstenberg, H.J. Gerner, N Weldner, R Rupp

**Title:** The role of autonomic bladder dysfunction in the development of periarticular ossification in acute tetraplegic patients: a predictor for autonomic dysreflexia?

**Purpose of the study.** The aim of this study was to investigate the influence of the initial ASIA (American Spinal Cord Injury Association) and the conversion rate in acute traumatic tetraplegic patients on the development of periarticular ossifications. The second objective was to prove the hypothesis if autonomic dysreflexia in neurogenic bladder (ADB) occurred more often in tetraplegic patients who developed POA.

**Methods:** A retrospective mono-centric analysis (2002 – 2008) of the EMSCI database ([www.emsci.org](http://www.emsci.org)) included 77 traumatic tetraplegic patients whose clinical data were reviewed to determine the appearance of POA (n=8) and its possible coincidence with ADB. First Spearman's correlation coefficient was calculated to test the relationship between POA and initial ASIA impairment scale (AIS) or AIS changes within 6 weeks. A matched pair (age, NLI) analysis of two samples (n=8 with appearance of POA and n=8 without appearance of POA; total n=16) was performed. Chi<sup>2</sup> - test analysis was computed to analyze differences in manifestation of ADB between groups.

**Results:** The appearance of POA correlated significantly with an initial ASIA A compared to incomplete tetraplegia at baseline ( $p < 0.017$ ). Additionally the conversion of ASIA A into incomplete tetraplegia correlated highly with the incidence of POA ( $p < 0.003$ ). In the POA group all patients developed ADB (n = 8, 100%) compared to their matched counterpart (no POA) presenting only one patient with ADB (n=1, 12%) and 7 patients (88%) without ADB. Between both groups we found a statistical significant difference ( $p < 0.001$ ). ADB showed a positive correlation with POA ( $r = 0.97$ ,  $p = 0.001$ ).

**Conclusion:** An initial ASIA A constitutes a risk factor in the development of POA, which constitutes a predictor in acute traumatic tetraplegic patients to develop an imbalance of the autonomous nervous system resulting in ADB.

## O26

### Abstract #: 159.00

**Authors:** Ms. Charlotte Vandendriessche, Mrs. Carlotte Kiekens, Mr. Tom Meurens



## **Title: Urological follow-up in adult meningocele patients: an algorithm to use by the rehabilitation physician**

**Purpose:** Follow-up of adult meningocele patients best takes place in a multidisciplinary rehabilitation centre, in close collaboration with other medical specialties.

**Material and methods:** A literature search was performed using the following key words: meningocele, adult, rehabilitation, urologic disease. Based on the data retrieved an overview of the urological problems is given and an algorithm was then developed for use in the follow up.

**Results:** Nowadays, many of the patients born with meningocele reach adulthood. At this age, renal failure stays the most important cause of death.

Therefore, a multidisciplinary and systematic approach is crucial. It is of utmost importance to keep these patients in follow-up. Patients with meningocele often see rehabilitation physicians for other complaints, so they are well suited to play a prominent role in the follow-up. Yearly urological follow-up comprises urodynamic studies, serum creatinine level and kidney ultrasound. Additional investigations such as DMSA-scan, Cr-EDTA-scan or video urodynamics are justified if indicated.

**Conclusions:** Adults with meningocele are a precarious group. After growing out of pediatric age, adequate multidisciplinary follow-up frequently lacks.

Rehabilitation medicine can play a coordinating role in the follow-up, in collaboration with other specialties. Therefore an algorithm concerning urological aspects was developed.

### O27

**Abstract #: 39.00**

**Authors:** Dr. Bum-Suk Lee, Dr. Dong-A Kim, Dr. Sung-Il Whang

**Title:** Analyzing the cause of injury to develop the prevention strategies of pediatric-onset SCI in Korea

**OBJECTIVES:** This study aimed to analyze the cause of pediatric Spinal Cord Injury (SCI) to develop the injury prevention strategies in Korea.

**METHODS:** During last 13 years(1996 to 2008), 2,815 persons with SCI admitted to the National Rehabilitation Hospital. Among them, pediatric-onset SCI (at 18 years or younger) were 230 persons. 164 persons (71.3%) had traumatic causes and 66 persons (28.7%) had non-traumatic causes. We reviewed medical records of 164 traumatic cases to develop the injury prevention strategies.

**RESULTS:** Of 164 persons, 73.8% were male, 57.3% were complete injury, and 42.7% were tetraplegics. Incidence of SCI were not so high at preschool age (0-6 years, 19 persons), at elementary school age (7-12 years, 12 persons) and at middle school age (13-15 years, 19 persons), but the incidence was very high at high school age group (16-18 years, 114 persons). The proportion of males were 36.8% at preschool, 58.3% at elementary school age, 73.7% at middle school age and 81.6% at high school age. The common causes of injury were motorcycle accident(48 persons), fall-down injury(33), passenger traffic accident(24), diving accident(17), and pedestrian traffic accident(9). The common causes at preschool and elementary school age were traffic accident(21). At middle school fall accident(6) and diving accident(3) were common, and at high school motorcycle accident(45), fall accident(17), passenger traffic accident(14) and diving accident(14) were common. After analyzing the causes of pediatric-onset SCI for 13 years, we could develop '5 strategies for injury prevention'. We have visited the school with SCI persons and have educated this strategies to more than 10,000 children per year.

**CONCLUSIONS:** After analyzing the causes of pediatric-onset SCI for 13 years, we could develop injury prevention strategies in Korea. According to this study, our disability prevention program will focus to prevent motorcycle accident and diving accident in adolescents.

## O28

### Abstract #: 230.00

Authors: Mr Priit Eelmae, Ms Margot Pintson, Ms Mari Alvela, Ms Kadri Englas, Mrs Vaike Kabel, Mrs Malle Pakkanen,

**Title:** The comparison of the results of observational gait analysis and 3D gait analysis when using functional electrical stimulation: a case report

**OBJECTIVE:** To compare the results of observational video analysis and 3D gait analysis when assessing the effects of FES during gait.

**METHODS:** Gait pattern of a 33-year-old male patient with incomplete SCI (fracture v.C5, ASIA D) was analysed with and without FES in clinical gait lab.

Data were collected by Vicon MX-T20 infrared cameras, and 2 Basler cameras. Videos were shown to 5 physiotherapists (PT). The results from observational gait analysis and from 3D gait analysis were compared.

**RESULTS:** Changes identified by PTs during observational gait analysis when using FES: improvement of knee flexion and right foot dorsiflexion, movement of foot progression angle toward eversion. PTs recommended FES as effective tool to improve the patient's gait. According to 3D gait analysis the only positive change appeared in foot progression angle. The other improvements seen by PTs, e.g. in dorsiflexion or knee flexion, were not identified by 3D gait analysis.

**CONCLUSION:** The results from observational gait analysis and 3D gait analysis differ: the visually observed changes when using FES were recognized as more significant.

## O29

### Abstract #: 52.00

Authors: Ms. Joy Teo, Ms Sharon Sew, Dr. Elizabeth Dean

**Title:** Health of people with SCI in Singapore: Implications for rehab planning and implementation

**Purpose:** To describe the health of people with spinal cord injury (SCI) in Singapore

**Methods:** Demographic data, injury information and information about SCI-related secondary impairments, chronic conditions and their associated risk factors, medical and hospital utilisation, participation (Craig Handicap Assessment and Reporting Technique) and life satisfaction (Satisfaction with Life Scale) were collected via interviews from people living with traumatic SCI. Descriptive statistics were generated, and post-hoc between-group comparisons and correlations were conducted.

**Results:** On average, participants (50 men and 5 women) were aged  $48.3 \pm 16.54$  years and had had their SCIs for 5 years. Three quarters (78.2%) had tetraplegia. The most prevalent SCI-related secondary impairments were pain, spasms, bladder problems, bowel problems and oedema. Chronic conditions (e.g. diabetes, hypertension and obesity) and their associated risk factors (e.g. smoking and physical inactivity) were prevalent. Participation and life satisfaction scores were lower than those reported for similar populations cross-culturally.

**Conclusion:** People with SCI in Singapore report experiencing lower levels of health than the general population in Singapore. By focusing on community reintegration and health promotion, physiotherapists and other rehabilitation professionals may augment health outcomes and improve the quality of life of this population in Singapore.

### O30

#### **Abstract #: 139.00**

**Authors:** Dr. Marcel Post, Dr. Floris van Asbeck

**Title:** Satisfaction with long term care of Dutch persons with SCI living in the community

**Purpose:** To analyse satisfaction with long-term care of persons with SCI living in the community in the Netherlands.

**Methods:** Cross-sectional postal survey including all members of the Dutch patients organisation Dwarslaesie Organisatie Nederland. Satisfaction was defined as a rating of 8 or higher on a 0-10 numerical rating scale. Participants were asked for satisfaction with the expertise in SCI, accessibility, attention and flexibility of 8 different disciplines.

**Results:** A total of 461 usable responses were received (response rate 46%). Mean age was 47.1 years and 65% were males. Mean time after injury was 13.4 years. Types of SCI were complete tetraplegia (20%), incomplete tetraplegia (14%), complete paraplegia (47%) and incomplete paraplegia (19%). Contact with specialized SCI rehabilitation care decreased with time after injury. In general, satisfaction was lower than expected. Especially low were ratings of expertise of primary care physicians (43% satisfied) and district nurses (39% satisfied). Most participants were satisfied about the expertise of their physiatrist (80%), but only a minority were satisfied with their accessibility (53%) and flexibility (54%).

**Conclusion:** Using a stringent criterion for user satisfaction, we showed marked differences of user satisfaction between specialized and non-specialized care for persons with SCI.

### O31

**Abstract #: 223.00**

**Authors:** Mr. Anshul Sharma, Mr. Hemant Rohilla

**Title:** Exclusive neck and trunk control scale for SCI patients: a step towards independent living

**Objective:-** To introduce exclusive scale for head and track control for Spinal Cord Injury.

**Method:** - Exclusive 1 year study on 100 spinal cord injured patients for defining neck and trunk control scale at Rehabilitation Department, Indian Spinal injuries Centre India. In the study 50-50 quadriplegics and paraplegics were studied. Head and trunk control scale includes eight tasks raking from tilt table to walking activities. Where 0 define no to minimum effort and grade 6 define maximum score on each attempt.

**Results:** - According to the study quadriplegic (ASIA A & B) score is between 12-16 and paraplegic ( ASIA A & B ) is between 20-29 whereas quadriplegic (ASIA C,D & E) score range is 20-27 and paraplegic (ASIA C, D & E) range is 26-32 at first four month after their injuries. On 2nd forth month each class showed increased performance 3-16.1% (+/-0.73%-0.81%) on score range. Final forth month shows increased range by 10.3-31.4% (+/-0.87%-0.92%) in each class.

**Conclusion:** - Head and trunk control is an important factor for all classifications of spinal cord injuries for rehabilitation. Lack of above can result in dependent wheelchair user in the community.

### O32

**Abstract #: 178.00**

**Authors:** Mr Pradeep Thumbikat ,Ms Amanda Wong, Dr Chris Hopkinson, , Mr Nazakat Hussain

**Title:** Outcomes in SCI patients requiring ventilatory assistance: a 5 year review

Retrospective review of ventilatory outcomes, respiratory management and complications in patients requiring ventilatory support post SCI

**Results:** 44 patients (n=36, data incomplete=8,22M,14F,mean age=42) were identified.

**Patient characteristics:** 31 trauma, 5 non-traumatic; 15 patients intubated at injury

site, 15 in ITU and 6 post-op. 52.8% injuries involved C1-C4, 33.3% C5-C8, 13.9% T1-S5. Median ITU admission was 40 days (6-190). At the time of transfer to PRSIC, 26 required full ventilatory support (FVS). 18 weaned, leaving 8 on lifelong FVS. Average weaning time was 81.1 days. 7 of those self ventilating through a tracheostomy were decannulated, leaving 3 with tracheostomy on discharge. Average time to decannulation was 97 days. Complications included chest infections (29 patients, average=2.86/person) and tracheostomy complications (11). Mean hospital stay in patients requiring FVS was 206 days and those with tracheostomy 190 days. All 7 patients discharged on FVS were C1-C4 tetraplegics. Discharge destinations included nursing home (5), rehabilitation centre (1), home (1), 1 died as inpatient.

**Conclusion:** All patients with C5 neurological level and below weaned  
Direct relationship between the level of injury and frequency of respiratory complications  
FVS patients were more likely to be discharged to intermediate care  
Could better early management have avoided assisted ventilation in a number of patients?

## Session IX

---

**O33**

**Abstract #: 239.00**

**Authors:** Mr. Mohit Arora, Dr. Harvinder Singh Chhabra

**Title:** Does physical therapy effect outcomes in chronic SCI subjects undergoing cellular therapy?

**Objective:** To retrospectively analyse if physical therapy effected outcomes in five chronic spinal cord injury subjects in the pilot clinical study titled Autologous Olfactory Mucosal transplant in Chronic Spinal Cord Injury: An Indian Pilot Study.

**Methods:** Data of all 5 subjects participating in the trial were retrospectively analysed. The subjects had undergone a similar planned exercise regimen for 2 hrs daily for 5 days a week for the entire follow up period. 4 subjects were followed up for 2 years and 1 for 6 months. Subject had been evaluated with all neurological, functional and patient reported outcome measures.

**Results:** There was no significant neurological recovery in any of the five patients. However there was an improvement in functional outcomes in all 5 subjects.

**Conclusion:** Statistically significant improvement in functional scores without significant neurological recovery suggests that the improvement was due to physical therapy rather than regeneration. This suggests that physical therapy as a confounding variable should be taken care of in all related clinical trails. The results also suggest that physical therapy could be an effective treatment modality even in Chronic Spinal Cord Injury patients who have not been effectively rehabilitated so far.

**O34**

**Abstract #: 252.00**

**Authors:** D. F. Tovar, F. Benvenides, J. D. Guest

**Title:** Improvement of locomotor performance following transplantation of autologous Schwann cells in a non-human primate with chronic spinal cord injury]

**Introduction:** Radiofrequency lesioning (RF) can be used as a stereotaxic model of spinal cord injury (SCI) to create a lesion cavity surrounded by a demyelinated penumbra. We tested the effects of intracavity autologous Schwann cell (SC)

transplantation and treadmill training on locomotor performance (LP) in a non-human primate (NHP) subjected to a RF lesion of the medullary pyramid.

**Methods:** Two monkeys (*Macaca fascicularis*) were used. One served as an uninjured control (NHP1). A second, NHP2, underwent RF lesion of the medullary pyramid 2.3 y before transplantation. The right pyramid was targeted. RF was delivered at 80° C for 75 seconds. Magnetic resonance imaging (MRI) was performed. SCs were purified from the sural nerve using the mitogens forskolin (2µM) and heregulin (2.5 nM) and cryopreserved for 2.3 years.

Cells were recovered and expanded for 3 passages before transplantation. Cultures were 90% positive for p75 and S-100. SCs were exposed to a GFP lentivirus at an MOI of 100. Three million SCs in 32 µl were injected into the lesion.

LP was tested for 11 weeks prior to, and 24 weeks after transplantation. Behavioral sessions consisted of 15-minute periods at progressively increasing speeds twice weekly. Video clips were analyzed using Peak Motus Software and several kinematic parameters of LP were studied. Inter-animal and pre to post-transplantation comparisons were performed.

**Results:** Quadriparesis was observed immediately after the RF injury. A partial recovery was observed over two weeks and a hemiplegia was evident thereafter. MRI showed an extensive lesion of the pyramid and olivary nucleus. LP did not change during the pre-transplantation testing period (11 weeks).

Paw/hand dragging, absence of coordination, and lack of weight support were prominent. During the post-transplantation period (24 weeks) a progressive improvement was observed. Parameters including hip height, ankle inclination, extent and variability of hip, knee, and ankle range of motion and cycle phase duration were significantly improved as compared to pre-transplantation. These parameters progressively normalized as compared to similar measures from the non-lesioned primate. Maximum recovery was reached at week 24 post-injury and behavioral testing was discontinued for approximately 4 weeks. Subsequent behavioral testing has shown neither further improvement nor loss of recovery.

**Conclusion:** Following SC transplantation we observed progressive recovery of LP in a NHP with a chronic pyramidal RF lesion. Stability of the improvement after discontinuing training suggests structural repair as opposed to only a training effect. Replication studies are ongoing.



## Session X – Pott's Spine

---

**O35**

**Abstract #: 238.00**

**Authors:** Dr. Harvinder Singh Chhabra; Dr. Darshan Gautam

**Title:** Outcome of Anterior Decompression and Posterior Fixation in Potts Spine Through Posterior Transpedicular Approach as Compared to Combined Anterior & Posterior Approach

**Objective:** To compare outcome of anterior decompression and posterior fixation in potts spine through posterior vs. combined approach.

**Methods:** At ISIC, outcome in 26 cases of Potts spine operated through posterior approach (posterior instrumentation and transpedicular anterior decompression with strut graft/cage) was compared with outcome in 48 patients treated through combined anterior and posterior approach.

**Results:** The average time taken for patients treated through transpedicular approach was less (250 minutes as compared to 320 minutes). The blood loss was also less (1720 ml vs 2010 ml). Chest tube was needed for an average of 3.5 days in patients treated by combined approach delaying mobilization (4.5 days as opposed to 1.5 days). There was significant morbidity especially related to chest complications in 4 of the 8 elderly patients (>65 yrs) treated by combined approach whereas the elderly patient treated by the posterior approach did well. The outcome with regard to neurological recovery was similar in both groups at 1 year follow-up.

**Conclusion:** Anterior decompression and posterior fixation could be done safely and with less morbidity through posterior transpedicular approach in patients with Potts spine. However a larger study with more patients and longer follow up is required.

**O36**

**Abstract #: 118.00**

**Authors:** Dr. MANISH CHADHA, Dr SHOBHA ARORA

**Title:** SINGLE STAGE ANTEROLATERAL/POSTEROLATERAL DECOMPRESSION WITH POSTERIOR INSTRUMENTATION AND GLOBAL FUSION IN PATIENTS WITH ACTIVE THORACOLUMBAR TUBERCULOSIS.

## **STUDY DESIGN:** Case series

**OBJECTIVE:** To study the correction of kyphotic angle, neural recovery and complications associated with the procedure.

**METHOD:** 20 patients with active dorsolumbar tuberculosis were included. Preoperative antitubercular chemotherapy was given for at least 2 weeks and continued for 12 months postoperatively. All were operated in prone position and anterolateral/posterolateral decompression was performed. Iliac crest strut graft was used anteriorly and supplemented with a posterolateral grafting. Pedicle instrumentation was used in 10 and Hartshill with sublaminar wires was 10.

**RESULTS:** Mean followup was 2 years, Mean Age was 22.6 years. Mean correction of kyphotic angle was 25 degrees and at 2 years was 20 degrees. All healed without reactivation. 19 patients had good neural recovery. 3 patients had problems with wound healing. Continuous serous discharge was observed in them that stopped in 3 months on ATT. No patient had implant failure.

**CONCLUSION:** Single stage posterior decompression and instrumented and global fusion is a viable option in Potts spine. It shortens the immobilization period, corrects kyphosis and prevents further collapse and graft failure.

## **O37**

### **Abstract #: 247.00**

**Authors:** Dr. Saurabh Jain, Dr. Anil Jain, Dr. I K Dhammi, Dr. Jaswant Kumar

**Title:** Simultaneously anterior decompression and posterior instrumentation by extra pleural retroperitoneal approach in thoracolumbar lesions

**Background/rationale:** Anterior decompression with posterior instrumentation when indicated in thoracolumbar spinal lesions if performed simultaneously in single stage expedites rehabilitation and recovery. Transthoracic, transdiaphragmatic approach to access the thoracolumbar junction is associated with significant morbidity, as it violates of thoracic cavity and requires cutting of diaphragm. It requires a separate approach for posterior instrumentation. We evaluated the morbidity of extrapleural retroperitoneal approach to perform anterior decompression and posterior instrumentation simultaneously by single "T" incision in thoracolumbar junction for spinal trauma and tuberculosis.

**Methods:** 48 cases of tubercular spine (n= 25) and fracture of the spine (n=23) were included in the study of which 29 were male and 19 female (mean age of 29.1 years) All patients underwent single stage

anterior decompression, fusion and posterior instrumentation (except 2 old traumatic cases) via extrapleural retroperitoneal approach by single 'T' incision. Tuberculosis cases were operated in lateral position as they were stabilized with Hartshill instrumentation. For traumatic spine initially posterior pedicle screw fixation was performed in prone position and then turned to right lateral position for anterior decompression by same incision and approach. They were evaluated for blood loss, duration of surgery, superficial and deep infection of incision site, flap necrosis, correction of the kyphotic deformity, restoration of anterior and posterior vertebral body height.

**Results:** In traumatic spine group the means duration of surgery was 269 minutes (range 215 to 315 minutes) including the change over time from prone to lateral position. The mean intra-operative blood loss was 918 ml (range 550 - 1100 ml). The preoperative mean ASIA motor, pin prick and light touch score improved from 63.3 to 74.4, 86 to 94.4 and 86 to 96 at 6 month of follow-up respectively. The mean preoperative loss of the anterior vertebral height improved from 44.7% to 18.4% immediate postoperatively and was 17.5% at final follow up at one year. The means preoperative kyphus angle also improved from 23.30 to 9.3 immediately after surgery which deteriorated to 11.50 at final follow up. One patient developed deep wound infection at the operative site as well as flap necrosis which needed debridement and removal of hardware. 5 patients developed bed sore in the sacral region which healed uneventfully. In tubercular spine (n=25) group means operating time was approximately 45 minutes less than traumatic group. The mean intra operative blood loss was 1100 ml (750-2200). The means pre operative kyphosis was corrected from 550 to 230. Wound healing occurred uneventful in 23 cases and wound dehiscence occurred in only 2 cases. 9 out of 11 cases with paraplegia showed excellent neural recovery while 2 with panvertebral disease showed partial neural recovery. None of the patient in both groups required intensive unit care.

**Conclusions:** Simultaneous exposures of both posterior and anterior column of the spine for posterior instrumentation and anterior decompression can be performed in single stage by extra pleural retroperitoneal approach by 'T' incision safely in thoracolumbar spinal lesions and is an easy alternative with reduced morbidity as chest and abdominal cavities are not violated, ICU care not required and diaphragm not cut.

## O38

**Abstract #: 82.00**

**Authors: Prof. Rajeshwar Nath Srivastava**

**Title: Instrumentation in Pott's Paraplegia**

A study was conducted to evaluate the effects of ATT with decompression and instrumentation(Gp3) in Pott's paraplegia and to analyze the results with conventional methods of treatment by ATT with decompression(Gp2 ) & ATT alone- without any surgical intervention(Gp1). Variables used were pain and function scores (PFS), deformity evaluation (angle of kyphosis), and neurological outcome (onset of recovery and final outcome).

PFS at different time intervals shifted towards excellency in each group ( $p=4.4 \times 10^{-7}$ ) being maximum in Gp3 ( $P=1.77 \times 10^{-3}$ ). Angle of kyphosis increased with time being maximum in Gp1 ( $t=0.18-1.59, p 0.15$ ) and minimum in Gp3( $t=2.95-0.35, p 0.70$ ). Ambulatory time in Gp3(12.32 days), in Gp2( 66.67 days) and in Gp1 (42.57 days)( $p<0.001$ ). Onset of neurological recovery was earliest in Gp2(2.23days) followed by Gp3(9.37 days) and late in GP 1(18.52 days) This could be possibly due to squeezing out of the collections due to further collapse of the diseased motion segments, which are not possible once instrumentation is done. At 6 weeks full neurological recovery was 40%(Gp1), 54%(Gp2) & 50%(GP3).Neurological outcome was almost same in all three groups 6 months, Decompression with instrumentation shifted pain & function scores towards excellency, significantly reduced ambulation time and deformity progression without affecting neurological recovery

### O39

#### Abstract #: 235.00

**Authors:** Dr. Ajay.R Kothari, Mr. Mihir Bapat, Mr. Kshitij Chaudhar

#### **Title:** Paediatric Tuberculous Kyphosis in Very Young (<5yrs):pitfalls

**Introduction:** Paediatric kyphosis is challenging in its uniqueness. Management protocols are ill-defined.

**Aims:** Outcome analysis in 19 consecutive cases.

**Material & Methods:** 19 patients were divided into two groups.

Group A: Weak anterior construct with posterior stabilization (n=11)

Group B: Strong anterior construct with posterior stabilization (n=08).

The average age was 4yrs and number of vertebrae destroyed was 3.5. Trans-thoracic anterior reconstruction was performed in 5. 7 patients had non-functional neuro-deficit.

**Results:** Irrespective of quality of posterior fixation, 8 Group A patients had deformity recurrence with failure of fixation. Average kyphosis was 47.62 (pre-op 56.22) at 12months. Pain scores improved from average 10 to 2.

7 GroupB patients healed with average kyphosis 28.50deg (Pre-op 58.10).

Complete neurological recovery occurred in both groups. 3 patients had MDR infection and 6 required revision surgery.

**Conclusion:** Weak Anterior construct decided recurrence  
Acceptable residual deformity was observed  
Revision surgery after healing was safe

## Session XI

---

### O40

**Abstract #: 78.00**

**Authors:** Mr. Jean-François LEMAY, Dr Sylvie Nadeau

**Title:** Concurrent validity of the Berg balance scale and the balance master for the evaluation of balance in a spinal cord injury population

**Objective:** To validate the Berg Balance Scale (BBS) and the Balance Master (BM) for a spinal cord injury (SCI) population.

**Methods:** 32 individuals with an ASIA D SCI walking independently with or without assistive devices were evaluated for their balance and gait capacities using the BBS, the BM, the Walking Index for Spinal Cord Injury (WISCI), the Spinal Cord Injury Functional Ambulatory Inventory (SCI-FAI) and the 10-m walking speed. The level of association between clinical outcomes was examined with Pearson and Spearman coefficients with R values exceeding 0.5 revealing moderate to very good associations.

**Results:** The BBS and limits of stability test (LOS) of the BM showed moderate to very good association with walking evaluations ( $0.423 < R < 0.816$ ;  $p < 0.05$ ). Correlations between walking outcomes and the static and anteroposterior weight shift tests were highly variable ( $-0.138 < R < -0.871$ ) and were weak with the mediolateral test ( $-0.03 < R < 0.347$ ). Only the BBS could detect differences in balance performance between paraplegic and tetraplegic participants. The BBS, WISCI and SCI-FAI displayed a significant ceiling effect.

**Conclusions:** Results suggest that the LOS of the BM and the BBS are both valid for quantifying balance abilities in a SCI population. A ceiling effect is present on the BBS. This project was funded by the Ordre professionnel de la physiothérapie du Québec (OPPQ)

### O41

**Abstract #: 75.00**

**Authors:** Mr. Shivjeet Singh Raghav, Dr. Manu Tewari

**Title:** Peer counseling - A holistic psycho-social rehabilitation approach

**Introduction:** Both Physical and psychosocial are of equal importance for successful rehabilitation.

**Aims:** To aid in the psycho-social rehabilitation of the spinal cord injured patients and their families.

To assess the long-term outcome of psycho-social counseling in follow-up cases.

**Methods and Materials:** The Pilot study was carried out under the auspices of the Department of Rehabilitation. A semi-structure Performa was used to obtain the Socio-demographic and details regarding the quality of life. After obtaining Consent from the patients, Peer Counseling was done in 10 sessions. Each session addressed specific problems. After that patients were reassessed.

Instruments - Semi Structure Performa,WHOQOL-BREF.

**Results:** Out of total of 40 sample size, Mean Age  $\approx$  34 years, 4 were females and 36 males.65% married. 57 % were employed at the time of injury. The WHOQOL measured changes in Physical health, Psychological health, Social relationships and Environment, reflected a favorable outcome.

**Conclusion:** It was found that patients who received peer counseling portrayed a more confident and sense of awareness of symptoms, progression and functional coping after the injury.

## O42

**Abstract #: 250.00**

**Authors: H J Erli, M Brüggmann, R Erli**

### **Title: Quality of life after thoracoscopic anterior surgery of the spine**

For our study to identify determinants of Health-related Quality of Life (HRQoL) after trauma of the thoracic and lumbar spine and minimal invasive anterior surgery, we evaluated the results of 41 patients (f/m - 17/24) with an average age of 46+/-16,1y. The anterior procedure was performed as stand-alone anterior surgery or combined with a posterior instrumentation.

To observe HRQoL we used the SF-36 questionnaire, the revised Aachen Longterm Outcome Score (reALOS), a visual analog scale (VAS) of the patients' global health status and the VAS Spine Scores of the Hanoverian Questionnaire. Psychosocial data like age, gender and profession as well as clinical data like parameters of surgical treatment, X-ray imaging and the physical and neurological state were taken into consideration.

Stepwise multiple regression analysis showed that surgery-related parameters like the kyphosis angle was a strong predictor for quality of life after vertebral fractures besides pain and mobility. In the previously investigated group of patients after open surgery only weak evidence for an effect of the kyphosis angle had been shown. A possible explanation of these results could be that the reduced level of pain after minimal invasive treatment allows the morphological parameters to gain more influence on the outcome.

Quality of life after spinal trauma is influenced by a complex network of factors. Only weak evidence exists up to now that the restoration of the kyphosis angle influences the long-term outcome. Our study indicates that a good reduction of fractures helps to bring forward good results after spinal surgery.

### **O43**

**Abstract #: 199.00**

**Authors: Mrs. Jennifer HOWITT BROWNING**

**Title: Peer training as a cost-effective tool for SCI management in low-income countries**

This paper presents the results of a two-year project in northern Uganda which used peer training to improve the quality of life of people with SCI. Over 75 percent of people with SCI in Uganda do not survive after two years due to pressure ulcers or urinary complications. One cause of this problem is that people with SCI are rarely taught to manage their bladder or prevent pressure ulcers. Given limited hospital resources, one cost-effective technique for providing this training is through peers, with healthy and active people with SCI providing support to newly-injured individuals. Through the project, peer trainers provided training for 44 people on topics including bladder and bowel care, pressure management, wheelchair skills and sexuality. Research methods included hospital admission data and semi-structured interviews. Outcomes included:

- o A 75% reduction in re-admission for pressure ulcers
- o Increased quality of life, including fewer bowel and bladder accidents and increased confidence
- o Increased independence, with many people earning an income or taking on household responsibilities

These results suggest that peer training is a useful model for providing cost-effective training and community-based follow-up for people with SCI and should be replicated in other low-income countries.



## O44

**Abstract #: 170.00**

**Authors:** Mr. Md. Shariful Islam

**Title:** Functional outcomes of patients with SCI at the halfway hostel of centre for the rehabilitation of paralyzed (CRP) in Bangladesh

**Purpose of the study:** To explore the functional outcomes of patients with Spinal Cord Injury (SCI) at the Halfway Hostel of CRP in Bangladesh

**Methods:** A mixed design was chosen to conduct the study. Functional outcomes of 203 patients was measured through reviewing modified Functional

Independence Measure (FIM) scores administrated at transfer to hostel and at discharge from the hostel. Five patients living in the community (following discharge from hostel) were also interviewed conveniently using face to face semi-structured interview

Data of the quantitative part was analysed using descriptive statistics whereas content analysis was chosen for qualitative part.

**Results:** In average, 15% improvement in FIM scores of the paraplegic patients was noted. On the other hand, for the tetraplegic patients that was only 3%. The paraplegic patients living in the community acknowledge their functional outcome in transferring and domestic activities of daily living from the halfway hostel. They consider hostel as a place of building confidence in independence functioning. Tetraplegic patients recognise the functional challenges they will face as a result of their time in the hostel.

**Conclusion:** The findings of the study justify the importance on community reintegration hostel as part of SCI rehabilitation centre.

## O45

**Abstract #: 201.00**

**Authors:** Dr. Maria Paola Pascali ,Dr. Giovanni Mosiello, , Dr Claudia Gatti, Dr Carmine Del Rossi, Dr Mario DeGennaro, Tiziana Radaelli, Francesca Schioppa, Cristina Dieci, Giorgiol Colombo

**Title:** Social and health care assistance of patient with congenital spinal cord lesion in Italy

Study Aim is to define the economic cost of healthcare and social assistance in spina

bifida(SB) patients in a retrospective multicenter study of SB patients in 3 SB units (February-April 2008, 3 months followup-T3). Cost data over a one year period before and T3 were obtained by patients/family interview.

Parameters were: demographic data, associated malformations, medical treatment, health resource use and associated medical costs and direct treatment-related non-medical costs. 128 patients (64M:64F) enrolled (average age 13 years-range 0-29), 84 school age and adolescent. 52 patients were walking, 33 walking by simple orthotics, 16 walking by complex orthotics and 25 not walking. 84 patients were open SB and 44 occulta. The mean annual total cost was euro 11351/patient.

Among medical cost/patient, euro 4.307 for the orthotics (38%), euro 927 for hospital admissions (8%), euro 592 for outpatient follow-up (5%), euro 318 for other treatments (2%). The annual non-medical costs were euro 295 for transportation and euro 4514 for caregivers absence from work.

This is the first significant study about the economic cost of SB in Italy. The addition of orthotics significantly increases the cost of healthcare, the largest indirect cost is caregivers work absence

## **O46**

### **Abstract #: 200.00**

**Authors:** Dr. Lena Rutberg, Lena Rutberg, Per Bodin, Havkan Benjaminsson, Ann-Katrin Karlsson

#### **Title: CPAP treatment is an important treatment of under-ventilation of SCI patients**

High spinal cord injury is associated with the risk of impaired or loss of voluntary breathing capacity. Some experience daytime fatigue or low oxygen saturation as signs of impaired ventilation. We know from our clinical experience that it is sometimes hard to motivate the patients to use non-invasive ventilation support as CPAP. In order to further increase our knowledge we collected data on patients who successfully used the treatment.

**Methods:** Sleep monitoring including apopnea hypopnea index (AHI), oxygen desaturation index (ODI) mean and minimum oxygensaturation and pulse rate were monitored before and after treatment.

**Results:** 7 patients successfully used the treatment. Their AHI index decreased from a mean level of 37,8 to 2,8 ( $p < 0,01$ ). ODI index decreased from 30,1 to 2,3 ( $p < 0,05$ ). Mean oxygen saturation increased from 93,5 % to 95,6% ( $p < 0,01$ ). Minimum oxygensaturation and pulse rate did not differ between measurements.

**Conclusion:** CPAP treatment is successful in decreasing the episodes of desaturation during night. It is important to motivate the patients to use the treatment.

## O47

**Abstract #: 108.00**

**Authors:** Prof. ROOP SINGH, Prof. R.B. SINGH, Dr. Vineet Verma

**Title:** Proximal femoral resection and myocutaneous flaps for recalcitrant trochanteric pressures Department of Orthopaedics, Physical Medicine, Paraplegia & Rehabilitation, Rohtak, India

**Purpose:** Pressure ulcers (PUs) which communicate with hip joint are very difficult to treat. Purpose of the present study is to evaluate the results of proximal femoral resection and Myocutaneous flaps in two trochanteric PUs communicating with hip joint.

**Methods:** In two patients with trochanteric PUs associated with sepsis of the hip joint were treated with serial debridement, proximal femoral resection and delayed closure with tensor fascia lata flap in one and tensor fascia lata & Vastus lateralis flap in other.

**Results:** After 24 months of follow-up there was complete healing of PUs and no recurrence of sepsis. Both the patients were using wheel chair and there was increase in ambulatory status & independence. Quality of life score (Global QoL VAS), haemoglobin and serum proteins increased from preoperative values of 24, 8.2gm% and 4.4gm% to 76, 10.4gms and 5.8gm% postoperatively.

**Conclusion:** This procedure is not only extremely effective in treating deep, recalcitrant trochanteric PUs around the hip, but also improves patients QoL, general health and ambulatory status.

## O48

**Abstract #: 185.00**

**Authors:** Mr. Nazakat Hussain, Mr. Pradeep Thumbikat, Dr Kidangalil Mathew, Dr Rajah Khan, Mr Martin McClelland

**Title:** Reducing the cost: family and friends' role in physical rehabilitation of SCI patients

Physical rehabilitation is a major component of rehabilitation process after SCI. This

Involves both preventing complications and maximizing the functional potential. In an era of severe financial constraints physical/occupational therapy services face significant reductions in their budgets and staffing levels.

Prolonged length of stay (LOS) in hospital is the unintended consequence of complications resulting from suboptimal therapy services. Patients' relatives and visitors are a potential resource. With appropriate information and training they can be utilized to prevent SCI related complications and achieve physical rehabilitation targets.

We conducted a survey of SCI patients' relatives and friends in UK's two largest SCI centres. Out of 78 respondents, 99% expected health service to provide optimum service and 75% were satisfied with current level of service, 57% felt they had not been provided adequate information by the healthcare

staff to help in physical rehabilitation process. 83% said they would be happy to be involved if they were given appropriate information and training. Only 27% thought that this would affect the patients' privacy or dignity. We propose a formal information and training process for relatives and friends so that they become confident to help in preventing complications and optimizing physical outcomes consequently reducing LOS.

## **O49**

**Abstract #: 226.00**

**Authors: Mr. HEMANT ROHILLA**

**Title: Therapeutic riding as a recreational activity - step towards balance control for quadriplegics**

**Objective:** - To determine the effect of Therapeutic Riding on Neck and Trunk Balance of Quadriplegics.

**Method:** - 4 month data based study on 60 quadriplegics (ASIA A and B) with mean time period of injury of 6 months divided into two groups with 30 quadriplegic in each group. Group I consist of quadriplegics underwent traditional balance rehabilitation and therapeutic riding on horse back for neck and trunk balance at Beeyas horse riding school at Vasant Kunj New Delhi and group II consist of quadriplegics who were under traditional method of rehabilitation in Indian Spinal Injuries Centre Rehabilitation Department.

**Results:** - On 4th week follow up Group I- 23.4%-26.5% score and group II 14.8%-16.2%.

On 8th week follow up group I increase performance by 37.6%-47.3% and group II by 25.7%-27.2%. On final week group I lead group II by additional 15.7%-23.8% than 8th week performance.

**Conclusion:** - Head and trunk control shows great importance factor for mobility and independency for active living in community for quadriplegics

## O50

**Abstract #: 112.00**

**Authors:** Jun Wen, Dajue Wang

**Title:** An online survey of neurogenic pain in SCI in China

**Purpose:** To shed light on pain in SCI in China.

**Material and method:** 100 replies to a Questionnaire on Pain were analysed. Due to subjectivity of Visual Analogue or Numerical Scale, a new grading (1-5) linked to Activity of Daily Living (ADL) was designed. Spasticity and medicine were also included.

**Results:** The new grading correlates ADL satisfactorily. Male:female=65:35. Average age:35. 22 persons had no pain. Breakdown of pain is shown in the table. There was no difference between genders in overall pain. However, males had more pain of Grade 3-5 (P=0.03).

Painscale	1	2	3	4	5	Total
Male	17	4	11	19	1	52
Female	13	5	2	6	0	26
Total	30	9	13	25	1	78

Both complete and incomplete lesion had 78% of pain. Eight persons regularly took medicine. Five with Grade 4 or 5 pain used Tramadol or morphine. Relation between pain and spasticity was uncertain.

**Conclusion:** Severity of pain was consistent with restriction of ADL and strength of medicine. They added a dimension to objective assessment of pain.

The high incidence of pain could be attributed to lack of care. That a minority took medicines could be due to difficulty in getting them.

## Session XII

---

### O51

**Abstract #: 243.00**

**Authors:** Nekram Upadhyay, Dr. H.S. Chhabra

**Title:** Impact of Customized Wheelchair and Seating on the Functional Ability among people with Spinal Cord Injuries

**PURPOSE:** The major purpose of this study was to investigate the impact of customized wheelchairs and seating system provided to people with spinal cord injuries, conducted at Indian Spinal Injuries Centre, on the functional abilities and quality of life. Participants were enrolled during their rehabilitation and at the time of discharge from ISIC, Delhi. These subjects were divided into two groups of 30. Group one which was experimental, received prescribed wheelchair and cushion along with the training at Department of Assistive Technology, ISIC, while other was control group received wheelchair by donation or govt. schemes.

**METHODS:** Data were collected 4 times; at wheelchair and cushion delivery time, at 3, 6 and 12 months during their revisit, phone or email. Instruments used were Test of Activities of Daily Living and World Health Organization Quality of Life Index, Indian Version (modified).

**RESULTS:** Results demonstrated that functional abilities in experimental group were significantly different from the day customized wheelchair with cushion given and at 3, 6 and 12 months. In the control group those who received hospital style wheelchairs by donation or govt. schemes, scores of functional ability were much lower. There was significant difference in QOL in experimental group than control group

### O52

**Abstract #: 106.00**

**Authors:** Mrs. Rebecca Dytor, Mr. J Roy Chowdhury, Mr. W El Masri

**Title:** Completed audit cycle of respiratory care in the acute stage: an Oswestry experience

**Background:** Patients with cervical cord injury are susceptible to respiratory complications. The MCSI has an intensive preventative management programme of respiratory care for self ventilating tetraplegics.

A previous audit in 2007 showed that such preventative measures were successful but identified certain areas to improve.

**Aim :** A completed audit cycle of the practice of respiratory care during initial admission of patients with cervical cord injuries.

**Method:** All patients with established cervical cord injury between 2007 and 2009 were included.

Neurological level, delay in transfer, respiratory complications before and after transfer, method of management of spinal injury, respiratory management, change in vital capacity, were audited.

**Results :** Total patients 105 (48% C4 or above neurology, 29% motor complete). 27 had chest complications prior to transfer, 15 requiring ventilation. 19 had chest complications after transfer, 10 had problems prior to transfer and only 9 developed 'new' problems. Great majority were successfully treated with our respiratory management programme with only 2 requiring ventilatory support.

**Conclusion:** Respiratory complications are potentially preventable in self ventilating high cervical lesions with a comprehensive respiratory management programme, endorsed by this completed audit cycle.

Those who do develop problems acutely are at risk of developing problems in the future.

## **O53**

**Abstract #: 117.00**

**Authors:** Dr. Shiv L. Yadav, Prof U Singh, Dr. Naveen Mathews

**Title:** Are SCI patients asexual? Myth or reality: An Indian perspective

In this paper differences in perceived self-concept and sexual response before and after SCI patients were examined. A questionnaire based interview evaluation was done. Majority viewed sexual relationships as very enjoyable, although many commented that changes in bowel and bladder function, spasticity, untold sexual issue had shown inhibited sexual expression. The need felt for more effective sexual counseling was highlighted. The current study investigated the association between sexual well-being, and age-of-onset, duration and level of injury, post injury relationship status, care dependency among SCI people. Sexual well-being was assessed in five areas: sexual satisfaction, sexual anxiety, sexual esteem, body esteem and perceived attractiveness to others. The increase age-of-onset of injury in men

there was decreased sexual satisfaction and body esteem. In women, only having a partner was a predictor of sexual well-being. Care dependency only had a minor effect in the male group. Furthermore, mental health and feelings of helplessness correlated significantly with sexual self images in men but not in women. The results also suggested that men with late-onset spinal cord injury experiences more adjustment problems than women and women place more emphasis on interpersonal aspects of sexuality than men.

## **O54**

**Abstract #: 94.00**

**Authors:** Dr. Yorck B. Kalke, Dr. Rita Taurman, Prof. Dr. Heiko Reichel

**Title:** Integration of the SCI centre in the training of medical students: experiences in the orthopaedic department of the University of Ulm, Germany

**Purpose:** It should be mandatory for medical students to get to know the comprehensive care doctrine of Sir Ludwig Guttmann to realize that paralyzed patients have to be treated in a SCI centre. In Germany we have 27 specialized centres but only a few are integrated in the teaching program.

**Methods:** The SCI centre as part of the Orthopaedic Department of the University of Ulm is involved in the training of about 300 medical students per year.

**Results:** In the main lecture in the seventh semester the topic SCI including patients is presented, also in the intranet. SCI specific questions are integrated in the final exam. A mandatory block internship for 4 to 6 students gives every student the opportunity to visit the SCI centre. Between the seventh and ninth semester the students have additionally to choose seminars taking place on 7 days where they have the opportunity to get to know more in details the rehabilitation of SCI patients.

**Conclusion:** In many ways, the junior doctors are brought in touch with the topic SCI. An evaluation of their grade of satisfaction with these teaching opportunities should be of interest.

## **O55**

**Abstract #: 137.00**

**Authors:** Ms. Christel van Leeuwen, Dr. Marcel Post, Dr. Floris van Asbeck, Dr. Sonja de Groot, Dr. Lucas van der Woude, Dr. Eline Lindeman

**Title:** Different trajectories in the course of life satisfaction in people with SCI



**Funding:** This study was supported by the Dutch Health Research and Development Council, ZON-MW Rehabilitation program, grant no. 1435.0003 and 1435.0025.

**Purpose:** To identify distinct patterns of recovery of life satisfaction in the period between the start of active rehabilitation and five years after discharge.

**Methods:** Multi-centre prospective cohort study with measurements at the start of active rehabilitation, after three months, at discharge, one, two, and five years after discharge. 206 Persons with SCI were analysed. Life satisfaction was measured as the sum score of 'current life satisfaction' and 'current life satisfaction compared to life satisfaction before SCI' (range 2-13). Latent class growth analysis was used to identify distinct life satisfaction trajectories.

**Results:** Mean total life satisfaction for the whole group was 5.35 at the first measurement and 7.44 at the last measurement. Five life satisfaction trajectories were identified: low scores at all time-points (3.62 - 4.57) (27%), medium scores at all time-points (6.40-7.20) (31%), high scores at all time-points (8.45-10.62) (17%), improvement from 3.40 at the first measurement to 8.50 at the last measurement (23%), and deterioration from 8.80 at the first measurement to 4.40 at the last measurement (2%).

**Conclusions:** Life satisfaction in people with SCI follows distinct trajectories. Further research is necessary to discover which predictors can distinguish among the trajectories.

## O56

**Abstract #: 174.00**

**Authors:** Dr. Bhavin Shial,

**Title:** Analysis of peri-operative complications of 60 cases of open transforaminal lumbar interbody fusion (TLIF)

**Objective:** Analyze the complications of open TLIF procedure and provide tips from our experience.

**Methods:** We did retrospective analysis on 60 consecutive cases of TLIF performed between January 2005 and December 2009. Patients were treated for degenerative disc disease (10), instabilities (43) and infections (7).

**Results:** Mean age of 60 patients was 53 years. The overall complication rate was 38.5% (23) including 30% (18) minor and 8.5% (5) major complications.

Minor complications included CSF leak (5), Superficial infection (5) managed conservatively, exiting nerve root paraesthesia (5) which resolved within 3 months, and hematoma (2) which resolved spontaneously. Major complications included deep infection (1) requiring debridement, screw cut out laterally during compression over cage (1) requiring repositioning of screws, radicular pain due to long S1 screw irritating L5 nerve (1) requiring repositioning and cage extrusion anteriorly (2) with inferior vena cava injury (1) requiring anterior surgery.

**Conclusions:** We suggest caution during compression of screws over rigid cage, during cage insertion to avoid exiting nerve root injury. In cases of infection and severe degenerative disease, anterior longitudinal ligament can be deficient and cage can extrude anteriorly. We suggest a novel oeLasso technique during cage insertion in such cases.

## O57

**Abstract #: 123.00**

**Authors: Dr. Divya Parashar**

**Title: The relationship between perceived stress, appraisals of disability, and coping responses on the variance in concurrent depression and anxiety in patients with acquired SCI**

Going beyond Stage Theory, the Stress Appraisal and Coping (SAC) Model explains the importance of factors such as individual perceptions of stress, appraisals of disability, and coping responses in psychosocial adjustment to SCI (Dean & Kennedy, 2009).

The present study examined the SAC Model in 100 SCI in-patients at the Indian Spinal Injuries Centre. Patients were assessed on stress, anxiety and depression, appraisals of disability, and coping responses to better predict psychosocial adjustment to SCI and their implications on counseling.

**Results:** Respondents endorsing items on Fearful Despondency, Overwhelming Disbelief, Negative Perceptions of Disability reported higher levels of anxiety and depression. Respondents endorsing fewer items on Growth and Resilience, and Determined Resolve reported higher anxiety and depression.

Significant correlations were reported between avoidance based coping and depression. An exploratory stepwise regression revealed that Perceived Stress, Negative Perceptions of Disability, and Growth and Resilience were significant predictors of variance in depression. Perceived Stress, Support and Guidance, Overwhelming Disbelief, and Growth and Resilience significantly predicted variance in anxiety.

O58

**Abstract #: 188.00**

**Authors:** Miss Amanda Wong, Mr Pradeep Thumbikat, Mr Martin McClelland

**Title:** New onset epilepsy in a SCI patient with multiple pressure sores

Report of a case of autonomic dysreflexia (AD) causing reversible posterior leukoencephalopathy syndrome (RPLS) resulting in seizures.

A 50 year-old man with complete congenital T4 paraplegia, chronic renal failure and a background of frequent AD episodes, was admitted to the Princess

Royal Spinal Injuries Centre for surgical management of bilateral trochanteric pressure sores.

He had four grand mal seizures lasting about a minute each, for which no cause was found. He was started on phenytoin and the seizures resolved. CT head was normal. He was re-admitted 3 months later following recurrence of the sores. The seizures resurfaced with visual blurring, headache and hypertension with systolic  $\sim 200$ mmHg, which settled with GTN spray. He could not recall the event but was orientated in time, person and place. Each seizure lasted about 1-2 minutes and frequency varied between 5-20 seizures per day. The phenytoin dosage was increased but to no effect. An MRI of his brain performed five days later, showed bilateral symmetrical areas of oedema in the parietal lobes in keeping with RPLS. It was concluded that AD caused RPLS which resulted in seizures. Tight control of his BP, (systolic  $<150$ mmHg) proved effective on controlling the seizures.

O59

**Abstract #: 227.00**

**Authors:** Dr Maureen Coggrave, Miss Ruth Ingram, Dr Brian Gardner

**Title:** Meeting the needs of chronic SCI individuals with significant bowel management difficulty - a neurogenic bowel care clinic

**Purpose-** To report development of a Neurogenic Bowel Care Service.

**Method-** Bowel dysfunction is a significant issue for quality of life. Problems following discharge from rehabilitation are common. This clinic provides focused assessment, advice, access to new interventions and education for patients and healthcare professionals. Assessment includes bowel diaries, measures of mood and

quality of life, colonic transit studies and anorectal manometry where indicated and follow up via telephone, email or re attendance.

**Results-** Over 24 months 123 individuals were seen in 35 clinics. Most (50%) were referred by their medical consultant, 18% self-referred, 14% referred by their general practitioner. Average age 48 years, average duration of injury 19 years. Reasons for referral included prolonged management (26%), constipation/diarrhoea (23%), faecal incontinence (20%), information seeking (8%), pain (7%). Outcomes included adapted conservative management (38%), transanal irrigation (38%) and ultimately stoma formation in 9 (8%).

**Conclusion-** The clinic meets the needs of individuals with significant bowel management problems; stoma formation is 3 times more common among attendees than in the general spinal cord injured population. There is a clear need to provide structured support for bowel management in the community-living spinal cord injured population.

## O60

### Abstract #: 46.00

**Authors:** Carlotte Kiekens, Mr Thomas Carpentier, Prof. MC Koenraad Peers

**Title:** Muscle rupture after minimal trauma of the spastic muscle: three case reports of patients with SCI

**AIM:** The aim of this study is to report three cases of muscle rupture caused by minimal trauma in SCI patients with severe spasticity and to give a literature based overview of the underlying mechanisms.

**METHODS:** Retrospective study of three cases of muscle ruptures in SCI patients with severe spasticity. All muscle lesions were diagnosed by ultrasound. Literature review (Pubmed) was performed to identify extrinsic and intrinsic risk factors.

**RESULTS:** Two cases are described of rupture of the m. semimembranosus, one even bilaterally. The third case concerns a rupture of the adductors of the hip. According to the literature and our clinical findings several structural and mechanical alterations of the spastic muscle in combination with specific stretching during therapy or transfer could have caused these ruptures.

**CONCLUSIONS:** To the authors' knowledge this is the first report of muscle rupture due to spasticity in SCI patients. Inferior mechanical properties of the spastic muscle in combination with extreme stretching can cause complete rupture of the spastic

muscle. Although this is a rare complication of spasticity, medical staff and therapists should be aware of the risk factors in order to prevent and quickly identify the lesions.

**Conclusion:** Perceived stress, appraisals, and coping positively predict distress; appraisals and coping strategies influence one another. Early identification and treatment of appraisals and coping responses would help in reducing anxiety and depression.

## O61

**Abstract #: 33.00**

**Authors:** M.Sumida, A.Tokuhiro, K.Furusawa, E.Genda, T.Tominaga, H.Tnaka

**Title:- Spinal Cord Injury Data Base In Japan**

**StudyDesign:** Retrospective study of inpatients

Objectives to study neurological and functional outcomes

Setting: Rosai Hospitals and Regional Rehabilitation center

Method: in total 3006 cases(1996-2007)

Data on admission and discharge were collected assessments:Database included gender, cause of injury, type of vertebral lesion, treatment, complications, ASIA/ISCOS Impairment Scale, neurological examination, FIM on admission and discharge and LOS.

**Results:** average age was 49.1(6-106)years. Causes included traffic accident 1076(35.6%),falls from height 984(32.7%) , falls on the floor 311(10.3%) andsports 183(6%).Neurological and functional recovery was observed on discharge from rehabilitation.

No different outcome was found as results of spinal surgery in the cases of non bony injury.

**Conclusion;** Patients with SCI become older year by year with incomplete tetraplegia. The causes of the elderly patients occupied slight damage by fall on the floor. Neurological and functional recovery (FIM recovery) increased 1.4-1.5 times at admission. Complications were the first paresis area numbness, thesecond spasticity and the third UTI.The final patients situations were return to home 1470, return to work 254 and return to school 64,

## Session XIII

### O62

**Abstract #: 160.00**

**Authors: Dr. Caroline McFarlane, Dr Peter New**

- **Title: Functional outcomes for patients admitted to a spinal rehabilitation unit with acute spinal cord ischemia**

There has been very little study of patient with spinal cord injury (SCI) due to cord infarction. The objective of this project was to study the functional outcomes for a cohort of these patients.

Data was retrospectively collected from consecutive patient admissions between 1995 and 2008. 44 patients included (26 males, 59%), with a mean age of 69 years. On admission, 41 (93%) patients had paraplegia. The majority of patients (75%) had incomplete SCI. Aetiology was related to vasculopathy in 20 (47%) patients.

The average length of stay in rehabilitation was 105 days (median 82). The most common complications were pain (77%), urinary tract infection (57%), spasticity (27%), cardiac failure (25%) and pneumonia (20%). At the time of discharge 35 patients (80%) had not changed in ASIA classification status.

Despite this, the median FIM motor subscale of 28 on admission improved to a median of 72 by discharge. At discharge, 70% of patients required formal support services. Only one of 44 patients remained faecally incontinent at discharge (compared with 86% on admission).

Despite the apparent lack of change on their ASIA grade, these patients made major improvement in their functional abilities during inpatient rehabilitation.

### O63

**Abstract #: 115.00**

**Authors: Marika Augutis, Caroline J Anderson**

- **Title: Categories of coping as recalled by persons who sustained a SCI during adolescence**

A persons cognitive and behavioral efforts to manage the stress after sustaining a

spinal cord injury SCI) are defined as coping. Coping styles have been found to be stable over time. The aim was to determine categories of coping as recalled in semi-structured interviews by recollections of 24 persons who sustained a SCI during adolescence (11-15 years) in Sweden.

The instrument Brief COPE was used as a framework to identify coping strategies in the interviews.

Findings from the interviews contain descriptions that Emotional/Instrumental support and Active coping are commonly used, but also Venting and Behavioural disengagement are described. The number of coping strategies varied among the interviewees. Two new categories of coping which were not previously defined by the BriefCOPE, emerged when analyzing the interviews. How they explain this in their own words will be presented.

Gaining insight into the way adolescents cope with their injury may help professionals to determine how they can promote the motivation the adolescents need to achieve a qualitative lifestyle.

## **O64**

**Abstract #: 192.00**

**Authors: Mr. Aheed Osman, Mrs Julie Ferguson, Mrs Emma Fosbrook**

**Title: Outpatient follow-up at the Midlands Centre for Spinal Injuries, Oswestry UK**

Since 1970 The Midlands Centre for Spinal Injuries (MCSI) has managed 3500 acute spinal injuries. In 2009 2042 patients attended the outpatient department where patients have access to all members of the Multi-Disciplinary team.

**Purpose of study:** In July 2009 a review of the outpatient service was commenced as part of a service improvement project including a patient satisfaction survey. As a regional specialist centre we asked how far patients travelled, waiting time in clinic & patient satisfaction of the service etc. Patients were asked if they were happy being followed up at MCSI or would prefer to be reviewed by their own local hospital.

**Method:** 50 patients attending their outpatient review between November & December 2009 were asked to complete a questionnaire & the results analysed.

**Results:** 90% of patients felt their review was necessary. 86% reported the frequency of their appointments was adequate to satisfy their needs. 84% of patients wanted to remain under MCSI follow-up. Travelling time varied from ten minutes to four hours.

**Conclusion:** The holistic approach adopted by the MCSI is necessary for monitoring the patients health & prevention of complications & is supported by our patients. We think it is a cost effective approach.

## O65

### **Abstract #: 219.00**

**Authors:** Dr Maria Paola Pascali, Dr Giulio Del Popolo, Dr Francesco Battaglino, Dr Tiziana Redaelli, Dr Giuliano Torre, Dr Mario De Gennaro

**Title:** Transanal irrigation: 1 year follow-up with analysis regarding failure and treatment interruption

Patients with Spina Bifida presented commonly bowel dysfunction (NBD) affecting quality of life (QOL).The real advantage was recently the trans-anal irrigation using Peristeen (Coloplast, Denmark) (PAI). PAI advantages have been demonstrated while follow-up it is still unclear. 10 patients aged 13-25 yrs , all with SB,were considered. All patients were treated with PAI for one month period and then continued their treatment with periodical control every 6 months .Patients were evaluated with a specific questionnaire regarding benefits and problems . Patients were divided in :a) in treatment , b) not in treatment The mean follow-up was 15.4 months, 7 still in treatment, 3 discontinued ( 1 not satisfied, 2 for economical reason related to health care system no reimbursement). Constipation was referred ameliorated in all,while differences were reported on fecal continence and patients independence,73% vs 33% and 87% vs 33% respectively.Problems were encountered mostly in group B, pain or balloon rupture.In conclusion PAI may play a role for the NBD as well as clean intermittent catheterization for neurogenic bladder. Clinical guidelines to increase the efficacy as well as to ameliorate the diffusion of PAI inside national health system, and solve reimbursement problems could be useful

## O66

### **Abstract #: 228.00**

**Authors:** Mrs. Karin Postma, Mrs. Janneke Haisma, Mrs. Maria Hopman, Mr. Michael Bergen, Mr. Henk Stam, Mr. Johannes Bussmann

**Title:** Respiratory infections and function 5 years after SCI rehabilitation

**PURPOSE :** To assess the occurrence of respiratory infections (RI) and respiratory function (RF) and their association with general health perception in persons with Spinal Cord Injury (SCI) 5 years after inpatient rehabilitation.



**METHODS :** We included 137 persons with SCI who participated in a Dutch multi-center prospective cohort study. Five years after discharge from inpatient rehabilitation, physicians determined whether participants had a clinically important RI during the previous year. RF was measured with forced spirometry and with a self-reported questionnaire on perceived RF. In this questionnaire participants were asked to grade their cough strength and the occurrence of shortness of breath (perceived RF). General health perception was measured with a subscale of the SF36.

**RESULTS :** Nine percent of the participants had RI, 27% had a Forced Vital Capacity (FVC) below 80% of the predictive value based on age, gender and height, 50% had weak cough, and 35% shortness of breath. RI and general health perception were associated with FVC (in liters), weak cough, and shortness of breath. RI was not associated with lesion characteristics, age, or smoking status.

**CONCLUSION :** RI and decreased RF are common and are negatively associated with general health perception 5 years after SCI rehabilitation.

## O67

**Abstract #: 173.00**

**Authors:** Dr. Premik Nagad, Dr Uday Pawar, Dr Abhay Nene

**Title:** Perioperative adverse events in spine surgery: a review of 900 surgical cases

**AIMS :** Review perioperative adverse events in a single surgeon series.  
Formulate protocol to minimize adverse events.

**MATERIALS AND METHODS :** 900 cases of a single spine surgeon in a single institute were included in the study. Intraoperative surgical adverse events were reviewed from the log book maintained by the operating surgeon. The cases were further classified according to their indications to discover any correlation in the difficulty index of the surgery and the complications.

**RESULTS :** 82 intraoperative surgical adverse events were noted in 900 patients. Adverse events were seen in cases with varied indications. Dural rent (38), wrong level exposures (12) and implant related adverse events (16). Post operative neurodeficit (9) uneventful root injuries (6). Also noted was the uncommon event of post-operative unilateral vision loss in 1 case. Even with growing surgical expertise complications were noted, presumably because more complicated surgeries were undertaken during this period.

**CONCLUSION:** Preventing adverse events/complications would be the most logical solution. For this, they should be acknowledged, assessed and used to shorten the

learning curve of the operating surgeon and his associates. The present study thus strongly recommends compulsory monthly surgical auditing of all the cases towards achieving this goal.

## O68

**Abstract #: 158.00**

**Authors :** Prof. Frederique COURTOIS K Charvier, J G Vézina, S Carrier, G Jaquemin, I Côté

### **Title:- Pharmacological Treatment of Anejaculation and Anorgasmia in Menwith Spinal Cord Injury**

F Courtois, K Charvier, J-G Vézina, S Carrier, G Jaquemin, I Côté, N Morel Journal A Leriche. Rehabilitations Centers in Montreal (IRGLM) and Quebec (IRDPC) Canada and Lyon (HCL) France

Few pharmacological treatments are available for anejaculation and anorgasmia. Midodrine, an alpha stimulating drug, may be successful but questions remain on its reliability for anejaculation and its effectiveness for anorgasmia.

**Objective:** Exploring the effectiveness and reliability of midodrine to treat for anejaculation and anorgasmia.

**Material and methods:** 41 SCI men tested with vibrostimulation alone or with midodrine (5-25mg) and 18 SCI men tested on an ABAB design alternating vibrostimulation alone (A) and combined to midrodrine (B). Results: Midrodrine significantly improved ejaculation compared to vibrostimulation alone. Systolic blood pressure increased by 43mmHg with midodrine compared to 32mmHg with vibrostimulation alone, diastolic blood pressure by 12mmHg compared to 13mmHg, and heart rate decreased from 14b/min compared to 10b/min. Orgasmic sensations including cardiovascular, muscular and autonomic sensations significantly improved following ejaculation with vibrostimulation and midodrine, but appeared less significant when midodrine was combined to vibrostimulation.

**Conclusion:** Results indicate that midodrine is a significant and reliable treatment for anejaculation but possibly not for anorgasmia. Orgasmic sensations appear primarily triggered by ejaculation – which is improved by midodrine – but not by the direct effect of the alpha stimulating drug. Implications of these results in terms of the neurophysiological model of ejaculation and orgasm are discussed.

Supported by Christopher and Dana Reeve Foundation.

**ABSTRACTS OF  
ASCON  
ORAL PRESENTATION**



## O69

Prof Dajue Wang, Chao Cui, Dajue Wang

**Title:** A Biomechanical mode to test a unique structure of subcutaneous layer with special reference to pressure sore

**Introduction:** The areas where the human skin sustains more pressure than others are occiput and back when lying, bottom when sitting up and feet when standing and walking. The rarely discussed unique structure in these areas to resist excessive pressure is a series of lobules of fat surrounded by fibrous tissues in all directions (Figure). Each lobule acts like a balloon that can distribute external force quite evenly due to its shape, thus protecting skin layers beneath it where the main blood supply of the skin comes from. A simple model is designed to test the effect.

**Material and method.** Six holes were cut through a rectangular piece of soft sponge and six balloons filled with water under tension were put through to fill the holes. It simulates subcutaneous layer with lobules. A piece of sponge without holes and balloons was used as control. Underneath the sponge, three cut sections of a catheter simulating blood vessels were glued to a flat hard surface. When a 500 gram weight was placed on the control sponge, the sections of the catheter began to collapse whilst not on the tested sponge. No heavier weight was used for fear of blowing up the balloons.

**Discussion.** This model clearly demonstrates the extremely important biomechanical function of the lobules. Any damage to this structure due to malnutrition and/or excessive pressure can further compromise the main blood supply of the skin underneath it and cause more severe damage.

## O70

Mr. Mohit Arora, Dr. Harvinder Singh Chhabra, Dr. Apichana Kovindha, Dr. Nazirah Hasnan

**Title:** Patients with spinal cord injury with South East Asia region: Epidemiology based on the International Spinal cord (ISCOs) data set

**Objective:** To report epidemiologic data of patients with spinal cord injury (SCI) based on the ISCOS data set.

**Design:** Cross-sectional study

**Setting:** Chiang Mai University Hospital, Thailand; Indian Spinal Injuries Centre, India and University of Malaya Hospital, Malaysia

**Method:** Data of 238 patients in South-East Asia (SEA) Region were extracted from the nation-wide International Classification of Functioning, Disability and Health (ICF) core sets for SCI study done in 2007, then analyzed and reported.

**Results:** Of all, 50% were chronic SCI, 80% were males and 59% were currently married. Median age ranged from 30.4-46.2 years; 33.6% were unemployed due to health problem(s); 19.7% had associated injuries and 78.1% had spinal surgery; 60% had complete lesion and 59.2% were paraplegic. Road traffic accident was the commonest cause of injuries. Median total SCIM II scores ranged from 24-45 in post-acute and 57-68 in chronic patients. Median total WHOQOL scores ranged from 40-60 in post-acute and 35-45 in chronic patients.

**Conclusion:** In this region, road traffic accident was the commonest cause. Middle aged individuals and men were more commonly injured. More than half became paraplegic with complete lesions. Chronic patients had more functional ability but less quality of life than post-acute patients.

## O71

**Dr. Nitinat Wongtra – Ngan, Dr. Apichana Kovindha, Dr. Siam Tongprasert, Dr. Pratchayapon Premkomol**

**Title:** Measuring quality of life with WHOQOL-BREF in Thai individuals with spinal cord injury

**Objective:** (1) To report quality of life (QOL) of patients with spinal cord injury (SCI) and (2) to assess factors that might relate with QOL.

**Methods:** Demographic data according with the International Spinal Cord Society (ISICOS) basic data set, SCI, and WHOQOL-BREF scores of 120 Thai patients with SCI were extracted from the world-wide ICF core sets for SCI study. The data were analyzed and reported.

**Results:** Of all 120 patients; 72.5% were males, mean age of 43.71 (SD 13.99); 5% had no education; 64.2% had transportation accident; 52.5% were tetraplegics; and 50.8% had complete lesion. According to WHOQOL-BREF, the mean raw scores of the four domains were as follows: physical health 22.09 (SD=4.45), psychological health 20.5 (SD=3.78), social relationships 9.52 (SD=1.75), and environment 26.37 (SD=4.32). When converting the raw scores to transformed scores of 20, all domains had the same

scores of 13. Only mean raw scores of the physical health were significantly different between post-acute and chronic groups (20.9 v 23.25,  $p=0.002$ ) and between tetraplegics and paraplegics ((20.54 v 23.81,  $p=0.000$ ). Severity of lesion was not related to any domains in WHOQOL-BREF.

**Conclusion:** In Thai individuals with spinal cord injury, all domains of quality of life were affected equally. Besides duration from onset, level but not severity of spinal cord lesions was related to the physical health domain.

## O72

**Ms. Noortje Lubbers, Mst. Reshma Parvin Nuri**

### **Title: Sexual health of women with spinal cord injury**

**Purpose:** Identify the factors that have a major influence on sexual health of women with SCI in comparison with able-bodied women in Bangladesh, to improve the rehabilitation strategy for women with SCI.

**Methods:** A questionnaire and a semi-structured interview were used to collect data concerning sexual health of women. Data was collected for women with SCI as well as for women without injury. One hundred women with SCI, who were admitted to the Spinal Cord Unit of CRP from 1999-2009, were included. An age-matched control group was selected with the help of the snow-ball method.

**Results:** In total, 92 questionnaires and 30 interviews were conducted. No significant relations were found between the physical factors and the sexual health in both groups, though vaginal dryness and physical discomfort were mentioned more frequently among women with SCI. Interestingly, environmental and emotional factors as stigma ( $p=0.01$ ), attitude and satisfaction of the husband ( $p=0.03$ ) and support of the husband ( $p=0.02$ ) and friends ( $p=0.01$ ) did not only influence the sexual health of women with SCI, but also of the able-bodied women.

**Conclusions:** Although the sexual health of women with SCI did not significantly differ from the sexual health of able-bodied women, most of the women with SCI were less satisfied. Finally, environmental and emotional factors, rather than physical factors were the most important aspects - for the cases as well as for the controls - influencing their sexual health.

## O73

**Dr. Apichana Kovindha, Dr. H.S. Chhabra, Dr. Nazirah Hasnan**

**Title: Individuals with chronic spinal cord injury (SCI) in south east Asian region (SEAR) : Facilitator vs barrier vs facilitator and barrier of environmental factor based on ICF**

**Study design:** Cross-sectional study

**Objectives:** To compare the environmental factors rated as facilitator or barrier or facilitator and barrier by chronic SCI individuals living in three countries in SEAR.

**Setting:** Chiang Mai University Hospital, Thailand; Indian Spinal Injuries Centre, India; University of Malaya Medical Centre, Malaysia

**Methods:** Data of environmental factors rated by 119 chronic SCI individuals from SEAR were extracted from the world-wide ICF core sets for SCI study. The top five categories that were rated as facilitators, barriers or facilitators and barriers were gathered and ranked.

**Results:** Apart from supports of health professionals and immediate family members, their attitudes were also among the top facilitators; building products for public use were rated as barriers; and for private use were rated as facilitator and barrier by majority of them in all three countries. Indians rated more on products and technology categories whereas Thais rated more on services, systems and policies categories as facilitators. Many Malaysians and Thais rated transportation categories as barriers whereas most of Indians rated human-made events as barriers. In addition, majority of Malaysians weighted products and technology as well as services, systems and policies as facilitator and barrier.

**Conclusions:** Individuals with chronic SCI in different countries in SEAR had different views on environmental factors. This might be due to different cultures, resources and experiences.

## **O74**

**Dr. Nazirah Hassan, Dr. Apichana Kovindha, Dr. H.S. Chhabra**

**Title: Individuals with chronic spinal cord injury (SCI) in south east Asian region (SEAR): analysis bases on the international classification of functioning, disability and health (ICF) basic core data sets for long – term context**

**Objective:** To report the opinions of individuals with chronic SCI in the SEAR on functioning, disability and environmental factors.

**Design:** Cross-sectional study



**Setting:** Chiang Mai University Hospital, Thailand; Indian Spinal Injuries Centre, India; and University of Malaya Medical Centre, Malaysia

**Methods:** Data of 119 individuals with chronic SCI from SEAR were extracted from the world-wide ICF core sets for SCI study. Top ICF categories rated as "impaired", "difficult" and "facilitators" were reported and compared with the world-wide ranks of the ICF basic core sets for SCI - long term context.

**Results:** The top three categories of body functions rated as "impaired" were muscle power (100%), muscle tone (96.6%), urination (94.9%) and defecation functions (94.9%). For categories of body structures; spinal cord (99.2), skin (38.6%) and structures of urinary system (12.6%) were the top three rated as impaired. In activity and participation; categories rated as "difficult" were moving around (93.3%), using transportation (74.8%), and moving around using equipment (59.7%). The environmental factors rated as "facilitator" were health professionals (68.9%), immediate family (65.5%) and personal care provider (50.4%).

**Conclusion:** Chronic SCI individuals in the SEAR rated impairments in muscle tone more than urination and defecation; more on structures of skin than urinary system; and more difficulty in mobility, not self-care. Health professionals and immediate family were the top facilitators.

## O75

**Mrs. Tuenchal Attawong, Dr. Apichana Kovindha, Dr. Siam Tongprasert**

**Title:** The correlation between functional outcomes and quality of life in patients with spinal cord injury in Thailand

**Objectives:** To assess the correlation between functional outcome and quality of life (QOL) of patients with spinal cord injury (SCI)

**Study design:** Cross-sectional study

**Setting:** Rehabilitation ward, Maharaj Hospital, Chiang Mai, Thailand

**Methods:** Data about ISCOS data set, WHOQOL-BREF and Spinal Cord Injury Measure, version II (SCIM-II) of Thai participants were extracted from the world-wide ICF core sets for SCI study and analyzed.

**Results:** The data were obtained in 80 SCI patients, with the median age of 46.13 (range 56.36) years. The total score of SCIM-II had significant correlation with WHOQOL-BREF in 4 domains ( $r = .490, .618, .356$  and  $.602, p < .01$ ). The subtotal score of self-care had

significant correlation and was a significant predictor for physical and environmental domains ( $r = .484$  and  $.294$ ,  $p < 0.01$ ; Beta  $.488$  and  $.340$ ,  $p < .01$ ), whereas the subtotal score of respiratory & sphincter and mobility had significant correlation with 4 domains of WHOQOL-BREF ( $p < .01$ ) and could predict social and psychological domains (Beta  $.293$  and  $.291$ , respectively with  $p < .01$ ).

**Conclusion:** The study shows weak to moderate correlation between functional outcome measured with SCIM II and QOL in SCI patients. Strategies for improving functions could improve their QOL.

## O76

**Mrs. Korny Marina Momen, Mr. Md. Sohrab Hossain, Mr. Muhammad Anwar Hossain**

**Title:** Common complications following spinal cord lesion after returning in the community in Bangladesh

**Purpose:** To find out common complications following SCL including the possible causes responsible to develop the secondary complications and way to minimize of it.

**Methodology:** The study design was descriptive survey. Data was collected by purposive sampling techniques where there were 12 structured and 4 semi-structured questions. The quantitative data was analyzed descriptive statistics and the qualitative data was analyzed by coding.

**Result:** Among the 76 sample, there are 56 participants who had at least a single complication. Among them the most common complications are pressure sore 32.14% (18), low back pain 17.86% (10), Urinary Tract Infection 12.5% (7). The other complications were pain at upper limb 3.57% (2) and lower limb 10.71% (6), burning sensation at lower limb 17.86% (10), burning sensation during micturation 7.14% (4), muscle spasm 8.93% (5), decreased range of motion 12.5% (7) and contracture 3.57% (2).

The most common causes of those complications develop from poor posture, lack of proper knowledge about secondary complications and its risk factors, alteration of assistive devices, less motivation, less attention of care givers, poor engagement in functional activities.

**Conclusion:** The study show that pressure sore is the most common secondary complication following spinal cord lesion in Bangladesh. The emphasis on prevention of pressure sore need to be look after more intensively how could the complication be minimize in the community.

## O77

**Dr. Chandana Karunathilaka, Dr. Narendra Pinto**

### **Title: A cost effective approach to spinal injury management in Sri Lanka**

Management of spinal injury patients is a major health care burden globally. The impact is worse in developing countries with limited resources. The National Hospital of Sri Lanka is the major tertiary care centre in Sri Lanka and delivers its services free of charge.

**Aim:** To identify a cost effective management policy to prevent long hospital stay and to overcome the complications related to it.

**Method:** Prospective cohort study at National Hospital of Sri Lanka. Duration of study from 01/ January / 2010 to 31/ June/2010.

**Results:** Total numbers of patients were 49 males 8 females. With neurological impairment of ASIA (A,B, C or D).

Direct and Indirect cost for conservative management and surgical intervention ( sub laminar wiring, pedicle screw fixation) were assessed. In the study we compared the cost effective impact of sub laminar wiring of thorocolumbar spine or pedicle screw fixation of thorocolumbar spine with conservative management policies.

**Conclusion:** Study shows significant reduction in cost difference in cost with regards to sublaminar wiring. In a developing country with free health care providing facility, sub laminar wiring of thorocolumbar spine is a cost effective approach which helps to reduce the economical impact on both the government and the patient.

## O78

**Ms. Anteena Aziz**

### **Title: Functional recovery for C6 traumatic tetraplegia after completing the rehabilitation phase at centre for the rehabilitation of paralysed (CRP), Bangladesh**

**Aim:** To assess the functional outcomes of the patients with a complete C6 spinal cord injury after completing the Rehabilitation phase at CRP.

**Objectives:** To evaluate the performance of feeding , grooming (face wash, comb/ brush hair, oral care) , bed mobility (side to side, rolling , supine to prone , supine to sitting) , sitting tolerance , manual wheelchair mobility (smooth surface , ramps , rough terrain) achievement through the rehabilitation phase at CRP after being diagnosed with complete C6 spinal cord injury in Bangladesh.

**Methodology:** The study was a non experimental, survey using quantitative methods to explore patients' functional outcome prospect. In Bangladesh, CRP is the only centre for the spinal cord injury patients where patients can stay to achieve Rehabilitative goals. After being admitted to CRP, the patients complete a bed rest for six weeks and then take part in the active Rehabilitation process; after completing the process, they need to stay at the hostel before leaving CRP. So, all the C6 SCI patients who have completed institutional rehabilitation at the CRP stayed at the hostel before leaving CRP who have gone back home have been taken as the samples for the study. The sampling was purposive. 29 complete C6 Tetraplegic patients were interviewed at their home during their home visit. Data was collected using functional measurement scale which was ordinal type. And for the measurement of functional ability, the score was used by the FIM (Functional Independent Measure). For the analysis of data descriptive statistic was used.

**Result:** Average functional was 4.86 and it was between the score 5 and 4 where score "4" (=57.14%) indicate minimal contact assistance or (require no more than touching and expense of 5% or more of the effort required in the activity and score "5" (=71.24%) indicate supervision or set up (no physical assistance is needed but need supervision). If highest score is "7" mean 100% then score "4.86" will mean 69.43% of activity.

**Conclusion:** In Bangladesh the number of SCI patient is increasing day by day. Among them C6 level is very common because Bangladeshi people carry loads on their heads and they also climb trees very often, and in this country safety measures are very poor during work. Most of them play a vital role to their family. After injury off course they lose some extent of functional ability but it is very important to find out how function will return to the C6 neurological SCI patients. There were 29 subjects in the study and interviews were taken after returning home and FIM chart was used to collect the information from the patients. And the findings is average functional was 69.43% of activity. This result was an overall interpretation about the functional ability of C6 neurological patients after completing the Rehabilitation phase at CRP.

## 079

**Dr. Wasuwat Kitisomprayoonkul, Miss Pimol Jongpisansatit**

**Title: Wii rehab in paraplegia with impaired sitting balance**

**Purpose:** To determine effects of Wii rehab in paraplegic patients with impaired sitting balance.

**Methods:** Six complete paraplegic patients with onset less than 1 year and impaired sitting balance were participated. They were randomized into 2 groups; 30 minute

conventional sitting balance training (control group) and 30 minute conventional sitting balance plus 30 minute Wii training (Wii group). All were participated 5 days a week for 2 weeks. Assessor blinded assessment was performed before and after 2 week training.

**Results:** Mean age and onset of control and Wii group were 52.0(25.2) and 27.3(14.9) years, 6.3(4.5) and 7.5(0.9) months, respectively. Median changes of Barthel ADL Index; BAI (point), functional reach test; FRT (inches) and functional related sitting tasks; FST (numbers of achieved task) of the control group were 1, 2.5, 1(foam cushion) and 1(gel cushion). Median changes of BAI, FRT and FST of the Wii group were 3, 5.3, 0(foam cushion) and 1(gel cushion). Mean patient satisfaction (VAS) of control and Wii group were 65.7(21.1) and 85.7(13.6) mm, respectively.

**Conclusions:** Two week Wii rehab does not added on effect regarding functional sitting tasks in 6 complete paraplegic patients with impaired sitting balance. BAI and FRT improvement and patients satisfaction of the Wii group were more than the control group. Further study is needed to determine effects of Wii rehab in sitting balance training.

## O80

**Dr. Abu Toha Md, Abdur Razzak, Dr. Sayeed Uddin Helal, Mr. Abdul Zabbar**

**Title: Pedicle screw fixation and conservatively treated unstable thoracolumbar fractures : A short report of prospective cohort study**

**Purpose of the study:** To compare the outcome in operative and conservatively treated patient with spinal injury in terms of correction deformity, hospital stay, complication, satisfaction of life and neurological status in a cohort.

**Methods:** A prospective cohort study was conducted during January to December 2009 among 86 patients with unstable thoracolumbar fractures (kyphotic deformity  $> 25^\circ$ , vertebral body height loss  $> 50\%$  and canal compromise  $> 40\%$  are unstable fractures). With same criteria some treated by short segment pedicle screw fixation and some treated conservatively.

**Results:** Among 86 patients 61 were operated and 25 were conservatively treated, 88.4% were male and 11.6% female. Mean age was 28.85 years. Thoracolumbar junction (D11- L2) found the most common injured (73%) vertebrae. Overall 31.6% patients improved neurologically of which 32.78% in operative group and 28% in conservative group. Preoperative average kyphosis  $28.33^\circ$ , average kyphosis correction found  $22.33^\circ$  in operative group. Average hospital stay was 86.25 and 106 days, 30% and 12% patient found satisfied in operative and conservative group respectively.

Conclusion: Although long term follow-up evaluation needs to be verified, the short term follow-up results suggest a favorable outcome for short-segment instrumentation in unstable thoracolumbar fractures.

## O81

Dr. Shiv L Yadav

**Title: Secondary impairment after spinal cord injury : is it neglect ?**

**Objective:** To determine the prevalence of secondary impairments among individuals with spinal cord injury and to establish the relationship between these impairments and several variables.

**Design:** In this study 140 individuals with spinal cord injury included who were either admitted or reported as on out-patient basis for subsequent follow-up. All were examined clinically including type and level of lesion and the presence of secondary impairments. The various aspects of sociodemographic, medical, psychosocial, and environmental information were also reviewed and analyzed.

**Results:** Urinary tract infection, pressure ulcer, contracture, stiffness, spasticity, depression, and issues related to sexuality were the most frequently reported secondary impairments. Relationships between the prevalence of secondary impairments and the duration of injury, as well as perceived health status, and educational & socioeconomic status were correlated to establish their interlinkages.

**Conclusions:** In this study, we find that Patients with spinal cord injury still present a fairly high prevalence of secondary impairments many years after their rehabilitation, despite patient education program and medical follow-up visits. Further studies are required to determine the specific impact that these impairments have on Care giver, the patient's social role and their quality-of-life.

## O82

Dr. Slam Tongprasert, Dr. Apichana Kovindha, Dr. Nitinat Wongtra-Ngan

**Title: Relation between Q1 and Q26 in WHOQOL – BREF and function domains : A study in patients with spinal cord injury (SCI)**

**Objectives:** to study correlations between simple self-rating questions on satisfaction with health (Q1) and global quality of life (Q26) and WHOQOL-BREF domains; and relations between Q1-Q26 and functional domains in spinal cord injury measurement version II (SCIM II) in patients with SCI.

**Methods:** Data of WHOQOL-BREF and SCIM II of 80 Thai patients with SCI (40 post-acute and 40 chronic; 55 AIS A-C and 25 AIS D) were extracted from the world-wide ICF core set for SCI study. Spearman's correlation were used to find correlations between Q1-Q26 and 4 domains in WHOQOL and general linear model were applied to find relations between Q1-Q26 and the 3 functional domains in SCIM.

**Results:** The mean Q1 and Q26 scores were 2.95 (SD 0.99) and 3.20 (SD 0.64), respectively and were significantly correlated with all 4 WHOQOL-BREF domains. There were no significant relations between the Q1 scores and all 3 SCIM domains scores but the Q26 scores were significantly related with the respiratory and sphincter control ( $p=0.014$ ) and the mobility domains ( $p=0.000$ ).

**Conclusion:** A simple self-rating question on global quality of life (Q26) in WHOQOL-BREF had relations with mobility and respiratory and sphincter functions of spinal cord injured patients. We may apply and rely on this simply global quality of life rating in those who have difficulty self-assessing the WHOQOL-BREF questionnaire.

## O83

**Ms. Sununta Boonsarawang, Ms. Wilasinee Duangartit, Mr. Teerapong Kittisak**

### **Will balance game for sitting balance training A pilot study in patients with spinal cord lesion**

**Design:** Pre- and post-test

**Objective:** To study whether playing the Wii Balance Games could improve shifting body's centre of gravity, reaching and maintaining sitting balance.

**Methods:** Patients with spinal cord lesion who had poor sitting balance were recruited. They were informed to play 6 Wii Balance Games while sitting and shifting on the Wii Balance board for 20 minutes each session, 2 times per day for 5 days. Primary outcome was modified functional reach test (MFRT) and secondary outcomes were modified peg board test (MPBT), upper body sway test (UBST) and penguin slide score (PSS) which is one of the Wii Balance Games. Each test was performed three times; and the best times and scores of each test were compared between before and after the trial.

**Results:** Three patients (1 paraplegic T9C, 1 paraplegic T3C and 1 tetraplegic C8B) were recruited into the trial. The paraplegic T9C had improvements in MFRT (gain 14 mm), PSS (gain 8 points) and anteroposterior sway (7 mm less). The paraplegic T3C had improvements in MPBT (1.3 seconds less), lateral sway (6 mm less) and PSS (gain 31

points). The last one, tetraplegic C8B only gained 37 points in PSS. All gained the penguin slide scores.

**Conclusion:** The Wii Balance Games seemed to improve in shifting, reaching and maintaining sitting position especially in low paraplegic patients.

## **O84**

**Ms. Shruti Sharma, Dr. Manisha Arora, Dr. Narkeesh Arumugam, Dr. Kanimozhi**

**Title: Comparative study on different type of Indian wheelchairs activity and its effect on various parameters in normal subjects**

We have advanced in the rehabilitation of sci patients. The wheelchair comprises an essential part of rehabilitation not only of sci patients but also in other neurological and musculoskeletal problems. Unfortunately, it is often neglected. It is required that the patient as well as the doctor should be able to understand the specific needs and be able to decide the kind of wheelchair suited best. This study will create an effectiveness of wheelchairs according to high sale and low cost availability in Indian market with respect to its effect on different human system parameters like heart rate, blood pressure, temperature, respiratory rate.

The study involves three types of wheelchairs commonly used by the patients in India- Non-folding standard, Light weight folding, Commode wheelchair with inclined seat. 30 subjects were taken. Subjects were made to drive wheel chair for a distance of 40 meters. Pulse, respiratory rate, temperature, blood pressure, VAS, rate of perceived exertion was measured before and after driving and results was estimated.

There are significant changes in parameters like heart rate, blood pressure, respiratory rate, temperature, pain rating and rate of perceived exertion while driving a wheelchair. Also there is significant relation between different parameters of wheelchairs. The study indicated that light weight folding wheelchair should be recommended to the patients with neurological or musculo-skeletal injuries.

Key words: wheelchair, physiological cost index, cardio-respiratory fitness

## **O85**

**Ms. Warangkana Sittkhikan, Dr. Apichana Kovindha**

**Title: ISCoS neurogenic bowel basic data set and neurogenic bowel score: A practice with patients with SCI in Thailand**



**Objectives:** To report outcomes of bowel management in patients with SCI and to compare between post-acute and chronic patients.

**Methods:** During admission, 20 post-acute and 20 chronic patients were interviewed according to the ISCOS bowel basic data set. Severity of bowel dysfunction was assessed according to Krogh's neurogenic bowel dysfunction (NBoD) score.

**Results:** Of all, 82.5% were males [median age 44 years (range 19-70) and time from onset 7.5 months (range: 1-252)]. Only 47.5% defecated twice/week; 77.5% applied enema (less than 150 ml) as a main assistive defecation method; 97.5% spent 0-30 minutes for defecation; 87.5% reported no uneasiness; 45% took laxative tablets; 60% applied digital evacuation more than one time/week; and 25% had anal lesions. Regarding incontinence, 52.5% reported fecal incontinence less than one time/month and 37.5% 1-4 times/month; 80% reported flatus incontinence. Only 2.5% used dapers; and 7.5% had perianal skin lesions. According to the NBoD score, 15% were classified as very minor dysfunction, 30% minor, 32.5% as moderate, 22.5 as severe; and the post-acute patients had higher mean score than the chronic patients had (11.95 v 9.65,  $p=0.095$ ).

**Conclusion:** Majority of Thai SCI patients had moderate neurogenic bowel dysfunction and no significant difference between post-acute and chronic patients. Most of them applied enema as a main assistive method and reported less defecation time needed and few related defecation problems.

## O86

**Dr. Raju Dhakal**

**Title: Incidence of spinal cord injury (SCI) per annum and its major causes**

**Objectives:** To find out the number of SCI incidence in Nepal within a year. To identify the number of people enrolled for comprehensive rehabilitation at SIRC in a year. To find out the major causes of spinal cord injury in our context.

**Methods:** Data collected from August 2009-August 2010 from hospital where patients are referred and managed in Acute phase of spinal cord injury. Data collected at Spinal Injury Rehabilitation Centre.

## O87

**Dr. Damodhar Thapa**

**Title: Evaluation of SCI patient after rehabilitation**

**Objectives:** To assess the outcome in a population of discharged patients with spinal cord injury who are discharged after rehabilitation. The assessed outcomes are mortality, state of health (Physical, mental, social, and psychosocial), occupation, mobility, autonomy, social and partner relationships, quality of life (QoL).

**Methods:** An analytical study was done for 30-40 patients who have been discharged and reintegrated, they come from different background and live in different parts of Nepal the methods used was home visit, follow up forms and telecommunication.

**Results:** During the time between discharge and follow-up, 33% patients had died, due to complication like pressure sore and UTI. .30% has been re-hospitalized in different hospital due to different complication such as pressure sore, renal stone, pneumonia, UTI. The descriptive analysis also shows that 47% of the patients are well settled. At present they are working and earning their daily living and living good life with their family and relatives.

**Conclusion:** Due to lack of proper health facilities and education at rural areas many of the patients are facing the late complication. Some of them are well reintegrated in the society .But the mortality rate and complication are still prevalent in Nepal .Regular follow up and education to the patient as well as care taker should be given in standard level. Organizations treating patient's with SCI should take measure from organizational level to minimize these incidence .Government health post and centers should be up to date about the situation and be capable of treating such situations.

**ABSTRACTS OF  
SCS  
ORAL PRESENTATION**



## O88

Dr. Amrithlal Mascarenhas, Dr. Harvinder Chhabra

**Title: Subsidence of mesh cage in thoracolumbar vertebral body reconstruction : What are the implications?**

**Aim:** Study the implications of mesh cage subsidence with respect to fusion, kyphosis, pain and clinical outcome in cases where thoracolumbar reconstruction was done for management of burst fractures.

**Materials and Methods:** Twenty-five cases of thoracolumbar burst fractures were given anterior strut support along with anterior Screw-rod systems or posterior pedicle screw fixation. Mean follow-up was 6 months till two years. Preoperative Cobb-angle and VAS score was compared postoperatively and at follow-up of 3,6,12 and 24 months. Cage position, fusion-rates (Using the Tan criteria and Bridwell criteria) and SCIM was noted at follow-up. Cases were divided into group A and B based on presence or absence of cage subsidence respectively. Statistical tests of significance were done.

**Results:** Cage subsidence was noted in 10 (40%) cases. Pseudarthrosis noted in 3 of these cases. Average loss of correction was 16.70 in group A and 7.60 in group B the difference being significant. Improvement in SCIM was 12 and 8.3 in group A and B (Statistically Insignificant difference). VAS score was 0.7 And 0.73 in group A and B and 0.66 in Pseudarthrosis patients at final follow-up (statistically insignificant difference).

**Conclusion:** Cage subsidence has no bearing on the outcome of the surgery even though there is a greater loss of correction. The increased kyphosis has not affected the patient outcome.

## O89

Dr. J. Naresh Babu, Dr. Venkata Swamy Chavala, Dr. Suresh Cheekata

**Title: Is paediatric spine is more accommodative for spinal cord shortening ? An evaluation of results of cord – level osteotomy in severe thoracic Kyphosis**

**Introduction:** Spinal osteotomies are increasingly used for posterior-only kyphosis corrections. Rigidity of adult thoracic spine limits flexibility resulting in neurological deficit. For the first time authors analysed the flexibility of paediatric spine by evaluating the distribution of correction after cord-level osteotomy. **Methods:** 20 patients with severe thoracic kyphosis (post-TB=12, congenital=8) with normal pre-operative neurology undergoing osteotomy above L1 were included. Average age=12.3 years (range 7 to 14). Relative sagittal angle correction at the osteotomy and in

adjacent segments, C7 plumb-line shift, amount of osteotomy-wedge and amount of laminectomy were measured using Surgimap-Spine software utilising pre & post-operative standing AP & lateral radiographs. Results: There was no incidence of post-operative neurological deficit immediately or at 2-years follow-up. Mean pre-op kyphosis angle was 107.30(range93-133). Mean percentage correction of kyphosis angle was 45.7% (SD=6.6). Mean degree of relative sagittal plane correction contributed by osteotomy wedge was 49.3degrees (range42-55) where as adjacent segment contributed a total of 45degrees (Apex+1=4.5, Apex+2=2.3, Apex+3=1.3, Apex+4=1 and Apex-1=5.5, Apex-2=7.8, Apex-3=8.5, Apex-4=7.5, Apex-5=6.8degrees). Mean relative shift in C7-plumb-line=17.1mm (pre-op 26.2to9.1). Mean total laminectomy performed was 3.9 laminae (range3-4.5). Conclusions: The results document the safety of cord level osteotomy for severe thoracic kyphosis in children when performed with wide laminectomy in neurologically intact patients. Vertebral segments above and below osteotomy contribute an additional and equal amount of sagittal correction to that achieved by osteotomy there by making paediatric spine more accommodative for spinal cord shortening.

## O90

Dr. Ankur Nanda

**Title:** Pelvic obliquity in Neuromuscular scoliosis radiologic comparative results of single – stage posterior versus two stage anterior and posterior approach

**Study Design.** Retrospective comparative study (Level III).

**Objective.** To compare the operative results of posterior fusion and a 2-stage anterior L5–S1 fusion followed by posterior fusion in neuromuscular scoliosis patients with significant pelvic obliquity (PO).

**Summary of Background Data.** PO in neuromuscular scoliosis is common and a challenging problem that affects proper sitting balance, necessarily addressing the deformity and proper maintenance of the correction.

**Methods.** A total of 54 patients with neuromuscular scoliosis and significant PO ( $\geq 10^\circ$ ) were divided into 2 groups. Group 1 (n = 24) was operated on for posterior fusion and pelvic fixation. Group 2 (n = 30) included patients who were subjected to a first-stage procedure consisting of a lumbosacral junction release and fusion through a midline retroperitoneal approach and then a second-stage procedure of posterior fusion and pelvic fixation. Parameters measured included length of the follow-up, number of fusion levels, age at operation, forced vital capacity, operative time, estimated blood loss, and postoperative complications. Radiologic parameters measured before

surgery, after surgery at the time of discharge, and at a final follow-up included Cobb angle.

T1 translation, sitting pelvic obliquity (PO) in the frontal plane, C7 plumb line, thoracic kyphosis, lumbar lordosis, and sacral inclination angle in the sagittal plane.

**Results.** The correction of scoliosis was similar in both groups. The preoperative PO averaged 19.5° in Group I and 22.9° in Group II (P = 0.22), which corrected after surgery to 9.7° versus 7.4° (P = 0.23), respectively. Group II correction progressively improved significantly compared to Group I (7.0° vs. 11.6° at P = 0.046) at the latest follow-up. A 40.6% correction (mean correction = 7.9°) in sitting PO in Group I compared to 70.7% correction (mean correction = 5.9°) in Group II was observed (P = 0.004). The average loss of correction of PO at the final follow-up was lesser in group II, but not statistically significant (P = 0.07).

**Conclusion.** Anterior fusion of the lumbosacral junction followed by posterior fusion provides superior correction and maintenance of PO in patients with neuromuscular scoliosis.

## O91

**Dr. Viyek Mittal, Dr. Harvinder Chhabra, Dr. Vikas Tandon**

**Title: Mini – open thoracoscopy assisted anterior approach for corpectomy in the thoracic spine**

**STUDY DESIGN** Prospective study of 15 consecutive patients of unstable traumatic thoracic spine injury managed with the mini-open thoracoscopy assisted (MOTA ) technique

**SUMMARY OF BACKGROUND DATA** Open anterior approaches to thoracic spine have a significant morbidity , so thoracoscopic approaches have been introduced but require long steep learning curve. Alternatively MOTA has been introduced **METHODS** 15 patients underwent one level thoracic corpectomy and reconstruction using the MOTA technique, after prior posterior pedicle screw fixation . Perioperative data upto discharge was collected

**RESULTS** Mean age was 33.2 years. The mean canal encroachment was 53.3%. Mean duration of surgery was 4.6 hours. Average blood loss was 406ml. The mean preoperative and postoperative cobb's angle was 35 and 16. 8 degrees , The mean duration of postoperative iv analgesics was 2 days.

The mean chest drain output was 475ml and mean day of drain removal was 4. Mean ICU stay duration was 1.4 and mobilization day had a mean of 2.4.

All patients were AIS-A on admission and remained same. 2 patients had intercostal neuralgia and one had CSF leak that resolved

**CONCLUSIONS:** The MOTA approach is safe, reliable, excellent alternative to thoracoscopic procedures

## O92

**Dr. Manish Chaddha, Dr. Gaurav Sharma, Dr. Shobha Arora**

**Title:** Association of facet tropism with lumbar disc herniation

**Study design.** Cross-sectional hospital-based cohort

**Background.** Facet tropism is defined as asymmetry between left and right facet joint angles and is postulated as a possible etiological cause in occurrence of disc herniation.

**Methods.** 60 patients(18-40 years) with single disc herniation(L3-L4, L4-L5, or L5-S1). Exclusion criteria included multiple/recurrent disc herniation, spondylolisthesis, transitional vertebra, scoliosis, previous surgery/trauma/infection and significant facet arthropathy. Facet angles were measured using MRI of atleast 1.5 tesla using the method of Karacan by two surgeons. Facet tropism was defined as difference of more than 5 degrees (1st criteria) and 10 degrees (2nd criteria) in facet joint angles between right and left sides. Normal disc adjacent to the herniated level was used as control. We also examined if disc herniated towards the side of more coronally oriented facet.

**Results.** Incidence of facet tropism by criteria 1 in herniated group was 38/60(63.3% and in control group was 24/60(40%),

Incidence of facet tropism by criteria 2 in herniated group was 18/60(30%) and in control group by criteria 2 was 4/60(6.67%). Disc herniation occurred more commonly on the side of the more sagittally oriented facet.

**Conclusion.** There was no statistical difference between the Facet tropism at the herniated and control levels.



## O93

Dr. Chandana Karunathilaka, Dr. Primal Peris, Dr. M. Narendra Pinto

**Title: Application of ASIA grading and preventable factors in Sri Lankan spinal injuries**

### APPLICATION OF ASIA IMPAIRMENT SCALE IN SRI LANKAN SPINAL INJURY PATIENTS

Spinal injury counts for 5% of total number of admissions to the accident "services The national Hospital of Sri Lanka in 2009.

The aim of this retrospective study is to identify applicability of ASIA impairment scale in our patients in the view of constructing a management protocol which includes rehabilitation. The aetiology varies, fallen from a height counts for 74%, 35% from battle casualties, 27.7% due to road traffic accidents.

The neurological assessment needs standardization in all health care institutions in the Sri Lanka. Application of ASIA scoring & impairment scale reviews as follows.

ASIA- A " 36.36%, B " 13.63%, C " 04%, D- 23%, E- 23% It implies the applicability of ASIA scoring in our spinal injury patients and the requirement of a proper management plan with rehabilitation protocol.

## O94

Dr. Shallu sharma

**Title: Feed back training and its effect on inter and intra rater reliability of graded mobilization**

**BACKGROUND:** Maitland's posteroanterior mobilization have been widely used for assessment and treatment of various musculoskeletal disorders of spinal origin, yet the reliability of these techniques is questionable. Positive impact of feedback training on motor skill acquisition has been suggested in the literature.

**METHODS:** two equally qualified professionals performed the procedure on lumbar 4th(L4) vertebra for 200 subjects. At two different point of times within two days using pressure algometer. ICC was computed for 95% CI.

**RESULTS AND DISCUSSION:** ICC for inter rater reliability without feedback training was 0.54 at  $p < 0.01$  with post training values of 0.79. Intrarater reliability on three consecutive days was 0.94.

**CONCLUSION:** pressure algometer is a useful device in providing feedback training and facilitating the motor skills for reliability of grade3 mobilisation procedure.

**O95**

**Dr. Firas Sarhan**

**Title: Use of mobile phones technology to assess pressure ulcer in person with spinal cord injury post discharge from rehabilitation hospitals**

### **Introduction**

Pressure ulcers are frequent and costly complications of spinal cord injury (SCI). People with SCI who have completed their initial rehabilitation remain at life-long risk of developing pressure ulcers. Considerable time is spent in educating them about the self care necessary to prevent this complication [1]. The annual incidence is 23-30% and the lifetime risk is over 70%. [2]

Telemedicine is slowly growing field in assessment and management of pressure ulcers in SCI patients. Mobile telemedicine is a recent development, which includes applications in which patients can participate using mobile devices such as mobile phones.

### **Methods**

Five staff nurses separately evaluated 50 pressure ulcers for variables within the TIME concept for pressure ulcers assessment (Tissue condition, presence of infection, presence of moisture and the condition of edges).

One staff nurse performed face to face consultation (gold standard), and three others performed evaluation via mobile phones. The image was obtained with the mobile telephone and immediately reviewed by the 2 nurse on the mobile screen to measure the agreement of the evaluation among the 5 nurses and evaluate the feasibility of telemedical wound care using mobile telephones with integrated cameras.

### **Results**

The agreement between the face to face and remote evaluations was good, the image quality was judged to be good in 35 cases and very good in 14. The nurses participated in the study felt comfortable making a diagnosis based on the pictures in 50 cases. The average agreement regarding the wound descriptors was: necrosis 80%, granulation tissue 79%, ischaemia 81%, cellulitis / infection 72%, erythema 74%.

### **Discussion**

The findings of this study were able to show that telemedicine for managing pressure

ulcer is feasible under routine conditions using mobile phones. The findings agree with recent research regarding the pressure ulcer stage and wound bed condition using TIME concept in patients with SCI. We also observed that the complexity of the pressure ulcer stage and location appeared to influence the agreement rate amongst nursing staff making the pressure ulcer assessments. That is, there was a lower agreement rate among staff involved as the pressure ulcers became deeper and more complex.

The present study suggests that a high percentage of assessments for patients currently travelling to specialist clinics for advice on managing pressure ulcers could be performed in the community using mobile phones and telemedicine concept.

#### **Clinical relevance**

This study was able to demonstrate the feasibility of such a telemedical pressure ulcers consultation to offer early advice re management of pressure ulcers and prevent acute and chronic pressure ulcers complications.

#### **O96**

**Dr. Chen Zu Rong, Dr. Chen Xi, Dr. Wang DaJue**

**Title: Application of skin traction for the treatment of Grade IV pressure sore: a clinical report of 160 cases –**

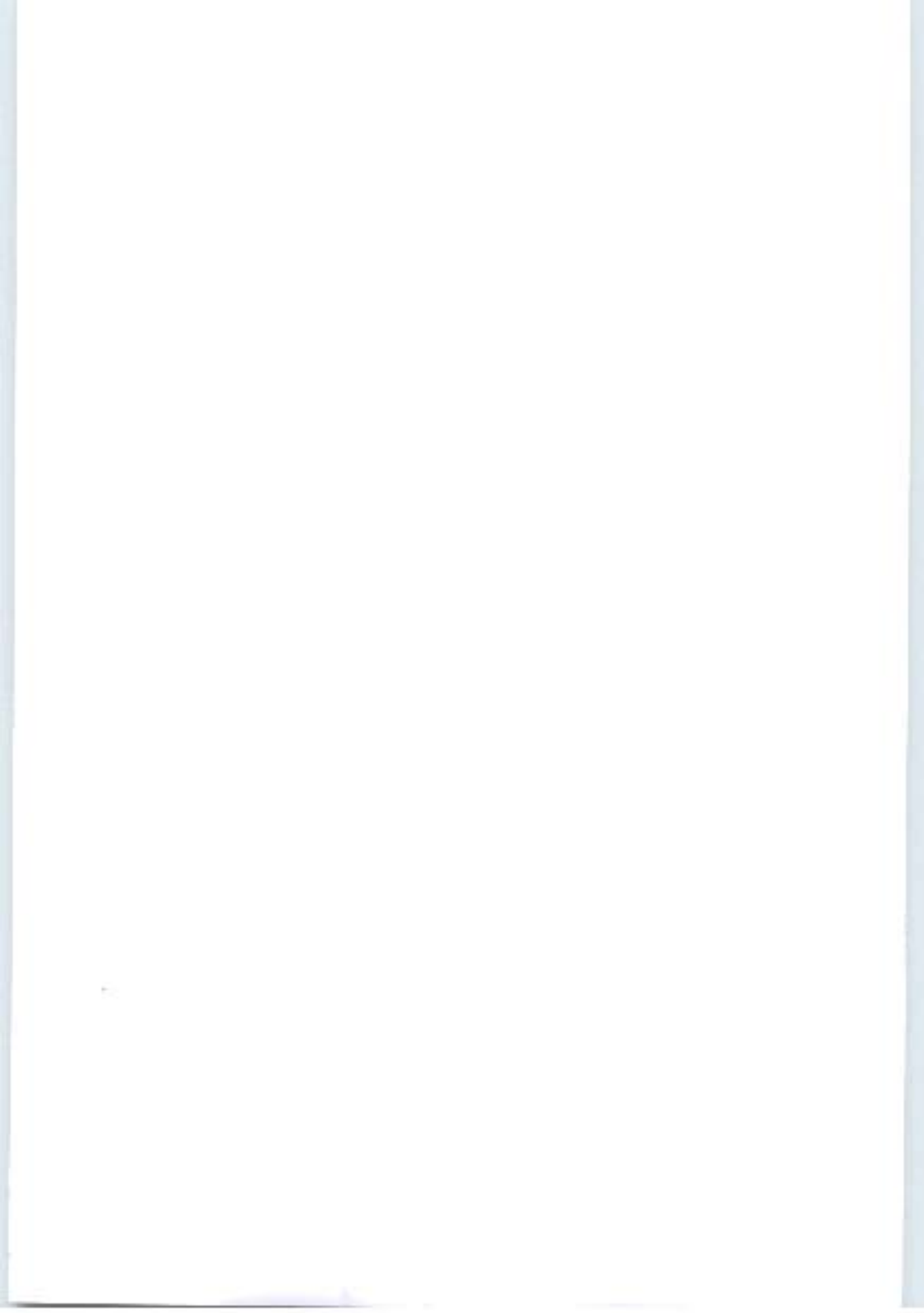
**Objective:** To report the results of skin traction in surgical closure of grade-IV pressure sore.

**Patients and method:** Between 2005 and 2009, a total of 160 patients with 235 grade-IV pressure sore(s) were admitted and treated surgically. Skin edges were brought closer together gradually by applying multiple parallel plasters to the surface of the skin. Meticulous wound preparation and debridement, accompanied by pre-operative and post-operative skin traction were adopted to achieve primary closure of sores with a diameter up to 10 cm.

**Results:** 225 sores (95.7%) healed primarily and only 10 patients with a large pressure sore each needed a second operation. They were evacuation of haematoma and re-suturing during stay in hospital. Patients were followed up for an average of 22 months (2 - 51 months). No patient needed flap surgery.

**Conclusion:** Grade IV pressure sore at the sacrococcygeal or greater trochanteric region up to 10 cm can be cured through primary closure assisted with parallel skin traction. This simple method has the advantage of minor trauma, high success and low recurrence rate. It is recommendable for wide clinical application.

**ABSTRACTS OF  
POSTER  
PRESENTATION**



## Poster Presentation

---

### P1

**Prof. Giulia Bassi, Dr. Sandra China, Dr. Mauro Menarini, Dr. Roberta Vannini**  
INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH (ICF)  
AND SCHOOL REINTEGRATION OF PATIENTS WITH SPINAL CORD INJURY (SCI)

**Objectives:** Evaluation of the ICF as an appropriate instrument to identify activities in the program of school reintegration in SCI patients.

**Subjects:** 20 patients, aged between 14 and 19 years, with quadriplegia C4-C6 (ASIA A and B) at first admission after the injury.

**Setting:** School Department in Spinal Cord Unit Montecatone.

**Methods:** In the rehabilitation treatment, patients are observed in their school insertion in two moments: at the beginning and after two months. Data were interpreted using a set of codes selected from ICF. The qualifiers performance, capacity and performance without assistance have been used to encode component 'activity and participation'.

**Results:** The use of the performance qualifier 'without assistance' has permitted to understand more clearly how much the 'performance increase' is linked to the provided aids and how much to the assistance (e.g. d420 87%, d465 20%).

The results of the study confirmed an improvement of performance and capacity.

**Conclusion:** The outlined study showed that 'performance without assistance' has proved essential to define more precisely for which activities and to what extent assistance is required. This information is fundamental when patients at discharge are going to return in their school as students.

### P2

**Dr. Zuhai Bayirli Karakoyun, Dr. Belgin Erhan, Dr. Berrin Gunduz**  
OSTEOPOROSIS IN SPINAL CORD INJURED PATIENTS

**Methods:** Between January 2009-June 2009, 78 patients who had osteoporosis in DEXA were included. Demographic features and risk factors were questioned. Neurological examination was assessed. Relationship between these findings with osteoporosis has been viewed.

**Results:** Twentysix patients were women. Mean age 41.9(20-75) years. Sixty patients were paraplegia, fifty patients were incomplete. As the age increases all BMD(bone mineral density)values were decrease. The effect of gender and educational level were not found. There was a negative correlation between time since injury and BMD. The arm BMDs were lower in tetraplegics. BMD values of complete patients were lower. Smokers(n: 26) had lower BMD in all regions. Sunlight exposure(n: 60) and consumption of dietary calcium(n:56) revealed positive effects. Forty patients could stand/walk.

Ambulation status and the presence of spasticity had no effect but spasticity severity had positive effect on BMD,

**Conclusion:** Age, time since injury, smoking, spasticity severity and completeness adversely affect BMD in SCI patients. Sunlight exposure and dietary calcium intake may have a positive effect but gender, educational status, and ambulation status have no effect on BMD.

### P3

**Mr. Shinsuke Katoh, Mr. Kosaku Higashino, Mr. Hirohumi Kosaka, Mr. Toshinori Sakai, Mr. Natsuo Yasui**

Anterior decompression of the thoracic spinal cord via postero-lateral approach. a report of 4 cases

Anterior compression to the thoracic spinal cord sometimes cannot be treated surgically by laminectomy alone because of thoracic kyphosis. Anterior approach usually needs thoracotomy. We have employed anterior decompression of the thoracic spinal cord via posterolateral approach for the patients with disc herniation or spur. We retrospectively reviewed the four cases treated by this method.

**Patients and methods:** Three men and a woman aged 20 to 58 were included. Two had herniated disc, and the other two had spur. All had myelopathy and one also showed radiculopathy. At surgery, conventional posterior approach was employed, pedicle screws were inserted and the affected segment was fixed to reduce the thoracic kyphosis. Partial facetectomy was made at the disc level to allow 45 degrees of angle for the instruments. The dura mater was retracted gently, and discectomy or removal of the spur was achieved using a high speed bur and the rongeurs. Decompression was confirmed by ultrasound.

**Results:** No neurological deterioration was noted, and all showed recovered neurologically. There was no complication and MRI taken after surgery showed that

decompression was achieved in all cases.

**Conclusion:** This method can be a good alternative approach in cases with para-centric thoracic spinal cord compression.

#### P4

**Dr. Peter Banczerowski, Dr. János Vajda, Dr. Róbert Vares**

#### NEW MINIMAL INVASIVE TECHNIQUES IN THE TREATMENT OF INTRAMEDULLARY PATHOLOGIC

LESIONS TO PREVENT DESTRUCTION OF THE DORSAL STRUCTURES OF THE SPINAL COLUMN AND SPINAL CORD INJURIES.

#### Abstract

**Objective:** Multilevel laminectomy for exposing the spinal canal to remove spinal cord lesions has been widely used in spine surgery. Destruction of the dorsal structures of the spinal column, detachment of the longitudinal musculature, resection of the vertebral arches, and injury of the joint capsules and ligaments are responsible most of the short and late-time complications. Spinal deformities, instability, subluxation, invasion of haematoma and scar tissue into the spinal canal - often associate with spinal cord injuries -, are the most often mentioned complications in the literature. The authors main objective was to develop a novel minimal invasive techniques suitable for exploring and treating different intramedullary pathologies with the aim of preservation of the stability of the spine.

**Methods:** 38 patients were treated with intramedullary lesions of the spine use the newly developed multilevel spinous process splitting and distracting laminotomy technique. The dorsal, paraspinal musculature was not detached from the laminae. With splitting and distracting the spinous processes and the vertebral arches, the vertebral joints, the joint capsules and the ligaments were not injured, these structures remained mostly intact. To achieve a moderate enlargement and decompression of the spinal canal, complementary intervertebral spacer insertion was performed in selected cases. The patients were followed with regular MRI, CT scans and neurological examinations.

**Results:** Adequate surgery of the lesions located intramedullary was achieved in all patients using our new procedures. Moderate enlargement and permanent decompression of the spinal canal was achieved with the insertion of homologous tricortical iliac crest bone graft or heterologous PEEK spacer (Fig 1.). The numbers of splitted laminae were 3 to 6. The splitted spinous processes were closed directly to



each other in 24 patients. In 9 cases a tricortical bone graft and in 5 cases a heterologous PEEK spacer was inserted between the facing bony parts. The incidence of postoperative local pain was lower, within acceptable limits (VAS: 2 to 5), and early mobilization was allowed. The average length of hospital stay was shorter too. The postoperative follow-up CT scans demonstrated bony healing, through the inserted graft or cage between the osteotomized faces. No compression or dislocation of the spacer was seen. Instability was not detected in any of the patients by flexion or extension lateral radiographs.

**Conclusion:** The split laminotomy surgical technique with or without complementary auto- or heterologous grafting method fulfills the requirements of other laminotomy techniques. This technique is suitable for removing intramedullary tumors, and the posterior stabilizing structures of the spine, as the vertebral laminae and the longitudinal musculature are completely preserved, nearly anatomical situation can be maintained. Leaving the longitudinal paraspinal musculature innervations intact, and with the preservation of the bone-muscle attachments and ligaments, the dynamic stability of the spine remaining unchanged. Retaining the bony structures and the vertebral joints the static stability of the spinal column remain intact, the chance of developing the long-term spinal deformation is minimal. The grafts, inserted between the osteotomized faces, provided permanent decompression of the spinal canal, and bony healing - throughout the graft or spacer - of the splitted vertebral laminae. With the use of the PEEK spacer the short and long time complications of the autologous bone graft harvesting procedure can be avoided.

This newly developed surgical procedure and its modifications can be used at any age of the patients, any level of the spine, theoretically on unlimited number of spinous processes.

Key words: laminotomy, splitting laminotomy, intramedullary tumor, intervertebral spacer

## P5

### **Dr. Sridhar Atresh \***

The use of Pentrox inhaler (Methoxyflurane) for shoulder manipulation in a paraplegic patient with bilateral frozen shoulders

#### **AIM**

Frozen shoulder is often a problem in paraplegics and interferes with transfers and manual wheelchair use. Manipulation of the shoulder joint under general anaesthesia is an accepted form of treatment for frozen shoulder. We were keen to explore the use of Pentrox inhaler (Methoxyflurane) for shoulder manipulation in an inpatient spinal rehabilitation setting to see if it could enhance shoulder function and improve range of

movement.

### STUDY DESIGN

This was a single case study with shoulder joint range of motion measurements recorded before and after repeated manipulations of both shoulders in an individual with bilateral frozen shoulders. The client underwent 5 manipulations under Pentrox inhaler (Methoxyflurane) jointly by the Rehabilitation physician and physiotherapist. Each manipulation lasted about half an hour. This was combined with a regular exercise protocol, which the client performed under guidance of the physiotherapist. Serial clinical photographs of the shoulders were also taken at the time of manipulation and shown to the client for discussion.

### RESULTS

There was improvement in the range of shoulder abduction as well as rotation after each manipulation under Pentrox inhaler (Methoxyflurane).

## P6

### Dr. Sridhar Atresh

Suprapubic catheter blockages in spinal cord injury

**Background:** Suprapubic catheter blockage is a common problem in the spinal unit. It is a common method to manage bladder in high tetraplegia with poor hand function.

**Aim:** To investigate the problem of suprapubic catheter blockages in persons with spinal cord injuries

**Methods:** Retrospective review of the case notes of patients with SCI admitted in the spinal unit between August 2007 to June 2008 who underwent SPC insertion. Case notes were reviewed for history, level of SCI, timing of SPC insertion, frequency of catheter blockage, infection, blood calcium level and therapeutic intervention.

**Results:** Charts of 20 patients who had SPC insertion were reviewed. All patients underwent SPC insertion as a definitive management for their bladder. Detailed results of the blockages, infection and spasticity as a causative factor will be described in the poster.

**Conclusions:** Suprapubic catheter blockage is a common problem and its cause is multifactorial. This pilot study highlights the problem associated with catheter blockage. Further prospective study needed to evaluate the problem.

## P7

**Dr. Sridhar Atresh, Dr. Boris Mak**

Devic's Syndrome—Our experience in the Rehabilitation Ward in Counties Manukau

**Background:** Devic's Syndrome, also known as Neuromyelitis optica (NMO), is an inflammatory demyelinating disorder of the central nervous system with a striking predilection for the optic nerve and spinal cord. It was until recently regarded as an unusual severe variant of multiple sclerosis. However, the last decade has seen major advances in our understandings of the pathogenesis and the discovery of NMO-IgG.

**Objective:** To describe the inpatient clinical course of four patients with Devic's Syndrome and a review of latest diagnostic guideline.

**Design:** Case studies. We describe the inpatient clinical course of four patients with Devic's Syndrome, and discuss its epidemiology, clinical courses, diagnostic guideline, treatment, prognosis, as well as the differences between Devic's Syndrome and multiple sclerosis.

**Results:** All the clinical features and investigation results will be presented in the poster.

**Conclusions:**

These four patients had varying functional deficits but all of them demonstrate improved function with rehabilitation efforts.

## P8

**Prof. Shuxun Hou**

REMODELING OF THE SPINAL CANAL AFTER CIRCUM DECOMPRESSION WITH POSTERIOR APPROACH FOR BURST FRACTURE

To observe the morphological changes of the spinal canal after circum decompression with posterior approach for burst fracture, and to investigate the method and timing of remodeling.

76 patients with thoracolumbar burst fractures underwent circum decompression with posterior approach and pedicle screw fixation. X-ray and CT scan were performed preoperatively and at different times of the follow-up. We measured the minimal sagittal diameter of the canal for the injured vertebral body, and the adjacent segments. The initial stenotic ratio of the spinal canal was recorded. The results were compared with the theoretical values by paired t-test during the follow-up. CT scans demonstrated a complete decompression of the canal and the spinal cord. Remodeling

developed to different degrees 12 months postoperatively.

2 years later, CT images of the same level revealed that the sagittal diameter of the remodeled canal showed no significant difference from the theoretical values ( $P > 0.05$ ).

Significant spontaneous remodeling of the spinal canal after the circum decompression was observed 12 month postoperatively. This process does not correlate with the fracture location or the different degrees of neurological deficit. The remodeled canal presents almost normal shape. Its sagittal diameter is in the normal range.

Burst fracture; Spinal canal; Decompression; Remodeling

## P9

**Dr. Amrithlal Mascarenhas, Dr. Harvinder Chhabra**

A Description of Various Implant- Related Complications in the Management of Vertebral Lesions

Vertebral fractures can be managed in numerous ways. This presentation looks at the numerous ways of management of these fractures. In the past 8 years, 785 cases of vertebral fractures have been managed by various methods. The cases include cervical, thoracic, lumbar and sacral lesions. Anterior surgery, posterior surgery as well as combined anterior- posterior surgeries was done. Representative cases have been chosen to high-light the method of management and its complications. Various complications like plate loosening, screw breakage, screw pull-out, cage subsidence/ displacement were encountered. This poster will be an effort at displaying these different methods of surgical management of fractures and their complications.

## P10

**Dr. Anupam Gupta, Prof. Arun Taly**

REPEAT SALINE CYSTOMETROGRAPHY IN MYELOPATHIES: CHANGES IN BLADDER BEHAVIOR IN THE LONG TERM FOLLOW-UP

**Objective:** To study changes in bladder behavior following myelopathies by repeated Saline Cystometrography (CMG) during long term follow-up

**Design & Setting:** Prospective longitudinal study in Neuro-Rehabilitation Department of tertiary care university hospital

**Patients & Method:** Eighteen patients (14 men) with myelopathies (6 traumatic & 12 non-traumatic), mean age  $31.1 \pm 10.2$  years (range 18-60 yrs), underwent CMG during

initial admission. Nine patients had overactive detrusor with / without sphincter dyssynergia whereas other nine patients had under-active detrusor. Bladder management was advised accordingly. Their neurological recovery (ASIA impairment scale) & functional recovery were recorded using Barthel Index score (BI) at discharge. Repeat CMG (consecutive) was performed after a mean duration of  $28.1 \pm 12.8$  months (range 12-65 months).

Results: Repeat CMG showed 12 patients with overactive detrusor with/ without sphincter dyssynergia showing significant change ( $p < 0.001$ ) in the bladder behavior according to CMG in the follow-up. Interestingly no significant changes were noted in the neurological recovery using ASIA impairment scale ( $p = 0.257$ ) and functional recovery BI ( $p = 0.08$ ) during this period.

Conclusions: Bladder behavior changes over period after myelopathies. Repeat CMG should be done for appropriate management of bladder and to avoid upper & lower urinary tract complications.

## **P11**

**Gerold Stucki, Claudio Peter, Rachel Muller, Alarcos Cieza, Gerold Stucki, Szilvia Geyh**

### **INTERNAL RESOURCES AND STRENGTHS IN PERSONS WITH SPINAL CORD INJURY: ASYSTEMATIC LITERATURE REVIEW**

The purpose of this study was to gain a systematic overview of the role that internal resources and personal strengths play in the adaptation process of people who sustained a spinal cord injury.

A systematic literature review was performed. The literature search was conducted in the databases Pubmed, PsycINFO, SSCI, ERIC, Embase and CINAHL. The assessed variables, measurement instruments and study results were extracted from the full text articles and summarized. The methodological quality of the identified articles was evaluated.

Overall, the identified articles displayed a low level of evidence, consisting mainly of cross-sectional descriptive studies. Self-esteem and self-efficacy are among the most frequently examined internal resources and were found to be associated with various indicators of positive adjustment, such as low level of depression, or coping strategies. Internal resources that are related to character strengths, such as courage or humour, were scarcely considered in the empirical literature of SCI.

Further consideration of internal resources and personal strengths as well as applications of positive psychology concepts in empirical studies of spinal cord injury with a higher level of evidence could contribute to enhance optimal interdisciplinary rehabilitation care for the affected persons.

## **P12**

**Gerold Stucki, Rachel MÅ%ller, Claudio Peter, Alarcos Cieza, Szilvia Geyh**

### **SOCIAL SUPPORT AND SOCIAL SKILLS IN SPINAL CORD INJURY - A SYSTEMATIC LITERATURE REVIEW**

The aim of the study was to gain a systematic overview of the current state of research about social support and social skills in people with spinal cord injury (SCI).

A systematic literature review was conducted. The literature search was carried out in Pubmed, PsycINFO, ERIC, SSCI, CINAHL, and Embase. The quality of the selected studies was evaluated, study results were extracted and a thematic synthesis was compiled.

The results show an accumulation of cross-sectional studies. Longitudinal as well as intervention studies considering social skills and social support are largely missing. Social support is consistently found to explain variance in health-related outcomes. Assertiveness is investigated most frequently among the social skills in SCI, generally related to performance outcomes.

The analysis of the literature confirms the important role of social support. However, social skills and competences as potential mediators to enhance social support are not yet well examined in SCI.

According to the model of WHO's International Classification of Functioning, Disability and Health, environmental and personal factors, such as social support and social skills, relate to each other and affect functioning. Thus, they can be important intervention targets in SCI rehabilitation psychology.

## **P13**

**Gerold Stucki, Szilvia Geyh, Eva Nick, Daniel Stirnimann, Sabine Ehrat, F. Michel, Peter Lude**

### **SELF-EFFICACY AND SELF-ESTEEM AS PERSONAL FACTORS IN THE CONTEXT OF FUNCTIONING AND DISABILITY IN SPINAL CORD INJURY**

The purpose of the study was to examine self-efficacy and self-esteem as personal factors within the holistic framework of the WHO's International Classification of Functioning, Disability and Health (ICF) in spinal cord injury (SCI). The relationships of self-efficacy and self-esteem with participation were explored, accounting for health conditions, body function impairments, and environmental factors.

A multi-center cross-sectional study with people with SCI and a staff comparison group without SCI was conducted. Data were collected by self-report questionnaires.

Overall, 102 persons with and 76 without SCI responded to the survey. Persons with SCI reported significantly lower self-efficacy and self-esteem compared to the staff sample. Significant correlations of self-efficacy (.58) and self-esteem (.63) with reintegration were found. Multivariate regression models explained up to 47% of variance in reintegration.

Self-efficacy ( $\beta = .31$ ) and self-esteem ( $\beta = .37$ ) remained the strongest predictors of reintegration when adjusted for socio-demographic and lesion-related variables, health conditions, depression, pain, social support, coping styles, and sense of coherence.

Considering personal factors like self-efficacy and self-esteem within the comprehensive framework of the ICF contributes to an in-depth understanding of functioning and disability following SCI, which in turn can facilitate the further development of targeted interventions to support the affected persons' adjustment and reintegration.

## **P14**

**Prof. Roop Singh, Dr. Gaurav Saini**

### **BODY COMPOSITION EVALUATION BY DUAL ENERGY X-RAY ABSORPTIOMETRY DURING FIRST YEAR OF SPINAL CORD INJURY**

**Purpose:** Present study evaluated body composition by DEXA during first year of SCI patients.

**Methods:** Bone mineral content (BMC), lean body mass (LBM), total body mass (TFM), Percentage Fat (% fat) were estimated by DEXA and body mass index (BMI) calculated at initial presentation, 3, 6 & 12 months in 80 patients with SCI.

**Results:** BMC was significantly lower ( $p < 0.05$ ) (17.2% linear decrease). Tetraplegia

group had 13.2% loss of BMC in arm. Motor- complete had significant lower BMC ( $p < 0.05$ ). LBM was significantly lower ( $p < 0.05$ ); with 23.8% loss of LBM in lower limbs. Tetraplegics group had 36% less arm LBM, & 16% less LBM in trunk. Decrease in lower limbs LBM was 18.2% in Motor- incomplete compared to 29% in motor complete ( $p < 0.05$ ). There was no significant change in TFM ( $p > 0.05$ ). An overall increase of 2.8% was observed in TFM; however % fat was significantly higher ( $p < 0.05$ ) at one year. No correlation was found between % fat and body mass index.

**Conclusion:** There is marked decrease in BMC & LBM; & increase in adiposity in all sublesional sites. Increase in adiposity may be relative due decrease in LBM. These changes depend on level & severity of lesion.

**Funding support:** None

## P15

**Dr. Manish Chadha, Dr. Anand V Naik**

### ASSOCIATION OF FACET TROPISM WITH LUMBAR DISC HERNIATION

**Study design.** Cross-sectional hospital-based cohort

**Background.** Facet tropism is defined as asymmetry between left and right facet joint angles and is postulated as a possible etiological cause in occurrence of disc herniation.

**Methods.** 60 patients (18-40 years) with single disc herniation (L3-L4, L4-L5, or L5-S1). Exclusion criteria included multiple/recurrent disc herniation, spondylolisthesis, transitional vertebra, scoliosis, previous surgery/trauma/infection and significant facet arthropathy. Facet angles were measured using MRI of at least 1.5 tesla using the method of Karacan by two surgeons. Facet tropism was defined as difference of more than 5 degrees (1st criteria) and 10 degrees (2nd criteria) in facet joint angles between right and left sides. Normal disc adjacent to the herniated level was used as control. We also examined if disc herniated towards the side of more coronally oriented facet.

**Results.** Incidence of facet tropism by criteria 1 in herniated group was 38/60 (63.3%) and in control group was 24/60 (40%).

Incidence of facet tropism by criteria 2 in herniated group was 18/60 (30%) and in control group by criteria 2 was 4/60 (6.67%). Disc herniation occurred more commonly on the side of the more sagittally oriented facet.



**Conclusion.** There was no statistical difference between the Facet tropism at the herniated and control levels.

## **P16**

**Dr. Manish Chadha, Anand V Naik**

**OSSIFIED LIGAMENTUM FLAVUM- A RARE CAUSE OF PROGRESSIVELY INCREASING SPASTIC PARAPARESIS.**

### **CASE REPORT**

A 65 year old patient presented with history of clumsiness while walking for the past 10-12 months. He had noticed progressively increasing weakness in both his lower limbs for the said duration and was associated with hypoesthesia. He had no bladder complaints and both his upper limbs were normal. Examination revealed a spastic paraparesis with hypoesthesia below D10. There was no tenderness or deformity of the dorsolumbar spine. Plain radiographs were inconclusive. MRI performed suggested compressive myelopathy in the dorsal spine, which was secondary to ossified ligamentum flavum (confirmed on CT Scan). 4 level laminectomy was performed. He had marked relief of symptoms postoperatively but still has residual spasticity at 12 month follow-up.

### **CONCLUSION**

Ossified ligamentum flavum is a rare condition and presents as a progressively increasing neural deficit. Differential diagnosis includes fluorosis and tandem stenosis. One should be aware of the diagnosis lest one misses it.

## **P17**

**EH Coulter, PM Dall, L Rochester, J Haster, MH Granat**

**DEVELOPMENT AND VALIDATION OF AN ACTIVITY MONITOR TO MEASURE PHYSICAL ACTIVITY OF WHEELCHAIR USERS'**

**Purpose:** Current tools to measure wheelchair physical activity are either not validated or are limited in their application. The purpose of this study was to develop and validate a monitoring system to measure wheelchair movement.

**Methods:** The system developed consisted of a tri-axial accelerometer placed on the wheel and newly developed analysis software. The two accelerometer outputs in the plane of the wheel were used to calculate wheel revolutions, absolute angle, and

duration of movement. Concurrent validity was assessed in comparison with video analysis in 14 people with spinal cord injury who propelled their wheelchair on an indoor track and outdoor wheelchair skills course. Validity was assessed using Intraclass-Correlation Coefficients (ICC (2,1)) and Bland Altman plots.

**Results:** The monitoring system demonstrated excellent validity for wheel revolutions, absolute angle, and duration of movement (ICC (2,1) >0.999, 0.999, 0.981, respectively) in manual and electric wheelchairs, including forwards and backwards propulsion and for movements of various durations.

**Conclusion:** This study has found the tri-axial accelerometer and analysis program to be an accurate and objective tool for measuring detailed information on wheelchair propulsion and manoeuvring regardless of the propulsion technique, direction and speed.

Funding was received from Glasgow Caledonian University.

## P18

**Ms. Nancy Moodley**

### POST TRAUMATIC STRESS DISORDER AND COGNITIVE FUNCTIONING IN SPINAL CORD INJURED PATIENTS

**Objectives:** This study investigated post traumatic stress disorder (PTSD) and cognitive functioning in patients with spinal cord injury (SCI).

**Method:** SCI patients at spinal units were assessed over a period of 2 years. In addition to a semi-structured interview various questionnaires (Impact of Event Scale, Post Traumatic Diagnostic Scale) were administered at two different time points. Cognitive functioning was established using a neuropsychological test battery and the Wechsler Adult Intelligence Scale III. Group differences were explored using ANOVA, X<sup>2</sup>, and t tests. Bivariate analysis was done to determine cognitive factors associated with PTSD.

**Results:** High levels of PTSD was associated with IQ, verbal comprehension, perceptual organisation, working memory, processing speed, learning, concentration and attention. Females were found to be at a greater risk of PTSD. Single young males were found to be at greatest risk of sustaining SCI. High road traffic accidents and crime were contributing factors to SCI and PTSD.

**Conclusion:** High levels of PTSD impacts negatively on cognitive functioning in patients with SCI.

## P19

Mr. Anshul Sharma

### EFFECT OF WHEELCHAIR SPORTS ON FATIGUE, PAIN, QUALITY OF LIFE AND CAPACITY OF UPPER EXTREMITIES FOR QUADRIPLÉGICS

**Objective:** - To share the International participation of first Indian wheelchair Rugby team and to define the relationship between the fatigue, quality of living, pain and capacity of Upper extremities among the Quadriplegic participant.

**Instruments:** -ASIA Chart, fatigue Severity Scale, Visual Analog Scale for Pain (VAS-P), Quality of living index (QOL), Capacity of Upper Extremity (CUE).

**Method:** - Data collected once before and after the training session of 90 days at the Indian Spinal Injuries Centre and again 15 days study, prior and after the competition of first Indian Wheelchair Rugby Team at International Wheelchair and Amputee sports (IWAS) World Games 2009 at Bangalore.

**Result:** - Studied 25 quadriplegics with ASIA A and B. Male (n=24) and female (n=1) with mean age group of 20-22. After training camp session level of fatigue and pain (n=8) reduced with much improved QOL and CUE. Further n=16, improved their function and QOL which in turn reduced level of fatigue and pain after competition session.

**Conclusions:** Fatigue diminishes the quality of life and reduces functional capacity. Wheelchair sports leads to better quality of living and improves capacity of upper limb resulting lesser pain and fatigue level.

## P20

Dr. Elena Andretta, Dr. Giullana Campus, Dr. Cristina Zuliani

### SURVEY ON THE SEXUALITY OF PARA-TETRAPLEGIC WOMEN

We evaluated the sexuality (Sex) in "para-tetraplegic women on a wheelchair" (PaTe) who accessed our department in 2009.

A self-made questionnaire was used; 34 PaTe were enrolled (age 23-63 years, mean 40.5). The mean age for para-tetraplegia onset was 30.2 years. The 82.3% of the PaTe have had a relationship post-paraplegia. The 73.5% were sex-active (with the birth of 6 children) and reported a suitable vaginal lubrication; Sex was satisfactory for 80%. Genital sensitivity was preserved in 52%. The 64% had orgasm (in 9 at a reduced

intensity) and in 4 cases it was reached notwithstanding the genital anesthesia (GA). 8/9 anorgasmic women had GA but 92% of the GA was sex-satisfied. 8 females (3 tetraplegic) were Sex-inactive with the para-tetraplegia onset at a mean lower age compared to the Sex-active (25.7 vs. 30.28) and with a further decrease to 20 in 6 unmarried women.

The majority of the PaTe has an affair with sex intercourses and reports sexual satisfaction. Also 4 GA reached the orgasm, probably thanks to extragenital stimulation. The PaTe in whom para-tetraplegia happened in the youth, especially if they were unmarried and tetraplegic, resulted the most affected in Sex.

## **P21**

**Mr Yicheng Liu, Mr. Kaibin Wei, Mr. Dajue Wang**

A quick and economical alternative of setting up a spinal cord injury (SCI) service

**Purpose:** To demonstrate an alternative way of setting up an SCI service in an existing institution.

**Method:** In contrast to the general trend of setting up a stand-alone SCI service with high investment, an SCI Collaborative Team was set up within the Tai'an City General hospital (1, 600 beds) with all necessary disciplines under a single strong leadership. Apart from general support from the hospital, the team specifically involves Accident and Emergency, ICU, Orthopaedic Surgery, Rehabilitation and Physical Medicine, Urology, Nursing and Basic Research. Very little extra investment was necessary. All the work was done by reorganising the flow of existing service in a relatively non-fragmented way. Relevant senior staff were trained at the Midlands Centre for Spinal Injuries, UK.

**Results:** The Team started working in March 2009. Since then, 59 SCI patients (41 para and 18 tetra) have been treated and rehabilitated. The success was illustrated with the management of a C4 complete injury without any complications. The collaboration has been smooth, efficient and effective. The Team is moving towards a proper SCI centre under one roof.

**Conclusion:** A single strong leadership at hospital level is the key to success. It cuts down fragmentation and red tape to minimum

## **P22**

**A Narkeesh, N K Multani, S K Verma**

Clinical significance of Electrodiagnosis in PIVD as compared with Radio diagnosis

Back pain, an ancient curse, is now appearing as an international epidemic". Low backache is one of the greatest human afflictions. One survey's results show that 75 to 85 percent of all people will experience some form of back pain during their lifetime. 80% of the world population suffers from low back pain, out of which only 40% of patients with low back pain have sciatica. 95% of sciatica is due to herniated intervertebral disc. Majority of the disc herniations occur at three disc levels, 47% of the herniated disc occurs at L4-L5 level, 43% at L5-S1 level and 10% at L3-L4 level, less than 3% at L1-L2 level. The studies have proved that MRI is not reliable as it gives false positive findings in asymptomatic patients also. MRI should be correlated with clinical findings as more than 50% asymptomatic person's shows bulging or herniation of disc on MRI. It can identify lesion, but is unable to detail the relationship of the finding with the patient's symptoms. Therefore MRI lacks specificity and sensitivity.

Now where imaging studies and clinical assessment do not coincide, electrodiagnosis can provide reliable information. Imaging studies visualize the structural abnormalities from which the neurological sequelae may be inferred, whereas the electrodiagnostic methods such as nerve conduction studies and electromyography assess the physiological integrity of the nerve root and have the added benefit of sensitivity to the non structural root disease. The present study 1377 patient with Low Back Ache participate in descriptive study and 120 patients with disc herniation at L5-S1 participated in clinical & Electro diagnosis procedure.

## CONCLUSION

A strong and statistically significant relationship was observed between Clinical diagnosis, Radio diagnosis and Electrodiagnosis in PIVD (L5 - S1). Motor & Sensory nerve conduction velocities with latencies & H-Reflex get affected in disc herniation at L5-S1 level.

X-ray is the only method of radiodiagnosis that is widely used in patients of LBA. However, it is not at all suggestive of PIVD. Amongst other methods of radiodiagnosis, CT scan, discography and myelography are not widely used, probably because of their high cost and low reliability & MRI is the only reliable method of radiodiagnosis. However, it is associated with high false positive results. Electrodiagnosis is a valid, sensitive, non-invasive, cost effective and useful method to assess the lumbosacral nerve root functions in patients with lumbar disc herniation. In addition to this, it also provides the objective evidence of PIVD which is especially important from the research's point of view.

Therefore, electrodiagnostic studies must be incorporated in the routine investigations of the patients suffering from PIVD.

## P23

Dr. Gururaj Sangondimath, Dr. Harvinder Singh Chhabra, Dr. Vivek Mittal

### REPORT OF THE DIFFICULTIES EXPERIENCED IN THE ANTERIOR CERVICAL PLATING IN THE CERVICO-DORSAL SCOLIOSIS PATIENT- A RARE CASE

**Objective :-** Anterior cervical plating is the common procedure done for the anterior decompression and fusion of the cervical spine. The same cervical plating poses special situation and poses difficulties when it is done in a patient with a scoliosis. Here we are reporting the case of anterior cervical plating done in a scoliosis patient and the difficulties faced.

**Material and methods :-** A 27 year old male patient with C5 flexion compression injury with cervico dorsal scoliosis treated with anterior corpectomy and plating and discussed the problems encountered during the fairly common procedure.

**Case report:-** A 27 year old male patient presented to our institution with history of RTA with left upper limb weakness. His investigation revealed C5 grade 4 flexion compression injury with left sided cervico dorsal scoliosis. We decided to do anterior corpectomy with cage and plate fixation. During the procedure we encountered the number of challenges starting from the deciding from which side to approach. We have documented these challenges in this case report.

**Conclusion :-** Anterior cervical plating in a cervical scoliosis patient is a challenging procedure and requires careful planning before venturing into it.

## P24

Dr. Gururaj Sangondimath, Dr. Harvinder Singh Chhabra, Dr. Vivek Mittal

### SUDDEN BILATERAL FOOT DROP: A RARE PRESENTATION OF LUMBAR CANAL STENOSIS.

**Objective:-** To report a rare case of sudden bilateral foot drop due to lumbar canal stenosis and its management. **Material and methods:-** A 54 year old male reported with a 1 day history of sudden onset of bilateral foot drop with urinary retention, he was thoroughly evaluated and managed.

**Case report:-** A 54 year old male presented with a 1 year history of backache, radiating to both the lower limbs and 1-day history of sudden bilateral ankle weakness that progressed to bilateral foot drop within 6 hours. He also developed retention of urine.

Investigations revealed severe degenerative lumbar canal stenosis at L3-4 and L4-5 with mild instability at L4-5. Following surgery the patient had progressive improvement.

**Conclusion:** - Sudden onset of bilateral foot drop is a rare but one of the presentation of lumbar canal stenosis. A timely decompression gives good results.

## **P25**

### **Dr. Subramani Seetharama**

REPETITIVE-ACTIVITY BASED TRAINING OF THE UPPER EXTREMITY USING A ELECTROMYOGRAPHY CONTROLLED NEUROROBOTIC DEVICE TO IMPROVE FUNCTION IN PERSONS WITH TETRAPLEGIA.

Neurorobotics system uses surface electromyography sensing to facilitate muscle reeducation in patients with stroke. The objective of this study is to evaluate the effects of repetitive task based training of the upper extremities in persons with tetraplegia using the myomo e100 neurorobotic system.

**DESIGN:** Case study 3 subjects.

Myomo training: 30 minutes to one hour, 2 to 3 times weekly till functional improvement

81-year-old female, C4 tetraplegia, ASIA C. Initial Manual Muscle Testing (MMT) showed absent biceps strength and weak triceps bilaterally, upper extremity motor score (UEMS) 25/50. Post rehabilitation: ASIA D with functional strength in biceps and triceps and UEMS of 44/50.

41-year male, C4 tetraplegia, ASIA A. Initial MMT showed 2/5 biceps strength and the UEMS was 4/50. Post rehabilitation: ASIA A, with improved upper extremity strength and a UEMS of 22/50.

51-year-old female C4 tetraplegia, ASIAC. Initial MMT showed weak biceps and triceps bilaterally, UEMS of 6/50, Post rehabilitation: ASIA D, patient had functional motor strength in bilateral upper extremities, UEMS of 37/50

### **CONCLUSION:**

MYOMO neurorobotic system directed repetitive task based training in persons with incomplete and complete acute Cervical Spinal cord injury showed significant gains in strength and upper extremity function.

## P26

**Dr. Ajay.R. Kothari, Dr. Ketan S Khurjekar**

### VALIDATION OF VACCARO'S CLASSIFICATION IN PREDICTING NEUROLOGICAL RECOVERY IN TRAUMATIC THORACO-LUMBAR FRACTURES – ANALYSIS OF 41 CASES

#### **Introduction:**

Lot of controversies has been raised when the prognostication of recovery has been tried for traumatic spinal injuries and associated partial to complete neurological deficit. Intactness of posterior longitudinal ligament complex is evaluated on Magnetic resonance images. Need of skeletal stabilization and its role in getting neurological recovery are debated. Vaccaro's classification is put to use in classifying thoracolumbar fractures and predicting neurological recovery.

#### **Material & Methods:**

Prospective linear study is designed. Till today 32 patients with traumatic thoracolumbar vertebral fractures with or without neurological deficits have been enrolled for the current study. Conservative treatment was given to vertebral fractures with stable configuration without neurological deficit. All the patients with neurological deficit underwent surgery. Posterior stabilization was carried out with posterior pedicular screw construct. Indirect and direct decompression techniques were used for decompression. The entire patient's neurological status has been recorded with Frankel grading.

#### **Results:**

Patients with dense paraplegia did not show any motor recovery after decompression and skeletal stabilization. Patients general well being and mobilization was significantly improved after skeletal stabilization. Patients who had intact posterior longitudinal ligament complex showed complete recovery of neurological deficit after decompression. Stable vertebral fractures without neurological deficit were treated with Taylor or ASH brace. Of 41 patients 34 patients with intact neurology or incomplete deficit 32 recovered and of 7 patients with complete paraplegia only 1 recovered.

#### **Conclusion:**

Early decompression in spinal injuries with partial neurological deficit plays important role. Intactness of PLL complex predicts neurological recovery. Stabilization was useful in mobilizing the patients. Vaccaro's classification is more clinically based and helps in prognosticating treatment.

## P27

**Ms. Jaskirat Kaur, Shefali Walia, Mr. Piyush Singh**



## CORRELATION BETWEEN FATIGUE, DEPRESSION AND QUALITY OF LIFE IN SPINAL CORD INJURY IN-PATIENTS

### **Objective:**

Fatigue is considered to be one of the feature among individuals with spinal cord injury. The impact of fatigue on daily life is substantial, as it prevents sustained physical and mental exertion, limits work and social role performance and is related to less satisfaction with quality of life.

### **Methods:**

Sample: 90 in-patients with SCI were taken based on inclusion and exclusion criteria. Fatigue Severity Scale (FSS), Center for Epidemiologic Studies Depression Scale (CES-D) and RAND-36 was administered to measure Fatigue, Depression and Quality of life.

**Outcome Measures:** Fatigue Severity Scale (FSS), Center for Epidemiologic Studies Depression Scale (CES-D) and RAND-36

**Results & Conclusions:** A positive correlation was found between fatigue and depression and a negative correlation was found between fatigue and some components of quality of life.

## **P28**

**Azafak Sahr Karamehmetoğlu, Dr. Kerem Gök, Dr. Murat Uludağ, Dr. Nurettin İrem Akmekeç, Dr. Halil Koyuncu**

## THE EVALUATION OF IRREGULAR FOLLOW-UP IN PATIENTS WITH SPINAL CORD INJURED PATIENTS

**Objective:** This study was carried out to review the reasons to be absent in regular examinations in patients with spinal cord injured (SCI).

**Method:** 50 traumatic SCI patients rehabilitated in our clinic and who had 5 years of irregular follow-up were included into the study. Two investigators made phone calls and a questionnaire of 12 parameters was completed.

**Result:** We reached 30 out of 50 patients. Only 9 of these 30 patients received nearly regular health care. Out of 21 patients 5 did not followed regular examination deliberately because they did not believe to the usefulness of these regular follow-ups. Sixteen SCI patients had serious physical and organizational obstacles to reach our clinic.

**Conclusion:** Although many of the SCI patients wanted to have a good medical assistance, they could not because of various obstacles. Therefore, especially for the patients who had not sufficient independence, possible barriers should be eliminated and/or home care services should be increased by the community.

## P29

**Dr. Halil Koyuncu, Dr. Murat Uludağ, Dr. Karim Gun, Dr. Nurettin İrem Akmekeç, Dr. Azafak Sahir Karamehmetoğlu**

### THE EVALUATION OF THE MENTAL STATUS AND MORTALITY RATE OF SPINAL CORD INJURED PATIENTS

**Objective:** This study was carried out to review the mental status and the mortality rate of spinal cord injured (SCI) patients.

**Method:** 50 traumatic SCI patients rehabilitated in our clinic and who had 5 years of irregular follow-up were included into the study. Two investigators were make phone calls and mental status assessment was done with a questionnaire of 13 parameters including orientation to time, orientation to place, registration, attention, calculation and recall.

**Result:** We were unable to reach 14 SCI patients by the registered phone numbers at the hospital records. According to information received from their families, we were informed that 2 patients died because of respiratory problems and 1 patient left his house and family, nobody knew where he was.

Mortality rate (6%) was lower than the literature (9%). We could communicate with only the remaining 30 SCI patients. Any significant mental status impairment was not observed in any patient.

**Conclusion:** We conclude that the main cause mortality in SCI patients was respiratory diseases

## P30

**Mr. Jyoti Vidhani**

### IMPACT - " INCREASING THE IMPACT OF ASSISTIVE TECHNOLOGY" - A CASE STUDY

**Purpose:** This case study documents the process of designing a "Client Oriented" approach for the provision of Assistive Technology (AT) solution for a 40-year-old individual with quadriplegia and reports the effect of the AT on his participation in life

activities. Method: We worked on a "customer oriented" approach to match the individual to an access solution pertaining to mobility, home/worksite accessibility, and computer access. Upon discharge a fitted wheelchair with semi-active features, suggestions for the changes in home and work environment and customized hand splint to promote the keyboard typing were prescribed.

Two months after, we measured its impact using Functioning Everyday with a Wheelchair (FEW) tool and Psychosocial Impact of Assistive Devices Scale (PIADS), a semi structured personal interview.

**Results:** After 2 months, the individual reported in the increased participation in the indoor and outdoor activities. He was spending an average 4 hours per day on the computer, engaging in electronic communication, recreational and educational activities.

PIADS revealed that the client felt increased satisfaction with the intervention undertaken.

**Conclusion:** By addressing individual goals, abilities and relevant environmental factors a client-oriented approach to AT provision paves a way to the improved quality of life for patients with spinal injuries.

### P31

Dr. Maria Paola Pascali, Dr. Giovanni Mosiello, Dr. Maria Letizia Salsano, Dr. Enrico Castelli, Dr. Mario De Gennaro

#### NEUROGENIC BLADDER TREATMENT IN SPINAL CORD INJURY: EXPERIENCE IN 37 CASES

Acquired Spinal Cord Lesion (SCL) in paediatric age is a rare condition, dramatically modify the patient and family life. Therapeutic approach is multidisciplinary because of the symptoms and systems involved. The aim of this study, in a retrospective study, is to describe different urological treatments, patient and family acceptance. Charts of 37 patient with acquired SCL admitted in the Neurorehabilitation Unit, aged 2 - 18 years (average age 7 years) were observed. Of the 37 patients, 13 did not attend follow up program and 3 dead. All patients underwent neurourological evaluation. Of the 21 patients regularly followed up, all started clean intermittent catheterization (CIC); 14 patients underwent urological specific treatment; 12 received botulinum toxin A (BoNTA) endoscopic treatment for neurogenic overactive bladder reaching clinical and urodynamic improvement in term of intravesical pressures and continence. 1 patient received endoscopic bulking agents injections and 1 patient underwent sacral neuro-modulation implant. 2 patients treated with BoNTA received simultaneous endoscopic

treatment for vesico-ureteral reflux. In the patient quality of life continence is one the most relevant aspect. CIC is frequently refused in acquired lesion patients, whereas alternative treatments as BoNTA or sacral neuromodulation are better accepted.

### P32

**Dr. Abhishek Srivastava, Dr. Sharmila Ranade, Dr. Mihir Bapat, Dr. Matthew Abraham**

#### MULTIPLE INJECTIONS OF IN-VITRO EXPANDED AUTOLOGOUS BONE MARROW MONONUCLEAR CELLS (ABMMNC) FOR CERVICAL SPINAL CORD INJURY

**Background:** A 22 year old male reported with complete tetraplegia, MRI revealed C4-C5 burst fracture and decompression with vertebral fixation was done four days after injury. SSEP revealed absent tibial somatosensory evoked potentials and functional MRI revealed no activation in motor area on foot tapping task.

**Materials & Methods:** His bone marrow was harvested twice, cryopreserved and expanded in-vitro and total five injections were given via lumbar puncture on day 22, 32, 42, 180 and 360 after injury.

**Results:** The relevant parameters were evaluated (i) immediately after injury, (ii) before first stem cell injection and (iii) after five stem cell injections. Objective improvements were noted with (a) Light touch score (20-22-40), (b) Pin prick score (20-20-32), (c) Anal sensations (Nil-Nil-Present), (d) Motor Score (11-11-21), (e) Motor level (C5-C5-C6), (f) ASIA score (A-A-B), (g) Neurological level (C5-C6-C6), (h) Spinal cord independence measure (9-12-45) and (i) Barthel index (0-0-40). Repeat MRI one year post injury show gliosis in the cervical spinal cord at C5 vertebra. Conclusion: Multiple intrathecal injections of in-vitro expanded ABMMNCs in a case of cervical spinal cord injury have been found to be safe and gradual objective improvement noted over a period of one year without any adverse outcome.

### P33

**Dr. Chandana Karunathilaka**

#### APPLICATION OF ASIA IMPAIRMENT SCALE IN SRI LANKAN SPINAL INJURY PATIENTS

Spinal injury counts for 5% of total number of admissions to the accident & services The national Hospital of Sri Lanka in 2009.

The aim of this retrospective study is to identify applicability of ASIA impairment scale in our patients in the view of constructing a management protocol which includes rehabilitation.

The aetiology varies, fallen from a height counts for 74%, 35% from battle casualties, 27.7% due to road traffic accidents.

The neurological assessment needs standardization in all health care institutions in the Sri Lanka. Application of ASIA scoring & impairment scale reviews as follows.

ASIA-A 36.36%, B 13.63%, C 04%, D- 23%, E- 23%

It implies the applicability of ASIA scoring in our spinal injury patients and the requirement of a proper management plan with rehabilitation protocol.

### **P34**

**G. Onose, M Haras, A Anghelescu, A Spanu, L Onose, C Giuglea, V Grigorean, C. Dala Chendreanu, I Andone, A. Mirea**

INTEGRATIVE EMPHASES ON INTIMATE TARGETS AND ACCESSIBLE RELATED THERAPEUTIC APPROACHES, IN SPINAL CORD INJURIES (SCI)

**PURPOSE:** To emphasize and comment connections between main cellular/ molecular targets, secondary to SCI and some accessible, for clinical practice, therapeutic options.

**METHOD:** An un-detailed, within our previous works, integrative focus, on which intimate nevrax principal detrimental propensity and pathways – intrinsic hindrances for recovery - after SCI, can be aimed for neuroprotection/ pleiotropicity/ multimodal, actions, by accessible drugs.

**RESULTS:** Accordingly, we have systematized some related feasible suggestions for considered beneficial treatments - obviously, not with spectacular effects, as unfortunately, there are not, by now, such outcomes in SCI -, based on known and already in clinical use (including mainly, for neurological conditions) medicines - but which at present, are not all yet, largely introduced as therapies also for SCI.

**CONCLUSION:** Scientifically motivated highlighting of some available drugs' "neuroprotective" (and not only) properties too, might enable practitioners to approach the difficult and still unsolved domain of SCI, with a larger therapy spectrum.

### **P35**

**Mr Priit Eelmae, Ms. Riina MÄmmim, Mrs. Malle Pakkanen, Mrs. Aina TÄmunutare, Mrs. Vaike Kabel, Mr. Priit Eelmae**

## RESPIRATORY FUNCTION IN SUBJECTS WITH CERVICAL SPINAL CORD INJURY

**Purpose:** To describe respiratory values in connection with ASIA Impairment Scale (AIS) and the level of independence in subjects with cervical spinal cord injury (CSCI).

**Methods:** 50 patients with SCI at C3-C7 level were studied (age  $34,6 \pm 12,7$  years; months from trauma  $68,1 \pm 55,54$ ; AIS grade A-29, B-6, C-7, D-8). Mean anthropometric values of patient were: height 180.4cm, weight 77.7kg and BMI 23.8kg/m<sup>2</sup>. The level of independence was determined by the ability to move with/without wheelchair or specific aid. Spirometric values (FVC-Forced Vital Capacity; FEV1-Forced Expired Volume after 1 sec; PEF-Peak Expiratory Flow) were evaluated.

**Results:** Software predicted respiratory values according to patients mean anthropometric values were: FVC 4.43l, FEV1 3.88l, PEF 8.04l/sec, but measured respiratory values in patients with CSCI were lower (mean FVC 3.78l; FEV1 3.17; PEF 6.53l/sec). Subjects in wheelchair or with AIS grade A/B had statistically lower FVC values compared with subjects AIS grade C/D. PEF values were not statistically significant.

**Conclusion:** Respiratory values in patients with CSCI were lower than the respiratory values predicted by software on the basis of patients' anthropometric data, especially in those with AIS grade A/B and in wheelchair.

### P36

Dr. Hitesh Dawar, Dr. H.S. Chhabra

Ascending myelitis in operated burst fracture L1 with paraplegia ASIA -A

**Objective** - To report a case of a patient with spinal cord injury due to burst fracture L1 with paraplegia ASIA-A with ascending myelitis post surgery and to examine and evaluate the possible cause of ascending myelitis incurred in this patient after the surgical fixation of burst fracture L1

**Case report** - A patient with history of fall from height had a burst fracture L1 with complete neurological deficit. She was operated wherein posterior pedicular screw fixation was done. Post surgery, on the 4th post operative day, patient developed weakness of upper limbs along with fever and neck rigidity, along with high counts. MRI showed signs of myelitis. CSF showed normal study. An aggressive antibiotic therapy was started. The blood counts, fever and neck rigidity settled with aggressive antibiotic therapy, but the neurological deficit only recovered partially, and patient was discharged for domiciliary care.

**Conclusions** - We were not able to confirm infection as the cause of the ascending myelitis with ascending neurological deficit. It could still be a case of ascending sympathetic myelitis, which though rare, is reported. The purpose of this case report was to describe this interesting incident of ascending neurological deficit in a patient who initially sustained paraplegia

### P37

**Dr. Yorck B. Kalke, Prof. Dr. Heiko Reichel**

#### THE ACTUALIZED OSTEOPOROSIS GUIDELINES OF THE GERMAN BONE RESEARCH SOCIETIES AND THEIR VALUE FOR THE SCI CENTRES

**Purpose:** The in October 2009 actualized guidelines of the joint organizations of the German-speaking bone research societies should be more helpful in treating the increasing number of elderly patients with SCI and osteoporosis.

**Methods:** Risk factors have to be differentiated implicating a 10 years fracture risk > 20%. Basic and specific therapy options have to be chosen.

**Results:** Diagnostic tools are geriatric and vertebral fracture assessment. Vitamin D 3 800-2000 IE and calcium total intake of 1000 mg are sufficient in osteopenia. Depending on DXA T-score, age and gender bisphosphonates on a daily up to a year base, strontium ranelate or teriparatide can be given.

Extending controls also in terms of therapy duration are necessary.

**Conclusion:** These actualized guidelines give valuable orientation also in SCI patients with osteoporosis.

### P38

**Dr. Yorck B. Kalke, PD Dr. Balkan Cakir, Prof. Dr. Heiko Reichel**

#### LONG-TERM IMPACTS IN A GERMAN PATIENT WITH POTTÅ'S SPINE : A CASE REPORT

**Purpose:** To describe the complications of a paraplegic patient with PottÅ's spine.

**Methods:** Long term follow up of a patient with an in Germany rather rare disease.

**Results:** Because of PottÅ's disease with abscess in the thoracic spine a seventeen-year-old boy got incomplete paraplegic (AIS D) and had to lie in a plaster bed for the

duration of two years in the early sixties.

He developed after 2 decades neurological deterioration because of syringomyelia making necessary shunt surgery and remained wheel chair driver (AISC) in the early nineties.

Because of increasing kyphosis he suffered from increasing pain syndrome in the transition zone and got after wedge osteotomy posterior-anterior fusion from Th 4 to Th 9 in 2004. During this surgery a tuberculoma had been opened with indication for tuberculostatic therapy. Because of partial loosening reinstrumentation from Th 4 to Th 11 became necessary. The patient remained incomplete (AISC).

Yearly follow-ups in the outpatient clinic show stable conditions also of the syrinx.

**Conclusion:** The complication of especially syringomyelia and kyphosis make long-term follow-ups in paraplegic patients with Pott's spine necessary.

### P39

Dr. Kurian Zachariah, V Hebbare, KN Gopinath, P Jacob, LH Basavaraju, K Rangaswamy, Ravishankar, N Rawat, A Sharma, VS Ramakrishna, N Machani, R Hariharan

SPINAL CORD INJURY REHABILITATION: RE-UNITING THE PATIENT BACK INTO SOCIETY, NOT JUST RE-UNITING THE FRACTURE - A PILOT STUDY

**Purpose :** To create awareness of the private costs (economic, social & psychological) that are incurred by a spinal cord injured (SCI) patient in the developing world, and to establish the need for these costs to form an independent, critical variable in deciding which acute intervention option is the most appropriate.

**Methods :** 30 SCI patients from 3 centres in Bangalore were randomly selected and analysed based on their socio-economic demographics, hospitalization details, costs incurred, funding sources, and neurological recovery, using SPSS.

**Results:** Their monthly income varied from Rs. 800/- to 13,200. The average cost per patient for surgical management was Rs. 106,434, and that of non-surgical management was Rs. 10,000. Majority of patients borrowed money to meet their treatment expenses; only in 3 cases was the full amount paid by the patients' company or by the insurance.

**Conclusion:** Patient treatment needs to be individualized and holistic; the decision making should take into consideration both the costs as well as the benefits (i.e., the



probability of neurological recovery) of each treatment option.

#### **P40**

**Mr. Arvind Bhawe**

##### **ABNEEDLE'-NEW DEVICE FOR VERTEBROPLASTY**

Vertebroplasty needle device assembly ,fully indigenously, patented devise designed to suit pedicle sizes of asian vertebrae. The needle is useful for doing minimally invasive surgery of 'VERTEBROPLASTY' for osteoporotic vertebral fractures, malignant painful vertebral conditions.

The other uses being for vertebral or bone biopsies.

In the present paper ,the development ,peculiarities of the 'ABNEEDLE' and it's successful usage in 150 vertebral levels over last 5 years is presented.

Key words: vertebroplasty, minimally invasive spine Surgery

#### **P41**

**Dr. Fahid H Malik, Dr. Jaydeep Ghosh, Dr. Saumyajit Basu**

Surgery for unreduced cervical facet dislocations - Which Approach ? - Our experience of 19 patients.

Introduction Sub axial spine dislocation with locked facets is common in cervical injury. The locked facets include unilateral and bilateral types. Different successful closed reduction rates have been achieved between unilateral and bilateral types by using rapid skull traction, which was commonly used to reduce the cervical dislocation. If traction does not reduce the dislocation completely, then operative reduction is imperative followed by fixation and fusion.

The choice of approach is controversial. We present our experience.

Methods A total of 19 patients with cervical dislocation with locked facet due to cervical injury treated by skull traction and operation from 2001 to 2009 were reviewed. There were 2 cases of complete cord injury, 8 cases of incomplete cord injury, 6 cases of only radiculopathy and 3 cases without any neurodeficit. Duration between injury and admission was 16 days average ranging from 1 to 58 days. All patients underwent X-ray/MRI/CT scan. Average of 2 days of traction was given ranging from 1 to 4 days. The issue of reducibility and approach for fixation was compared statistically. Patients who were reduced successfully underwent anterior cervical

discectomy and fusion at the injured level, and those who failed in closed reduction received posterior open reduction and fixation along with supplementary anterior cervical discectomy and fusion with fixation. (ACDF). All patients were followed up for at least one year with average duration of follow up being 45.84 range 12 months to 108 months.

**Results :** Our series showed preoperative reduction by traction of bilateral to unilateral dislocation in all cases but complete reduction was not achievable. Unilateral facet dislocations reduced by traction in about 29% cases. No patients underwent neurological deterioration. All patients with radiculopathy improved completely, patients with incomplete cord lesions improved by 1 to 2 grades and patients with complete cord lesions showed no improvement. All patients fused within one year.

**Conclusions :** In patients with successful closed reduction only anterior decompression and fixation was possibly enough. If un-reducible by closed means then open reduction via posterior approach involving partial/full facetectomy and 360 degree fusion with instrumentation is required.

## P42

**Dr.SS Patil, Dr. Uday Pawar, Dr. Abhay Nene**

### EARLY POSTOPERATIVE MOTOR DEFICIT FOLLOWING POSTERIOR LUMBAR SPINE SURGERY

Retrospective cohort study.

**Objective.** Analyze postoperative motor deficits following lumbar spine surgery and depict their long term outcome.

**Background data.** Incidence of motor deficit following lumbar surgery is 0-3% in literature. Nevertheless long term outcome of these deficits is ill-reported. This study attempts to evaluate post-surgical lumbar spine motor deficits and their recovery pattern.

**Methods.** An independent observer retrospectively assessed 13 patients. Operating surgeon was interviewed to register intra-operative adverse events. Postoperative management and motor recovery data were collected. Patients were investigated with an MRI and/or CT scan postoperatively and were regularly followed up for 18 months. The effect of the complication on functional activities was noted.

**Results.** Sixty percent patients underwent minimally invasive lumbar decompression. Four patients had instrumented fusion. Two patients had malpositioned screws, other

two had iatrogenic root injury. Rest all were considered iatrogenic injuries due to disproportionate handling. 70% patients recovered completely to their preoperative neurology, 20% recovered by grade I power and 10% show no recovery at final follow up.

**Conclusion.** Although these injuries show fair long term result, caution should be exercised, especially during minimally invasive procedures. Aggressive postoperative investigation to reverse any correctable complication to the neural structures is vital.

### P43

Ms. Christel van Leeuwen, Dr. Marcel Post, Dr. Floris van Asbeck, Dr. Sonja de Groot, Dr. Lucas van der Woude, Dr. Eline Lindeman

THE SPIQUE STUDY: AN ONGOING PROSPECTIVE COHORT STUDY ON QUALITY OF LIFE OF PERSONS WITH SPINAL CORD INJURY IN THE NETHERLANDS

**Funding:** This study was supported by the Dutch Health Research and Development Council, ZON-MW Rehabilitation program, grant no. 1435.0003 and 1435.0025.

**Purpose:** Although many persons with SCI regain good quality of life, prevalence of psychosocial problems is substantially higher and societal participation lags behind that of persons in the general population. In 1999, a nation-wide longitudinal cohort study was initiated to determine the course of functioning, fitness and quality of life of persons with SCI and its determinants from the start of inpatient rehabilitation up to five years after discharge. Specific research aim for this 5-year follow-up measurement was to analyse associations between personal factors and quality of life.

**Methods:** Prospective cohort study of 225 persons with SCI. Measurements at the start of active rehabilitation, after three months, at discharge, one, two and five years after discharge. An extensive measurement protocol administered at all measurements included medical examination, tests of physical functioning and exercise capacity, and questionnaires on perceived health, participation and life satisfaction. Questionnaires on emotional stability, self-efficacy and illness cognitions were now added to the protocol.

**Results:** In 2007, the first 5-year follow-up measurements were performed. About 138 participants have been tested by now and in total 145 participants are expected.

**Conclusion:** This study is expected to increase our understanding of determinants of long-term quality of life after SCI.

## P44

Prof. Nalli Uvaraj, Dr. Nalli Gopinath

### SPINOPELVIC STABILISATION FOR LUMBOSACRAL TUBERCULOSIS

Tuberculous infection of the lumbosacral junction constitutes 3% of tuberculous lesions of vertebral column (Tuli). Management of tuberculosis of the Lumbosacral region poses a challenge to the treating physician. In tuberculous spondylitis, fusion of affected segments usually occurs after either surgical or conservative management.

Conservative treatment can provide good results in most cases. However in some instances tuberculous infection of Lumbosacral spine if extensive can lead to instability with associated pain after healing. This would warrant spinal stabilization and fusion. In the event of the tuberculous lesion involving multiple vertebral bodies of the lower lumbar region and the sacrum itself, spinal stabilization becomes difficult. In such a situation Spino-pelvic fixation may be the solution.

**Methods:** We are herewith presenting our experience in the management of two patients ( two young female patients) with active tuberculosis of the lumbosacral region in whom Spinopelvic stabilization with fusion was done in stages. Both patients had extensive involvement of the Lumbosacral junction.

**Result:** Both patients with Lumbosacral tuberculosis managed by Spinopelvic stabilization and fusion were mobilized early while being on anti tuberculous treatment and had complete healing of the lesion without pain.

**Conclusion:** Spinopelvic stabilization prevents late complications like spinal instability and pain.

## P45

Mr. Rick Jay, Mr. Nekram Upadhyay

### ANTI-DECUBITUS CUSHION OUTCOME STUDY PURPOSE

This study will evaluate 100 - 150 user outcomes in less developed countries of a fluid anti-decubitus cushion developed by Rick Jay, formerly designer of the Jay Cushion. A majority of patients enrolled will be traumatic spinal cord injuries.

The new cushion seeks to replicate the effectiveness of the Jay Cushion at only 10% of the cost. Rick's new enterprise, JARIK Cushion LLC, is a social enterprise. Rick is donating his time and all manufacturing set-up costs to the enterprise, while charging only for the actual costs of producing (in Shanghai) and distributing the cushions.

The first goal of this study is to measure outcomes and satisfaction of patients at "Moderate" or higher risk of developing a pressure sore (as defined by the Braden Scale), comparing the new fluid cushion to the cushion previously used by that patient. The second goal is to validate the durability of the materials chosen. The third goal is to ascertain whether this cushion is as appropriate for use in less resourced environments as it has been in developed countries, where over 1,000,000 fluid (JAY) cushions have now been used.

#### **DESCRIPTION OF METHODS**

The study will have 4 phases: 2-3 week trials among 100-150 patients; 6 months trials among 30 patients; one year follow-ups among the same 30 patients; and two year follow-ups among the same 30 patients.

There are 10 spinal cord centers participating in the study in the following countries: Bangladesh; India (2); Kenya; Malaysia; Nepal (2); S. Africa; Sri Lanka; and Vietnam.

Rick Jay (JARIK Cushion, LLC) provided participating facilities 6 cushions each free of charge, with each facility bearing all costs of conducting the study. To participate, facilities agreed to follow these cushions during a 28 month period, according to the strict protocol outlined, and filling out each of the 6 modules required. Outcomes of the study are being tabulated and written up by the Chief Investigator, Nekram Upadhyay, Rehabilitation Engineering Technologist at Indian Spinal Injuries Centre in New Delhi, India, under the supervision of Dr. H.S. Chaabra.

#### **SUMMARY OF RESULTS AND CONCLUSIONS REACHED**

Results of each phase of the study will be tabulated and published at [www.jarikcushion.com](http://www.jarikcushion.com) within 90 days of the completion of Phases 1, 2, 3 and 4. Phase 1, involving 100-150 patients, is deemed to be the most important phase, with results posted by Oct 1, 2010.

#### **P46**

**A/Prof. Lisa Harvey, Dr. Colleen Canning, Dr. Cath Dean**

eLEARNING TO TEACH PHYSIOTHERAPY STUDENTS ABOUT MANAGEMENT OF SCI  
Harvey L1, Canning CG2, Dean CM2, Ada L2, Crosbie J2, Stark A2, Kilbreath S2

1. Rehabilitation Studies Unit, Northern Clinical School, Sydney School of Medicine, University of Sydney, Sydney, Australia
2. Discipline of Physiotherapy, Faculty of Health Sciences, University of Sydney, Sydney, Australia

Investment in undergraduate physiotherapy education has important implications for the future care of people with SCI. An eLearning module was developed to supplement existing lectures and tutorials for physiotherapy students. The emphasis of the eLearning module was to reinforce practical manual-handling skills learnt in tutorials. The module contained video clips demonstrating these skills. The purpose of this study was to evaluate the effectiveness of the eLearning module. One hundred undergraduate physiotherapy students from the University of Sydney participated in the study.

Students were provided with the usual package of SCI lectures and tutorials but were also provided with the eLearning module. A questionnaire was used to determine usefulness of the eLearning module. In addition, exam results and website access were evaluated. Nearly all students (95%) accessed all parts of the eLearning module outside formal lectures and tutorials. Students reported that the eLearning module made it easier for them to master the practical skills involved in managing people with SCI and helped them prepare for their exams. Students requested that the eLearning module be extended to other units of study. Exam results were 5% (95% CI 2-8) better in questions covered in the eLearning module than questions not covered. The eLearning module also helped improve the consistency of teaching between different tutors. In summary, the eLearning module is an effective adjunct for face-to-face teaching and enhances students' learning of practical manual-handling skills necessary for the management of people with SCI.

## P47

**Dr. Marcel Post, Dr. Floris van Asbeck**

### PARTICIPATION PROFILES OF PERSONS WITH CHRONIC SCI IN THE NETHERLANDS

**Purpose:** To analyse participation of persons with chronic SCI in the Netherlands in relation to personal and SCI characteristics.

**Methods:** Cross-sectional postal survey including all members of the Dutch patients organisation Dwarslaesie Organisatie Nederland. Participation was measured with the Utrecht Activities List.

**Results:** A total of 461 usable responses were received (response rate 46%). Mean age was 47.1 years, 65% were males and 65% were married or cohabitating. Mean time after injury was 13.4 years. Types of SCI were complete tetraplegia (20%), incomplete tetraplegia (14%), complete paraplegia (47%) and incomplete paraplegia (19%). A total of 47% had paid work, for a mean of 25.2 hours/week. Another 12% was in education (9.8 hours/week) and 75% performed housekeeping (11.8 hours/week). Volunteer work was done by 37% (6.6 hours/week). Participants indicated that they had to spend

extra time on self-care (9.6 hours/week), handicap management (2.7 hours/week) and transportation (3.5 hours/week) due to their SCI. Activity levels of participants were lower than those of the general Dutch population and were related to type of SCI, time after SCI and demographic characteristics.

**Conclusion:** Participation of persons with SCI is profoundly affected, in part because having an SCI takes much extra time by itself.

#### P48

**Dr. Ralph Marino, Dr. Patricia Ditunno, Mrs. Mary Patrick, Dr. Georgio Scivoletto, Dr. Tania Lam, Dr. John Ditunno**

CONSUMER PREFERENCE IN RANKING WALKING FUNCTION UTILIZING THE WALKING INDEX FOR SPINAL CORD INJURY (WISCI)

**Objective:** To determine consumer preference in ranking walking function utilizing the WISCI in individuals with spinal cord injury (SCI) from Canada, Italy, and the U.S.

**Method:** Forty-two consumers with incomplete SCI (24/cervical, 13/thoracic, 5/lumbar) from Canada (12/42), Italy (14/42) and USA (16/42) rank ordered the 21-levels of the WISCI scale by their individual preference for walking. Photographs of each WISCI level used in a prior pilot study were randomly shuffled and presented one-on-one by the research coordinator. Data were collected and analyzed at one center (USA).

**Results:** The majority (64%) of consumers (27/42) ranked WISCI Level 17 (1-person assistance) higher than multiple levels of the WISCI requiring no assistance. In the USA/Canada groups, the ranking was bimodal; 50% of Canadian (6/12) and USA (8/16), but 100% of Italian consumers preferred walking with assistance (level 17) to no assistance (levels 12, 13, 15 and 16). These results were unexpected, since the hypothesis assumed consumers would conform to performance measures such as the FIM/SCIM that rank independent walking higher than walking with assistance.

**Conclusion:** The influence of consumer preference for walking should be considered in designing SCI trials that use consumer estimates of significant improvement as an outcome measure.

#### P49

**Dr. Hidenori Suzuki, Prof. Toshihiko Taguchi, Dr. Hiroshi Tanaka**

Transplantation of bone marrow stromal cells combined with neurospheres into

injured spinal cord : significant recovery of motor function and electrophysiological evaluation.

(Introduction) It is well known that BMSCs have a strong neuroprotection effects and fraction of stem cells which can be differentiated into neuronal cells. Transplantation of such stem cells has potency to promote functional recovery after spinal cord injury (SCI). (Purpose)We examined the possibility of neurospheres differentiated from BMSCs (BBRC 2004) for improved motor dysfunction. (Materials and Methods)Using rats, SCI was produced by inflating a Forgaty balloon catheter under Th9 lamina. One week after SCI, 10 rats were received transplantation of mixed, differentiated nestin-positive cells and BMSCs. (Results)After SCI, all rats showed almost complete paraplegia. Histological examination showed that the spinal cords were severely damaged.

Four weeks after transplantation, three rats out of the ten could barely walk with weight bearing and three rats were recorded motor evoked potential in the soleus muscle after transcranial stimulation. Conversely, no treated rats with SCI had almost no lower limb functional recovery. (Conclusions)Based on our experiment, the rats with transplantation exhibited significant recovery of motor function after SCI. The motor recovery was also proved electrophysiologically in some rats. This treatment has the possibility of being clinically applied for patients with spinal cord injury or other neuronal disorders.

## P50

Angela Mc Namara, Maeve Nolan

### THE PATIENT EXPERIENCE OF REHABILITATION

**Purpose:** Although there is an increasing interest in how people experience health care and share in decision making, the experiential worldview of people undergoing rehabilitation during a time of profound identity transformation has not been the explicit focus of a large body of research. The aims of this paper are 1) to examine the literature on the patient experience of rehabilitation and 2) to present a personal account of the experience by a Consultant in Rehabilitation Medicine who developed Guillain Barré Syndrome (GBS) and became a patient in the SCI unit where she had previously held the team leadership role.

**Methods:** A review of the literature of the patient experience of rehabilitation supplemented by a rich subjective account of that experience.

**Summary of results:** A synthesis of outcomes of available literature, with a particular focus on implications for rehabilitation practice, will be presented together with



personal reflections from the unique perspective of a rehabilitation consultant who became a patient.

**Conclusions:** At a time when there is a proliferation of standards for rehabilitation facilities it is important to focus on what is important to the patient. A Consultants experience of rehabilitation, in combination with a review of the literature suggests important implications for patient-centred rehabilitation.

## **P51**

**Prof. Rajeshwar Nath Srivastava**

### **MOTOR SEGMENTAL RECOVERY IN SPINAL CORD INJURY - A BLESSING IN DISGUISE!**

In a 2 year followup study, 100 Thoracolumbar injuries in ASIA A underwent surgery. In 60, posterior instrumentation alone (Gp1) and in 40 posterior instrumentation with laminectomy (Gp2) was done. Results of these were compared with randomly picked up 100 similar cases treated conservatively (Gp3). When ASIA A recovered to ASIA D/E, distal neurological recovery was said to be functional (FDNR). FDNR was almost similar in all three groups- 11.67% in Gp1, 12.5% in Gp2 and 7.0% in Gp3. Motor segmental recovery (MSR) in zone of partial preservation was found to be more in surgical group than conservative group- 68.33% in Gp1; 92 % in Gp2 and 40.0% in Gp3. MSR was said to be significant (MSR-Sig) only when at least 2 key muscles had power of more than 3 on both sides. MSR-Sig was 26.67% in Gp1, 47.5% in Gp2 and 13% in Gp3. Laminectomy facilitated motor segmental recovery of spared nerve roots. When laminectomy was added to posterior instrumentation (Gp2) MSR-Sig was statistically significant.

This was a blessing in disguise in complete thoracolumbar injuries (ASIA A) where MSR-Sig of the L2 & L3 roots made all the difference between an ambulatory life (with braces) and an otherwise permanent wheel chair bound life

## **P52**

**Prof. Rajeshwar Nath Srivastava**

### **PROGNOSTIC FACTORS OF NEUROLOGICAL RECOVERY IN SPINAL CORD INJURY**

During 2006-2007, of 403 Spinal cord injury cases admitted, 91 could be followed up for upto 2 years. Outcome measures were improvement in the sensory and motor scores of ASIA Impairment Scale (AIS).

Variables studied for outcome were classified into static and dynamic. Demographics,

mechanism of injury and vertebral level were static. These were recorded at admission and correlated for any association with neurological recovery at two year. Neurological level, duration of spinal shock, rate of reflex recovery, sensory & motor scores and complications like bedsores, flexor spasms, UTI, URTI, & DVT were dynamic. These were recorded at admission, at weekly intervals till discharge and 3 monthly in follow-up. In static variables, vertebral level was significantly associated with recovery. Proximal the lesion, better the outcome. In dynamic variables, sacral sparing, intact bladder, spinal shock of <24 hours were good prognostic factors. Complete lesion, priapism, spinal shock for >1 week, bedsores within 1 week and flexor spasms within 3 weeks were poor prognostic factor.

When regressive linear analysis was done, speed of recovery in the initial three weeks was the most important prognostic factor irrespective of other variables studied against the final neurological recovery.

### **P53**

**Prof. Rajeshwar Nath Srivastava**

#### **A COMPARATIVE STUDY OF POSTERIOR FIXATION IN ACUTE UNSTABLE THORACOLUMBAR INJURIES BY MONOAXIAL AND POLYAXIAL PEDICLE SCREWS**

38 cases formed the study group. By random allocation 18 were managed by polyaxial pedicle screw and rod (Gp A) and 20 by monoaxial pedicle screw and rod (Gp B)

In GpA, at 1 year, 12/17 (66.6%) of AIS- A remained at AIS-A, 2/17 (11.11%) recovered from AIS-A to AIS-B and 1(5.55%) recovered from AIS-A to AIS-C. 2/17 (11.11%) patients were ambulatory at 1 year and had shown full neurological recovery AIS-A to AIS-E.

In GpB, at 1 year, 13/16 (81.25%) of AIS A remained at AIS-A, 2/16 (12.5%) recovered from AIS-A to AIS-B and 1/16 (6.5%) recovered from AIS- A to AIS-C.

In Gp A average kyphotic angle at admission was 32o which postoperatively was reduced to 10.3o with average correction being 21.7o. In GpB average Kyphotic angle was 26o at admission which postoperatively was reduced to 9.6o with average correction being 16.4o. At 1 year, average kyphotic angle in Gp A was almost same as in postoperative phase - 13.3o with a loss of 3o surgical correction. In Gp B, the average kyphotic angle was 17.6o with a loss of 8o of surgical correction. This was found to be statistically insignificant. There were none implant related postoperative complication in GpA, 3 in GpB

## P54

Prof. Rajeshwar Nath Srivastava

### PROGNOSTIC & CLINICAL VALUE OF MRI IN SPINAL CORD INJURY

MRI findings were correlated with clinical findings at admission & discharge according to ASIA Scores & ASIA impairment scale.

On bivariate analysis

There was a definitive correlation of cord edema involving <3cm of cord & > 3cm of cord with sensory outcome(odds ratio = 5.75 (95% CI: 0.95, 36), Fisher's exact p = 0.0427(p<.05).

Presence of sizable focus of haemorrhage in cord (>1cm)was most strongly associated with the poor outcome(odds ratio 6.97 and p= .0047).

Epidural hematomas was not a risk factor and it is not related with the outcome(odds ratio - 0.5 and p=0.22).

Presence of severe cord compression >75% was a risk factor for poor outcome(odds ratio - 4.90 and p= 0.0143)

On multiple logistic regression

Sizable focus of hemorrhage >1 cm was most consistently associated with poor outcome (odds ratio -6.73 and p= 0.32)

In the patients with severe cord compression >75% the risk of poor outcome was more (odds ratio 4.3 and p=0.149) however was not statistically significant.

Presence of cord oedema / non haemorrhagic contusion was not associated with poor outcome (odds ratio 0.25 and p=0.178)

Epidural hematoma was not a risk factor and did not influence outcome

## P55

Mr. Kiichi Sato, Mr. Fumihito Towatari, Mr. Tomomichi Kajino

PHYSICAL THERAPY, FROM ACUTE PHASE TO HOME DISCHARGE, FOR SPINAL CORD INJURED PATIENTS.

## -INTRODUCTION OF THE APPROACH IN HOKKAIDO CHUO ROSAI HOSPITAL SPINAL CORD INJURY CENTER IN JAPAN-

[Background] The center receives spinal cord injured patients, by the helicopter transportation system, within 6 to 8 hours after injuries. Annual average number of patients with spinal cord injuries, being admitted to the center, is 60 to 70. After the admission, patients undergo the integrated treatment system from acute treatments through rehabilitation programs to home discharge. Through the period, each patient is attended by a group of a same physician, a same physical therapist and a same occupational therapist.

[Concept] 1) Surgical treatment of spine is considered to start the rehabilitation program from the early stage of spinal cord injury. 2) After the admission to the hospital, patients begin the program of holding sitting-position as anti-gravity position, as early as possible, in order to prevent the disuse syndrome.

3) Securing mobility skill in physical therapy and its functional use in the ward should be synchronized.

[Expected Benefit] Physical therapy intervention from early stage in spinal cord injury can minimize the disuse syndrome. We can expect quick functional recovery of patients and also early securing of self-care and independent life.

### **P56**

**Mr. Pradeep Thumbikat, Mr. Nazakat Hussain, Ms. Amanda Wong, Dr. Kidangali Mathew, Dr. Shagufta Khan, Dr. Salman Karim**

#### **AUTONOMIC DYSREFLEXIA: DO WE NEED TO LEARN MORE?**

Autonomic Dysreflexia (AD), is a potentially life-threatening condition, which affects individuals with spinal cord injury (SCI) above the major splanchnic outflow (at or above the T6 neurological level). Prevalence of AD in SCI has been reported from 19% to as high as 70%. Untreated episodes of AD may have serious consequences, including intracranial hemorrhage, retinal detachments, seizures and death. A survey of Accident and Emergency departments of UK hospitals was conducted to assess awareness of AD. A typical patient scenario was followed by questions regarding the diagnosis, treatment, common causes and awareness of any guidelines for AD. The A&E physicians included 13 consultants, 39 registrars, 48 junior doctors. Of the 100 respondents only 7 would treat the high blood pressure and majority of them (59%) were not aware of the term. Most (78%) did not know any precipitating factors and

none (0%) was aware of any guidelines within their departments. We conclude that awareness of this potentially lethal condition in non-spinal injury staff remains very low. We propose that patients at risk of developing AD should be provided with an identification card with guidelines to manage AD. More work is needed to educate the acute care physicians about this condition.

## **P57**

**Mr Pradeep Thumbikat, Mr. Nazakat Hussain, Mr. Kidangall Mathew, Mr. Martin McClelland**

### **LONG TERM FOLLOW UP (MEAN 24 YEARS) OF POST-TRAUMATIC LUMBAR SYRINGOMYELIA**

Post-traumatic syringomyelia is an uncommon complication of spinal cord injury (SCI). Early recognition and timely intervention may reverse delayed neurological deterioration. There is a paucity of literature on lumbar syringomyelia and its long-term consequences. Medical notes of five patients with lumbar syringomyelia were reviewed for qualitative parameters. Age, mode, level and severity of SCI, nature of bony displacement, management of fracture, residual deformity, presenting symptoms of syrinx, time interval between the initial SCI and onset, extent of the syrinx, bowel, bladder and sexual dysfunction or limb symptoms were ascertained. All had high velocity trauma with significant displacement of spinal column. Mean interval between the initial SCI and development of symptoms was 5 years. The nature of ascending sensory symptoms, pattern of muscle weakness the character and distribution of pain, autonomic symptoms, new onset bowel and bladder dysfunction are all described. Surgical management of the syrinx and its results were analysed along with follow up data over 20 years. Post-traumatic lumbar syringomyelia presented with worsening neurology and functional deterioration. Early detection and intervention was an important factor that gave good long term outcomes. Surgical interventions were effective in all the patients in this series, despite some of them requiring repeated procedures.

## **P58**

**Miss Meena Agarwal, Mr. Vijay Gudla, Ms. Gail Williams, Mr. Christian Nayar, Mr. Colin Buck**

**Use of Botulinum Toxin in the treatment of Neurogenic Detrusor Overactivity.**

The aim of this study was to investigate the efficacy and safety of an intra-vesical injection of Botulinum Toxin in patients with neurogenic detrusor over activity.

**Patients and Methods:** Eleven patients, 8 females and 3 males, aged 33 to 73 years with severe neurogenic bladder dysfunction due to; multiple sclerosis (7) & spinal cord injury (4) were treated with an intravesical injection of Botulinum Toxin (750 units Dysport). Pre-treatment and post-treatment assessment at 6, 12 and 24 weeks was by means of the Kings Health Questionnaire (KHQ), to measure the quality of life and symptomatology across 9 domains enabling a numerical scoring system, urodynamic studies and a frequency volume diary.

**Results:** Nine patients completed the 24 weeks of study. Two patients were withdrawn due to protocol violations. There was a significant reduction in the KHQ score which was most marked at 6 to 12 weeks. There was a substantial reduction in the use of pads and decrease in daytime frequency and nocturia. Urodynamic studies showed decreases in cystometric pressures.

**Conclusions:** Intra-vesical Botulinum Toxin injection is an effective and safe treatment for patients with neurogenic bladder dysfunction. The maximum benefit appears to be seen at 6 to 12 weeks.

## P59

Dr. Cornelia Putz, Dr. Cornelia Putz, Dr. Ing. RAdiger Rupp, Prof. Dr. Hans JArger Germer, N Weidner, C.H. Furstenberg

### **MALIGNANT CORD COMPRESSION: WHAT ARE RELIABLE PROGNOSTIC FACTORS INFLUENCING THE FUNCTIONAL OUTCOME AFTER SURGICAL TREATMENT?**

Advanced tumour disease and metastatic spinal cord compression (MSCC) are two entities with a high impact on patients' quality of life. Prognostic factors after primary surgical neurodecompression are not defined or evaluated standardized. The aim of this review was to determine if prognostic tools influence the functional or ambulatory outcome in tetra- and paraplegic patients with MSCC after spinal surgery.

Focused MEDLINE database searches were conducted using relevant keywords in order to identify all abstracts referring to prognostic tools before surgery with an impact on ambulatory outcome in patients with MSCC. Details of all selected articles were assembled and the rate of ambulation was stratified.

Six surgical clinical articles were eligible after review. Prognostic factors were found to be related to the patients general status, duration of neurological deficit, to mechanical and biological factors. Evidence from five retrospective trials and one observational prospective study does not support a single prognostic factor to be predictive for postoperative ambulatory status.

The screening of all relevant prognostic factors before surgery may determine postoperative functional outcome in patients with MSCC. This is essential to assess quality of life and should be validated in future prospective clinical trials.

## P60

**Dr. Amitabh Jha, Dr. Timothy Hudson**

### UTILITY OF A SHAM NEEDLE IN ACUPUNCTURE RESEARCH – PRELIMINARY FINDINGS IN PERSONS WITH SCI.

**Objective:** To report preliminary findings on the ability of a sham needle to serve as a control treatment in blinded studies of acupuncture.

**Design:** Cross-sectional.

**Participants/methods:** 16 participants who consented to participate in a clinical trial of acupuncture to improve neurological function after subacute, incomplete SCI and received at least 1 treatment. After the first randomly assigned treatment, participants were asked to guess which treatment they received.

**Results:** Preliminary, blinded analyses show that the mean age was 33.4 years, and 11/16 were male. The average days post injury was 33.75 days and 11/16 were tetraplegic. Of the 8 subjects who received treatment A, 6 believed they received true acupuncture. Of the 8 subjects who received treatment B, 7 believed they received true acupuncture.

**Conclusion:** This study helps provide some insight into the ability of a sham needle to serve as a control treatment in acupuncture studies involving persons with SCI. While the sample is small, the results suggest that participants were adequately blinded. There is some debate as to whether sham acupuncture is truly inert or must be considered a placebo.

**Support:** NIH, National Center for Complementary and Alternative Medicine (#R21AT002763)

## P61

**Dr. Bum-Suk Lee, Dr. Jong-Hoon Kim, Dr. Sook-Hee Yi**

### TRANSFER ACTIVITIES IN PATIENTS WITH SPINAL CORD INJURY AFTER DISCHARGE FROM HOSPITAL

Bum-Suk Lee, Jong-Hoon Kim, Dong-A Kim, Sook-Hee Yi

National Rehabilitation Hospital, Seoul, Korea

**Objective:** To investigate the transfer activities in patients with spinal cord injury (SCI) after discharge, and assess the caregivers' pain related to patient transfer in the community residence.

**Method:** One hundred seventeen SCI patient and 35 caregivers for the patients dependent on bed-wheelchair transfer activities were included. As for SCI patients, motor index score (MIS), one transfer item from the Korean version of modified Barthel index (K-MBI), and three items related to transfers from the spinal cord independence measure (SCIM) II were evaluated. Regarding caregivers, musculoskeletal pain with patient transfer, ease-of-use and safety of transfer methods including an electric-powered lift were measured.

**Results:** The degree of transfer activity changed in 21 patients (17.9%). During follow-up, all patients with SCI at and above C6 showed dependent transfer activities. Eight from 10 patients with SCI at C7, and all patients with SCI at and below C8 performed independent bed-wheelchair transfer activities. Thirty caregivers complained of chronic musculoskeletal pain. The degree of pain at the time of patient transfer was significantly lower in those who used electric-powered lifts compared to manual transfer methods. Caregivers using electric-powered lifts showed significantly better ease-of-use scale than those using manual transfer methods. However, there was no significant difference in the safety scale.

**Conclusion:** The use of electric-powered lifts is essential for patients who cannot perform independent transfers, especially those with SCI at and above C7.

## P62

**Dr. Lawrence Vogel, Dr. Erin Kelly, Dr. Caroline Anderson**

### RELATIONSHIPS BETWEEN OUTCOMES OF CAREGIVERS AND YOUTH WITH SPINAL CORD INJURY

Authors: E. Kelly, C. Anderson, S. Garma, H. Russell, S. Klaas, J. Gorzkowski, L. Vogel

Affiliation for Presenting Author: Shriners Hospitals for Children, Chicago, Illinois, United States; Rush Medical College, Chicago, Illinois, United States

**Purpose:** To determine the impact of caregiver psychological outcomes on the outcomes of their children with spinal cord injury (SCI).



**Methods:** This was a longitudinal study with data collected at two time points, approximately 1 year apart. Youth ages 7-17 years who had been injured at least one year and were receiving care within three specialty hospitals completed the Revised Children's Manifest Anxiety Scale and Children's Depression Inventory. Primary caregivers completed the Beck Anxiety Inventory and Beck Depression Inventory. Two hierarchical linear regression equations were conducted to predict time two child anxiety and depression from time one caregiver mental health, controlling for significant demographic and injury-related variables and time one child anxiety and depression, respectively. Caregiver mental health was characterized by a composite variable that summed scores from caregiver anxiety and depression measures.

**Results:** 93 youth were enrolled: mean age was 13.53 years at follow-up (SD=3.03), 52% were female, 63% were Caucasian, 81% had paraplegia, 52% had complete injuries, and mean age at injury was 6.38 years (SD=5.10). Controlling for time one child anxiety, current age, and injury level, time one caregiver mental health significantly predicted time two child anxiety ( $B=.234, p=.002$ ; Model  $R^2=.584$ ). Controlling for time one child depression, child sex, and injury level, time one caregiver mental health significantly predicted time two child depression ( $B=.175, p=.018$ ; Model  $R^2=.643$ ).

**Conclusion:** There are significant relationships between caregiver mental health and child anxiety and depression among youth with SCI.

## P63

Dr. Lawrence Vogel, Dr. Kathy Zebracki, Ms. Kathleen Chlan

### CHANGE IN ECONOMIC STATUS IN YOUNG AND MIDDLE-AGED ADULTS WITH A PEDIATRIC-ONSET SPINAL CORD INJURY OVER A TEN-YEAR PERIOD

**Objectives:** Assess change in economic status between 2 cohorts of young (24-29) and middle-aged adults (30-39) with pediatric-onset SCI between 1999 and 2009.

**Methods:** Structured telephone questionnaire and standardized measures: Craig Handicap Assessment and Reporting Technique (CHART), Short-Form 12 Health Survey.

**Results:** 97 young adults in 1999 and 73 in 2009, and 46 middle-aged adults in 1999 and 45 in 2009. Current young adults were more likely to be students (29% v 6%). Fewer currently unemployed young adults were not actively looking for a job (12% v 32%). Annual income for young adults did not change between the 2 time points. Current young adults' household incomes (\$42,109 v \$61,100) were significantly lower. Current young adults reported less CHART economic self-sufficiency (71.3 v 82.5). No differences were found on economic variables between the middle-aged

cohorts. Current young and middle-aged adults were more likely to have received mental health treatment over the past year.

**Conclusions:** Young adults in 2009 differed from their 1999 cohort on several economic status variables. Current economic crisis has had a greater negative impact on young adults with SCI than those middle-aged

## **P64**

**Mrs. G Fizzotti, C Pistarini**

### **BLADDER AND VAGINAL INFECTIONS IN THE WOMEN WITH A SPINAL CORD INJURY**

#### **Objective\***

Sometime vaginal infection can coexist with bladder infection; the main microbial strains responsible for urinary tract infection can colonize vagina. We have considered the incidence of this condition in the women with a spinal cord injury.

#### **Methods\***

10 patients were included; 8 with paraplegia and 2 with cauda equine syndrome. All the patients used intermittent catheterization to empty the bladder.

A urine culture and vaginal tampon were studied in all these patients before and after urinary tract and vaginal infections. \*\*

#### **\*Results\*\*\***

In this study all the patients have presented urinary tract infections and vaginal infections at the same time and over all the aetiologic bacteria were the same in urine culture and vaginal tampon. \*\*

#### **\*Conclusions\***

A possible communication between bladder and vagina during an infection has called our attention to a good choice of drugs. Some antibiotics will change the balance between our body's "good" bacteria and the "bad" bacteria that has caused a urinary tract infection.

## **P65**

**G Fizzotti, S Cremascoli, G Rusconi, C Pistarini**

### **WHAT THE PATIENTS WITH A SPINAL CORD INJURY THINK ABOUT THE VOIDING DIARY?**

## Objective

The goal of intermittent catheterization is to: completely empty the bladder, prevent further bladder or kidney damage, prevent urinary tract infections

<<http://www.nlm.nih.gov/medlineplus/ency/article/000521.htm>>. After a spinal cord injury, the patients learn how to perform this procedure and complete a voiding diary after the intermittent catheterization.

We have considered the utility of the voiding diary.

## Methods

30 patients: 7 females and 23 males were included. During stay in hospital \* or by a telephone call the patients have completed a\* questionnaire about the function and the utility of voiding diary.

## Results

23 patient have considered positive the compilation of voiding diary but only 12 have made it every day. When the patients returned to home forgot to complete it because they preferred to take care of visceral sensations.

## Conclusions

The results have confirmed that voiding diary represents a therapeutic instrument when the patient complete it after a right explanation. It can become a possible instrument to prevent further bladder or kidney damage. A good nursing of the patients with a spinal cord injury must include this attendance.

## P66

**Dr. Gabriele Bazzocchi, Erica Poletti, Mauro Menarini**

### RELATIONSHIP BETWEEN INTESTINAL TRANSIT AND NEUROGENIC BOWEL DYSFUNCTION SCORE IN PATIENTS WITH SCI: BOTH NECESSARY FOR DEFINING CONSTIPATION

Bowel dysfunction is a serious disorder in SCI patients and a specific symptom-based score was developed and validated: it has 10 items and range 0-47 [Spinal Cord 2006; 44: 625]. Our aim was to investigate the relationship between NBD score and Intestinal Transit (IT) in SCI patients reporting difficulties of defecation. NBD score was calculated in 63 consecutive patients (16 tetraplegic); a single abdominal x-ray was taken after daily ingestion of 10 radioopaque markers for six days and IT in hours was obtained. Mean IT was 82±37 hours and mean NBD score was 17±6; Pearson's coefficient is 0,03, showing no correlation between the two parameters. In fact, IT resulted pathologic in similar percentages of patients for each bowel dysfunction level: it was delayed in the

87%, 70% and in the 74% in Very Minor and Minor dysfunction (8 patients), in Moderate dysfunction (10 patients) and in Severe dysfunction ( 45 patients with NBD score <sup>3</sup>14) respectively. IT resulted normal in 16/63 patients affected by constipation; conversely NBD score classified as Minor dysfunction 7/8 patients showing the same slow IT of those having Severe Dysfunction. Both the investigations are necessary for a complete clinical assessment of constipation in SCI patients.

## **P67**

**Dr. Norhayati Hussein, Dr. Saini Freddy Jeffery Abdullah**

### **UNILATERAL THIGH SWELLING IN PARAPLEGIA**

**PURPOSE:** Spinal cord injured patients can present with unilateral thigh swelling attributed to multiple differential diagnoses. The objective is to report occurrence of unilateral thigh swelling in paraplegic patients demonstrating differing pathologies towards two similar clinical presentations.

**CASES:** Case 1 involved a 68 years old gentleman, 4 weeks post-injury with neurological level T10 ASIA A. He has concurrent left open Grade 1 upper shaft femoral fracture with was internally fixed after 4 weeks of external fixation. Left thigh swelling developed 2 days after femoral fixation, which was confirmed as deep vein thrombosis.

Case 2 involved a 56 years old gentleman, 4 years post-injury with neurological level T7 ASIA A. He presented with insidious right thigh swelling with circumferential difference of 15 cm and worsening lower limbs spasticity. Initial laboratory and radiological investigations (plain X-ray, USS Doppler) were negative. Subsequent three-phase bone scan confirmed the diagnosis of right hip neurogenic heterotopic ossificans.

**CONCLUSION:** Spinal cord injured patients, both in the acute and chronic phase can present with unilateral thigh swelling attributed to various differential diagnoses. Determining accurate diagnosis requires a high level of suspicion. This is crucial in planning appropriate treatment plans and interventions.

## **P68**

**Dr. G.L Jacquemin, A. Delure, I. Robidouxm. M-T. Laramae, Dr. P.G. Harris, M.A. Danino**

**TENDON TRANSFER FOR TETRAPLEGIA: HOW TO START A SURGERY AND REHABILITATION PROGRAM.**

**Objectives:** To provide an overview of the steps we followed to develop a tendon transfer program for tetraplegia. **Introduction:** Tendon transfer in tetraplegia is a well known procedure and evidence based for a small club of specialists. It is however still an unknown technique for most of the medical community. We present a retrospective study of program set up in Montreal Canada. **Methods:** We did a qualitative analysis of the entire process from the first idea to the effective establishment of the program. All the correspondence about the program was reviewed retrospectively. The thematic analysis was guided by complexity theory, a contemporary form of systems theory, which selects attributes to be measured and clustered them into themes. **Results:** Six decisive step were identified:

First step was members selection for the multidisciplinary team. Second step was exhaustive literature review. Third step, establishment of links with a mentor team. Fourth step, participation to the international meeting. Fifth step, establishment of administrative procedures in the organization. Sixth step, first surgery to restore pinch and grasp in a 22 years old lady. **Conclusion:** Tendon transfer surgery and rehabilitation needs a dedicated team. Building this program is a long and organized process.

## P69

**Dr. G.L.Jacquemin, I. Robidoux, A.Dlure, Dr. A. M. Danino**

### TENDON TRANSFER IN TETRAPLEGIA: HOW MANY ACTUAL CANDIDATES FOR SURGERY?

**Study design:** Retrospective study

**Objectives:** The aim of this study was to compile data's concerning reasons for candidate rejection for tendon transfer surgery.

**Methods:** We reviewed the charts of all tetraplegic patients hospitalized in the last 2 years in our center. This review included a review of all the medical conditions, the level of injury, the quality of the rehabilitation process etc. We identified the reasons for rejecting patients for surgery. Analyzing those reasons, we classified them in categories and sub-categories.

**Results:** Patient's clinical factors was one category, which we further subdivided into several sub-categories: level of injury too high, incomplete patient with insufficient hand function, age, poor compliance to rehabilitation, medical issues preventing surgery etc. Patient's personal choices was the other category, which we subdivided into: not wanting to have the arm operated, wanting to wait for other cure, not wanting to be dependant again, other reasons (family, work issues).

**Conclusion:** Tendon transfer surgery brings true functional improvement in tetraplegic

patients. Unfortunately, there are many reasons for not proceeding to this surgery. A clear comprehension of those reasons could help us optimizing the recruitment.

## P70

**Mrs. Joyce Mothabeng**

### PHYSICAL ACTIVITY IN PEOPLE LIVING WITH SPINAL CORD INJURY

**Background and purpose:** Physical activity (PA) is necessary for health in both the able-bodied and people with disabilities, including those with spinal cord injury (SCI). This paper reports on factors influencing the participation of PLWSCI in PA. Method: Secondary Data Analysis (SDA) was conducted on previous data from a study investigating the physical activity levels of PLWSCI. Descriptive statistics were used for data analysis.

**Results:** Interview transcripts of thirty one PLWSCI (four female and 27 male) were analysed. Factors that encouraged participants to be physically active were availability of equipment, environmental factors, family support and self motivation. Unavailability of equipment, inaccessible environments, attitudes of able-bodied people and lack of personal motivation were among factors that discouraged participants from participating in PA.

**Conclusions:** This study identified personal factors and environmental factors as important factors influencing PLWSCI to participate in physical activity. Targeted health promotion measures including education therefore need to be put in place in order to promote healthy lifestyles and prevent complications related to the sedentary lifestyle that is associated with SCI. Awareness of society also needs to be raised regarding PA needs of PLWSCI, in order to facilitate their social integration.

## P71

**Dr. Gulsun Iska, Dr. Belgin Erhan, Dr. Ayse Nur Bardak**

### THE RELATIONSHIP BETWEEN THE FINDINGS OF URODYNAMIC EVALUATION AND NEUROLOGICAL EXAMINATION IN SPINAL CORD INJURED PATIENTS WITH LEVEL T10-L1

**Objective:** The aim of this study is to determine the relationship between the findings of the neurological and the urodynamic examination in spinal cord injured (SCI) patients with level T10-L1.

**Materials-methods:** Fifty SCI patients who admitted to hospital between April and

October 2009 with a neurological level T10-L1 who were out of spinal shock, were included in the study. Neurological examination according to ASIA standards were made and all the patients evaluated with video-urodynamics.

**Results:** The median duration of injury was 55.5 (range 4-365) months. Six percent of the patients had normal findings in urodynamic study; overactive detrusor was found in 54%, areflexia in 40%. There were no relationship between the detrusor activity and the neurological level, the severity of the lesion, the ASIA Impairment Scale and presence of perianal pinprick sensation. The presence of bladder sensation was significant higher in patients with the neurological level of T12 and L1 than in T10 and T11 patients. All of the patients with bladder sensation had an incomplete lesion. Significant relationship was found between the presence of bladder sensation and voluntary anal sphincter contraction, perianal light touch and pinprick sensation.

**Conclusion:** Neurological bladder type can not be estimated with the neurological examination; but the neurological examination can be predictive for bladder sensation.

## P72

**Dr. Kaydar Al-Chalabi, Dr. Abdul Karim Msaddi**

SPINAL CORD INJURIES Experience of Neuro Spinal Hospital Dubai, UAE

**Study design :** Retrospective study

**Objective :** To address Spinal Cord Injuries in UAE and to highlight the experience of Neuro Spinal Hospital, Dubai, UAE

**Setting :** Neuro Spinal Hospital, Dubai, UAE

Since establishment and functioning in 2002 Neuro spinal hospital received 98 patients, either for surgical, rehabilitative or for complications management. 49 patients (50%) were UAE (citizens), 25 patients (25.5%) expatriates Arab and rest were from different nationalities. The main cause among the UAE nationals was road traffic accidents (69.3%). Incidence of fall from height and sport injuries is high among other nationalities.

Sixty eight (68) patients were paraplegic and thirty (30) were tetraplegia. Males were 77, females 21.

The surgical procedures done for them were either laminectomy, decompression, fixation, Baclofen pump implantation, spinal cord stimulation, neurotomies, sacral

root stimulation and others.

All patients underwent rehabilitation program according to the level of injury and degree of completeness with all ADL assistive devices.

Conclusion Neuro spinal hospital is considered to be the premier Neuroscience Center not only in UAE but in the whole Gulf region affording comprehensive surgical and Rehabilitation management for SCI

### P73

**Dr. Vivek Mittal, Dr. Harvinde Chhabra, Dr. Gururaj Sangondimath**

#### CONSERVATIVELY MANAGED EPIDURAL HAEMATOMA IN THE THORACOLUMBAR SPINE – A CASE REPORT

**Background:** Spontaneous epidural hematoma is a rare condition, which usually requires urgent surgical treatment.

**Objectives:** To report one case of spontaneous epidural hematoma in the thoracolumbar spine, in a patient on oral antiplatelets, which was successfully treated conservatively.

**Case Report:** A male of 76 years, taking ecosprin, clopidogrel for coronary bypass grafting, presented to us with acute onset of back pain with bilateral lower limb weakness with bowel, bladder involvement, since three days. He had improved gradually over the 3 days. No history of constitutional symptoms, trauma. Blood counts were normal. MRI showed a dorsal epidural collection at the level of D12, L1 and L2. There was no enhancement with Gadolinium. As patient was already improving, it was decided to treat the patient conservatively. Ecosprin and clopidogrel were stopped. Patient improved rapidly neurologically. Serial MRIs showed resolution of the haematoma.

**Conclusion:** Emergency physicians need to be aware of the possibility of spontaneous rapid neurological recovery in patients with spinal epidural hematoma. To avoid unnecessary surgery in patients who will spontaneously recover, neurological evaluations need to be repeatedly performed.

### P74

**Dr. Vivek Mittal, Dr. Harvinder Chhabra, Dr. Gururaj Sangondimath**

#### MISMANAGED THORACOLUMBAR SPINE INJURY – A CASE REPORT



**Background:** In traumatic spine injury, laminectomy without fixation is contraindicated since it increases the instability, causes progressive kyphosis and late neurological deterioration

**Objectives:** To report a case of thoracolumbar spine injury mismanaged with a laminectomy

**Case Report:** Female of 19 years had history of fall from height 9 years back. Had fracture T12 vertebra with complete deficit. Was operated elsewhere with laminectomy. Patient improved neurologically. Presented to us with increasing back pain since 3 years, radiating pain both lower limbs, increasing deformity and incoordination in walking. She had angular kyphosis and tenderness with UMN signs. Radiographs showed old fracture D12 with wide laminectomy from D10 to L3 with Cobb angle of 75 degrees. MRI showed stretching of cord over internal gibbus. Through posterior approach pedicular screw stabilization and kyphosis correction done. She had a dural leak intraoperatively, which was repaired. But she developed meningitis which was managed with antibiotics. Subsequently patient improved for pain and neurology

**Conclusion:** In traumatic spine, laminectomy alone without fixation is contraindicated. This is especially true for pediatric spine injuries. Surgical correction of these kyphotic deformities is associated with higher complication rates

## P75

**Dr. Vivek Mittal**

### FALLING NECK IN A PATIENT WITH NEUROMUSCULAR SCOLIOSIS – A CASE REPORT

**Background:** In progressive neuromuscular scoliosis it is essential to maintain the functional status of the patient

**Objectives:** To report a case of neuromuscular scoliosis who had a falling neck and was treated with corrective surgery and fusion

**Case Report:** Male of 21 years. Patient noted deformity in back before 10 years and was progressive. Gradually his head starting tilting upwards due to which he had to stoop forwards to maintain the forward gaze. Initially he was managed with brace. On examination, neck in mild extension, neck flexion restricted. Left shoulder at higher level. He had grade 4 power in all limbs. Radiographs showed double major curve which was rigid in bending. MRI showed no anomaly. Muscle biopsy showed inflammatory changes. Occiput to L5 stabilization done, partial correction of scoliosis achieved and posterior bone grafting done. Head was fused in maximal flexion. Patient

improved for his gait and could walk with his head upright , no longer had to support his head and could walk without stooping

**Conclusion:** It is important to assess the patient's complaints in cases of neuromuscular scoliosis without which patient may end up worse after surgery

## P76

Ms. Parneet Kaur Bedi, Dr. Narkeesh Arumugam

**Title:** Role of spinal electrical stimulation in reduction of spasticity in sci patients :a literature review

**Methods and materials:** Books, articles and online journals -Spinal cord, Nature.com, PubMed,National Medical Library.

**Articles from authors :** Zeba E Vanek,Joyce Campbell,Sheriff M Elbaslouny,Vivan K Mushawar,Arjan vander Salm

**Abstract:** Spasticity is involuntary, velocity dependant, increase in muscle tone that results in resistance to movements. The condition may occur secondary to disorder or trauma such as spinal cord injury, brain injury, tumour, stroke or peripheral nerve injury.Despite successful reports of spasticity management by electrical stimulation over the past 246 years,this potentially effective and economical tool is often overlooked in clinical practice in favour of oral medications with serious side effects or surgical procedures.The authors critically review the neural mechanisms that may contribute to spasticity after spinal cord injury.Findings indicate that increased excitability of both motor neuron and interneuron plays important role in pathophysiology of spasticity.New interventions including forms of spinal electrical stimulation may reduce spasticity and its complications and lead to development of new criteria for spasticity management.

**Conclusion:** The Body of literature on electrical stimulation and spasticity management provides a rationale for relative merits of all strategies employed in spasticity reduction and optimal patient outcome.

**Keywords:** spasticity, spinal electrical stimulation,spinal cord injury.

## P77

DR Gururaj, Dr. Harvinder Singh Chhabra, Dr. Vivek Mittal, Dr. Ankur Nanda, Dr. Vikas Tandon, Dr. Darshan Gautam

**Title:- Andersons lesion in a Rheumatoid Arthritis patient-A rare case and literature review**

### **Introduction**

Since the first description in 1937 by Anderson of Anderson's lesion complicating ankylosing spondylitis, a few reports of such disco vertebral lesions appeared in the literature. It is most commonly known to occur in thoraco lumbar junction in

ankylosing spondylitis patients. But It is very rare to see Anderson's lesion in Rheumatoid Arthritis patients. Here we report a rare case of Anderson's lesion at L4-L5 in Rheumatoid Arthritis patient. Material and method A 48yr old woman known case of Rheumatoid Arthritis presented with back pain, who was thoroughly evaluated and treated.

#### **Case report:**

A 48 year old woman presented to us with back pain and radiculopathy in the distribution of L5 dermatome since 10yrs. Patient was known case Rheumatoid arthritis. Plain X ray revealed erosion and irregularity of the end plates of the L4-L5. MRI was done which showed signs of spondylodiscitis at L4-L5 with degenerative lumbar canal stenosis. Dynamic x rays done showed instability at the L4-L5, which explained her back pain. After confirmation of the diagnosis, she was advised for TLIF at L4-L5 with pedicle screw fixation. But patient refused surgery and wished to continue to be on thoraco-lumbar corset.

#### **Conclusion:**

Anderson's lesion is a very rare complication of Rheumatoid arthritis. Fixation with the fusion is the treatment of choice for symptomatic lesions.

### **P78**

**Mrs. Vicky Sigworth, Mr. Jonathan Sigworth, Mr. Dilip Patro**

#### **Title:- POST-HOSPITAL RESOURCES IN A DEVELOPING COUNTRY TO EMPOWER PEOPLE WITH SCI TO LEAD USEFUL LIVES**

The purpose of this study was to find cost-effective and replicable resources to empower SCI persons to live meaningful lives despite limited access to finances and outpatient programs. We followed ten tetraplegic patients in India for 2-4 years following their discharge from initial hospitalization; we present three of these patients in a 25-minute documentary film, "More than Walking". The film addresses the two major barriers to independent living that we found. One was the negative attitude of medical personnel and families toward the long-term prospects of patients. The second was unfamiliarity with available therapy and other resources. We found that the following resources were effective in overcoming these barriers: (1) access to active therapy and equipment; (2) encouragement and mentoring from the SCI community, typically through telephone or internet contact; (3) access to community and educational resources; (4) encouragement for families and communities to invest in patients' futures; (5) involvement in team sports; and (6) limited financial help from

local or international organizations to provide equipment, etc. We conclude that many more SCI patients in India could be living independent and productive lives. They need to be connected to existing resources, and they, their doctors, and their families need to know that it is possible for them to become a blessing rather than a burden. Financial support was from the International Humanitarian Foundation.

## **P79**

**Ms. Anteena Aziz**

### **Title:- Situation of Women with Spinal Cord Injury in Bangladesh**

The purpose of the study is to explore family & social attitudes towards women with spinal cord injury in Bangladesh.

#### **Objectives:**

To discover the challenges that women with spinal cord injury (SCI) face in their family, conjugal life and in their community.

#### **Methodology:**

To conduct this study a qualitative methodology was selected to explore the lived experience of women who have experienced a Spinal Cord Injury; twenty subjects were selected through convenience sampling from CRP, Mirpur, Dhaka & also from home visits at Manikgong & Norshingdhi. Data was collected through face to face, semi-structured interview. Interviews were transcribed and field notes taken to record non-verbal observations). Data was analyzed using a thematic coding system.

#### **Result:**

After reviewing the data from women with SCI in Bangladesh, it is evident that family, social and physical barriers play a vital part in restricting their re-integration into mainstream education and paid work. In Bangladesh, women with SCI are considered as economically unproductive and socially unacceptable. Problems arise in marriage & conjugal life due to culturally accepted superstition, folk believes and dowry system. As a result women with SCI are given lower priority in their own family & the community. It was found that this group of women experience both physical and emotional abuse.

#### **Conclusion:**

The life of women in Bangladesh is such that survival is a way of life. Bangladeshi women are confined by the unfair, unjust and undue freedom of male members of

their families. There has been much talk about improving the downtrodden position of women, equal rights for women, and so on. But still

there is far cry from anything like equality. Of course many development organizations are rendering services to this group. So, if these organizations remain patient, one day this dream become reality. To establish their (women with SCI) right these organizations have to fight against the destructive dowry system, the primitive judicial system and traditional superstition, folk belief because the victims of these underdeveloped systems are usually these women. Now it should be tried to find out the situation concerning women with SCI in Bangladeshi society from some of the socioeconomic phenomena.

## **P80**

**Ms. Sonia Goel, Mr. Nekram Upadhyay**

**Title:- HINDI TRANSLATION AND PSYCHOMETRIC PROPERTIES OF QUEBAC USER EVALUATION OF SATISFACTION WITH ASSISTIVE TECHNOLOGY (MOBILITY TYPES)AMONG PEOPLE WITH SPINAL CORD INJURIES.**

### **ABSTRACT**

#### **Objective:**

To translate the English version of Quebec user evaluation of satisfaction with assistive technology (QUEST 2.) to Hindi and evaluate its reliability and validity.

**Method:** The translation of Quebec User evaluation of satisfaction with assistive technology was performed according to the standard guidelines. Patients with spinal cord injury using different type of mobility devices rated their satisfaction with respect to 12 aspects on five point scale in the translated version of Hindi-QUEST. Content validity was tested by analyzing applicability of the 12 aspects. Within 48 hours subjects completed the QUEST-HINDI again to assess its test-retest reliability.

#### **Results:**

Content validity proves to be good for mobility type of assistive devices. The device subscale, service subscale and total Quest-Hindi scores achieved good test-retest stability (ICC scores were 0.82,0.82 and 0.90 respectively)

#### **Conclusion:**

QUEST-Hindi is a valid and reliable patient reported instrument for assessment of user

satisfaction (i.e clients with spinal cord injury using different type of mobility devices) with assistive technology.

## **P81,**

**Dr Gururaj, Dr. Harvinder Singh Chhabra, Dr. Vikas Tandon, Dr. Vivek Mittal, Dr. Ankur Nanda, Dr. Nishit Patel**

### **Title:- Sacral decompression a miraculous surgery**

A 36 year old female patient from Assam presented to us after three weeks of fall from height of 12 feet with not able to stand and not able to pass urine and stool. She was evaluated by doing CT scan and diagnosed to have a C-shaped Roy-Camille Type 2 sacral fracture with cauda equina syndrome with bilateral L5 transverse process fracture. As she was having severe pain while sitting, standing and turning in the bed she put on strict bed rest. As the patient was worried about the bowel bladder function they consulted for further management after thorough evaluation and consultation patient was taken to surgery and decompression by doing laminectomy of S2-S3 with removal of comminuted fragments was done. Intra op we found 2 lacerated nerve roots on left side and intact roots on right side. Post op she was put on intensive rehabilitation programme with bowel bladder training. She started having recovery in per anal sensation in within first week of decompression. She was mobilized and made to walk with walker support on eighth post op day.

## **P82**

**Ms. Anteena Aziz**

### **USE OF SPLINTS / ORTHOTICS IN SCI CARE IN BANGLADESH**

For the Rehabilitation of spinal cord injury individuals an Occupational Therapist can play an integral role in maximizing physical & psychological restoration as well as enhancing functional performance to an optimal level of independence (Colan, M. 2000). The aim of Occupational Therapy in rehabilitation of spinal cord injured patient is to maximize function according to the level of injury. There are many models, approaches and techniques used in rehabilitation of SCI. Among them splinting / Orthotics play a vital role to fully rehabilitate the SCI Tetraplegic patients. This poster will help to provide some information about the use of splinting / Orthotics in SCI care.

#### **Objectives :**

- " To deliver a brief description about splinting.
- " To identify the significance of splints for spinal cord injury.

" To explain the use of specific splints for specific neurological levels.

" To show how splinting can enhance functional performance in activities of Daily living (ADL's) across different neurological levels.

" To identify health professionals involved in splinting.

" To provide further reference about splinting and splinting materials.

### **Conclusion:**

Splinting / Orthotics are a vital part of SCI care for tetraplegic clients. Splinting / Orthotics also play a key role to complete the full rehabilitation program of SCI tetraplegic clients through preventing contracture or deformity, maintaining normal shape of the hand, keeping a functional position, developing tenodesis grip, maximizing the performance of ADL's ( such as by using a writing splint the client is be able to write independently ). But it is very important to be careful during the selection of specific splints / Orthotics according to the specific neurological level and the client's individual physical ability.

### **P83**

**Dr. Gururaj Sangondimath, Dr. H.S. Chhabra, Dr. Vikas Tandon, Dr. Ankur Nanda, Dr. Vivek Mittal, Dr. Darshan Gautam, Dr. Nishit Patel**

### **Title: AUTONOMIC DYSREFLEXIA DUE TO INJURY AT D12-A RARE PRESENTATION**

#### **INTRODUCTION :**

Autonomic dysreflexia is one of the potentially devastating complications of spinal cord injury if not recognized and treated properly at the earliest. Incidence of autonomic dysreflexia is 5.2 to 5.7% according to the available literature. Individuals with a spinal cord injury at the thoracic level T6 or above are generally at risk of developing autonomic dysreflexia, although cases involving injuries as low as T8 have been reported, but there is no case reports in the literature of autonomic dysreflexia caused by the injury of the cord at D12. Here we are reporting a rare case of Autonomic dysreflexia due to the injury at D12.

#### **CASE REPORT:**

Mr. Ravi Yadav ,36 years old male was admitted on emergency basis who was operated elsewhere for traumatic fracture D12 with paraplegia(ASIA-B) with bowel and bladder involvement which he sustained after RTA on 27/08/2009 . Patient was undergoing comprehensive rehabilitation and physiotherapy. Mean while he started having episodes of high blood pressure (200/100) ,with headache, nausea, sweating, restlessness since 01/02/2010 for which Cardiologist and Physician opinion was taken



and managed with antihypertensive and NTG. He was thoroughly investigated to rule out secondary hypertension by doing thyroid profile, ACTH, Catecholamine, urinary VMA, cortisol, CT abdomen to rule out Pheochromocytoma and thyrotoxicosis. But all the investigations were normal. There was no postural hypotension. We further evaluated him by taking thorough history and could relate his episodes being started after episode of constipation and need to stress more for passing stools. So after a comprehensive evaluation and discussion with all the specialities we came to the conclusion that he is suffering from Autonomic dysreflexia and he is being treated accordingly.

**Conclusion:** Even though Autonomic dysreflexia is common in spine injury above T6, it can present in spine injury as low as D12.

## **P84**

**Dr. Vivek Mittal, Dr. H.S. Chhabra, Dr. Gururaj Sangondimath**

**Title: Traumatic spondyloptosis of the thoracolumbar spine**

### **OBJECTIVE :**

Traumatic Grade V thoracolumbar spondyloptosis are uncommon spinal injuries. These injuries are uncommon and there is paucity of literature on these devastating injuries.

### **METHODS:**

The authors undertook a retrospective review of a tertiary care regional spinal cord injury patient population treated over a 5 year period (2005-2010). They analyzed data regarding age, sex, mechanism of injury, associated injuries, neurological status, treatment and complications.

### **RESULTS:**

Four patients were identified (3 men and 1 women) with ages ranging from 15 to 57 years. All patients had sustained high-energy closed spinal injuries: 3 motor vehicle accidents, 1 injured by fall of heavy object. All patients had complete deficit (ASIA A). Two had sagittal-plane spondyloptosis- at D9-D10 and D11 -D12; two had coronal plane spondyloptosis- at L2-3 in all. All patients had sustained concurrent multisystem trauma including chest injury in 3, head injury in 3, limb fractures in 1. All patients underwent surgery in form of posterior pedicle screw stabilization and bone grafting. 1 patients developed postoperative wound infections.

### **CONCLUSIONS:**

Traumatic thoracolumbar spondyloptosis is an uncommon injury. They are frequently devastating usually complete injuries with multisystem trauma, higher complication

rates and even end up with mortality. Surgical reconstruction and stabilization allow for early mobilization and rehabilitation.

## **P85**

**Dr. Vivek Mittal, Dr. H.S. Chhabra, Dr. Gururaj Sangondimath**

### **Title : Misjudged C2 fracture - A case report**

#### **Background:**

The management of C2 fractures depends on the precise location and anatomical pattern of the fracture. Failure to understand the pattern can lead to poor fixation of the fracture. Objectives: To report a case of misjudged C2 fracture pattern with resulting improper fixation. Case Report: Male of 31 years had history of fall from height while going in a car. Had fracture of C2 with D3 vertebra without deficit. Was investigated with CT scan and MRI. It was concluded from the CT scan that the fracture of C2 was through the body and not through base of odontoid. Subsequently was operated and C2-3 discectomy, grafting and plating was done along with posterior pedicle screw stabilization of fracture D3. Postoperatively on flexion and extension films, there was C1-2 instability due to a type 3 odontoid fracture. On retrospective inspection of the MRI it was realized that actually it was a type 3 odontoid and not a body fracture of C2. Then patient was immobilized with a halo vest. On follow up the patient did well and his odontoid fracture united at 3 months.

**Conclusion:** In traumatic spine injuries careful analysis of the preoperative films is necessary and would help to plan the fixations properly.

## SCS POSTERS

**P86**

**Dr. Vivek Mittal, Dr. H.S. Chhabra, Dr. Gururaj Sangondimath**

**Title: Mismanaged pediatric cervical spine injury - A case report**

**Background:**

Pediatric spinal injuries are an uncommon occurrence . Cervical spine is the most common location for spinal injuries in children. Objectives: To report a case of mismanaged cervical spine injury in a child of 6 years.

**Case Report:**

Male of 6 years had history of fall from height while going in a car. He developed neck pain with upper limb radiation with torticollis. He was taken to a local hospital where he was investigated with X rays, CT scan and MRI. He was diagnosed there with a C4-5 unifacetal dislocation and C5-6 subluxation. He was given cervical traction. Patient obtained some symptomatic relief and was subsequently discharged. When patient presented to us at 3 weeks, he had a stiff neck with torticollis with radicular pain with C5 grade 4 power. On a fresh Xray there was persistent subluxation at both levels. He was advised surgery as the torticollis was not acceptable to the parents. He underwent anterior C4-5 , C5-6 discectomy ; followed by posterior unilateral facetectomy at C4-5. Reduction was done . Then in the same sitting he was fixed anteriorly with a locking cervical plate from C4 to C6 and bone grafts were kept for fusion. Postoperatively patient was relieved of torticollis and radicular pain and regained full power in C5 at 6 weeks follow up. Postoperative Xrays showed good alignment with reduction of subluxation at both levels . Conclusion: Proper analysis of investigation and films is necessary in all patients with spinal injuries especially in pediatric patients , in whom there is a high incidence of missed injuries. Subsequent follow up after primary management is very essential so as to avoid long term disability. In the present case we could fortunately get a good clinical and radiological outcome even after 3 weeks , which is not always the case.

**P87**

**Dr. Vivek Mittal, Dr. H.S. Chhabra, Dr. Gururaj Sangondimath**

**Title: Progressive cervical kyphosis in an operated patient of neuromuscular scoliosis - a case report**

**Objective:**

To report a case of progressive cervical kyphosis with progressive neurological

deterioration in a patient who was operated for neuromuscular scoliosis.

#### **Case Report:**

Male of 15 years presented to us increasing scoliosis. He was a known case of post polio paralysis in childhood. He had thoracolumbar kyphoscoliosis with Cobb angle of 135 degrees. He was operated and D2 to L5 scoliosis correction, pedicle screw fixation and fusion was done. Postoperatively patient had normal neurology. On the third day he developed sudden deterioration in upper and lower limb power. MRI showed the presence of epidural hematoma in the cervical spine. He was decompressed with a laminectomy, but no hematoma was found, only a leash of vessels was found. But patient failed to improve neurologically. On progressive MRIs there was increase in kyphosis of cervical spine. He had further neurological deterioration after 6 months. He was then operated and fixed from C2 to T1 with C4 and C5 corpectomy with plating anteriorly and deformity correction. The patient improved neurologically postoperatively. On retrospective analysis it was concluded that it was the increase in the cervical kyphosis subsequent to the decrease in the thoracolumbar kyphosis which was responsible for the neurological deterioration primarily and not the epidural hematoma.

#### **Conclusion:**

This case highlights an unusual case of progressive cervical kyphosis secondary to kyphoscoliosis correction, which should be considered in case of postoperative neurological deterioration.

#### **P88**

**Ms. Shikha Bhat \***

#### **Title: PSYCHOSOCIAL INFLUENCE OF WHEELCHAIR TRAINING IN TRAUMATIC SPINAL CORD INJURED**

**Background and Purpose:** Psychosocial epidemiology explores the way people interact with their social environments may influence health either directly through biological responses to what is commonly called stress or indirectly through health behaviors. People with spinal cord injury rely on assistive technology, and especially their wheelchair, to engage in many of life's activities. Unfortunately, wheelchair users frequently encounter environmental obstacles that limit their opportunities. So, the purpose of this study was to evaluate the effect of wheelchair training on psychosocial impact of using wheelchair in traumatic spinal cord injured subjects.

#### **Subjects and Methods:**

The study was done on thirty-five traumatic spinal cord injured subjects, conducted at

Indian Spinal Injuries Centre, New Delhi. Subjects were assessed for psychosocial impact of assistive devices score and wheelchair skill test scores pre and post (four weeks) wheelchair training. Wheelchair training was given to the subject under the supervision of certified trainer till the subject learned and performed the skill proficiently. For further analysis subjects were divided into four groups. Main Outcome Measures: psychosocial impact of assistive devices scale (Version 4.2b) and wheelchair skill test (version 4.1).

#### **Results:**

Paired 't-test' was applied for pre- and post analysis of psychosocial impact of assistive devices (version 4.2b) and wheelchair skill training scores (version 4.1). The main finding of this study suggested that there is statistically significant difference among psychosocial impact of assistive devices competence, adaptability and self esteem scores after wheelchair training in traumatic spinal cord injured manual wheelchair users. Also, wheelchair skills test score was significantly improved after the training. One way analysis of variance (ANOVA) was applied for between group analysis, showed significant difference between groups on psychosocial impact of assistive devices scale.

#### **Conclusion:**

Wheelchair training is effective in improving psychosocial impact of wheelchair in traumatic spinal cord injured subjects.

Keywords: psychosocial influence, wheelchair training, traumatic spinal cord injured

### **P89**

**Firas Sarhan<sup>1</sup>**

**Title : Pressure ulcer risk factors in persons with Spinal Cord Injury at acute and rehabilitation stages**

#### **Introduction**

Pressure ulcers are a common complication following a spinal cord injury (SCI). Good prevention requires the identification of individuals who are at risk for developing this complications. The risk factors that correlated with the SCI patients medical care management during the acute stage of a SCI as well as the rehabilitation stages are essentially linked to care management and treatment modalities. Risk assessment scales used nowadays were designed on pathophysiological concepts and are not SCI specific [1]

## Methods

Systematic review of literature and retrospective study was carried out. To determine pressure ulcers risk factors correlated to the patients with SCI, medical care management during the acute as well as in rehabilitation and chronic stages. The medical and nursing records of 100 completed first admissions for traumatic SCI were examined.

## Results

The majority of patients were male, with an average age of 40 and the average length of time between injury and discharge was 155 days. Third of the patient were neurologically complete SCI. The results show that there were 15 pressure ulcers grade 1, 18 pressure ulcer grade 2 and 13 pressure ulcers grade 3 on admission. Some patients appear to have more than one pressure ulcer. Sixty five percents of patients were cervical injuries. Potential risk factors identified as sociodemographic, neurological, functional, clinical, medical management and biological.

## Discussion

The main methods used here describe the risk of any newly injured SCI patient suffering from a pressure ulcer during the period between injury and initial discharge from spinal units. Retrospective record review is the only practical way of obtaining such data[2]. The risk factors at acute stage do not appear to be related to the clinical variables. Medical care management appear to have an unsuspected impact on the onset of a pressure ulcer.

## Clinical relevance

This study was able to demonstrate the pressure ulcer can have a serious consequences on the individual life, long of stay in hospital and involvement in the community at a vocational and educational level. Measures need to be taken to reduce the time acute SCI patients spend in referring units prior to transfer to the spinal injuries unit. Need for improved links between referring hospital and accepting spinal units.

## P90

### HEALTH-RELATED PROBLEMS AND EFFECT OF SPECIFIC INTERVENTIONS IN SPINAL CORD INJURY - AN OUTCOME STUDY IN NORTHERN INDIA

**Roop Singh, Rajesh K. Rohilla, Ramchander Siwach, Satyavir S. Dhankar, Narender K. Magu, Sukhbir S. Sangwan**

**Aim:** To assess the long-term health-related problems of patients with SCI, to develop specific strategies targeted to minimize these problems, and to assess the effect of these interventions on long-term problems of SCI patients.

**Method:** Fifty persons with spinal cord injury (SCI) were surveyed for various secondary medical problems, specific interventions were carried out to ameliorate them, and follow-up assessment was performed 6 months later to examine the impact of these over time.

**Results:** At mean 3.7 years post SCI, bladder problems (44%), neuropathic pain (42%), bedsores (36%) and spasticity (60%) were the major secondary medical problems and were responsible for medical interventions or hospitalization in the participants. Specific interventions directed towards minimizing health-related problems in SCI population were effective in terms of minimizing the intensity and incidence at 6 months follow-up survey. Ninety-two percent of the patients in the present study were either very satisfied or satisfied with the specific interventions.

**Conclusion:** The present study highlights that incidence of secondary medical problems in SCI population is high compared to the western world and this issue needs an urgent attention. The outcomes of this study further substantiate that by paying attention to general principles of care for paraplegics and by developing specific strategies targeted to minimize these health-related problems, persons involved in management and rehabilitation of SCI population can reduce the incidence and intensity of secondary medical problems.

**Keywords:** Spinal cord injury; pressure sores; health-related problems; urinary tract infections; spasticity; rehospitalisation; orthostatic hypotension; bladder and bowel problems.

## **P91**

### **LONGITUDINAL STUDY OF BONE MINERAL DENSITY AND BIOCHEMICAL MARKERS OF BONE TURNOVER AFTER SCI**

**Roop Singh, Gaurav Saini**

**Purpose:** Spinal Cord Injury (SCI) causes immediate & in some regions permanent gravitational unloading. Osteoporosis in SCI patients is generally considered due to disuse, although other facts in pathogenesis, neuronal lesion & hormonal changes also seemed to be involved in this process. We evaluated Bone mineral density (BMD) using DEXA and biochemical markers of bone turnover during first year of SCI.

**Methods:** 106 patients with SCI (ASIA A & B) were enrolled, 11 patients died & 15 patients could not complete 1 year follow up leaving 80 patients for final 1 year evaluation. 44 patients showed some motor recovery (ASIA C & D) & 36 patients did not have any motor recovery (ASIA A & B). BMD was estimated by DEXA; serum calcium, phosphorus, creatinine and alkaline phosphatase; and 24 hours urinary

calcium, phosphorus and creatinine were estimated at initial presentation 3, 6 & 12 months.

**Results:** There was significant decrease in BMD below the level of injury with maximum decrease in the proximal tibial epiphysis (28%;  $p < 0.001$ ) at one year. Other sites like hip (20.2%;  $p < 0.05$ ), distal tibial epiphysis (24%;  $p < 0.01$ ), and 10% at tibial diaphysis also showed decrease in BMD. Hip spine dissociated demineralization with BMD well preserved in lumber spine was observed. There was no difference in BMD of lower limb and spine in tetraplegics versus paraplegics, however BMD in distal end of radius was significantly lower (25%;  $p < 0.05$ ) in tetraplegics. Patients with motor-complete injuries showed significant difference in BMD at hip ( $p < 0.05$ ) & proximal tibial epiphysis ( $p < 0.05$ ). Serum calcium and phosphorus were normal; alkaline phosphatase was raised significantly. There was no correlation between lower extremity BMD and calcium, phosphorus and alkaline phosphatase. 24 hours urinary calcium and phosphorus values were not significantly different from initial values compared to the values at one year ( $p > 0.05$ ).

**Conclusion:** The present study corroborates that there is rapid deterioration in bony architecture which is influenced by the severity of injury in the first year of SCI. Trabecular bone is most susceptible to these changes. Proximal tibial epiphysis shows maximum deterioration. However, biochemical markers of bone turnover except for serum alkaline phosphatase did not significant rise during first of injury. It is better to plan strategies aimed at reducing this relative decrease in BMD early in the course of injury.

**Funding support:** None



### Autologous mucosal transplant in chronic spinal cord injury: an Indian Pilot Study

HS Chhabra<sup>1</sup>, C Lima<sup>2</sup>, S Sachdeva<sup>3</sup>, A Mittal<sup>4</sup>, V Nigam<sup>1</sup>, D Chaturvedi<sup>5</sup>, M Arora<sup>6,7</sup>, A Aggarwal<sup>8</sup>, R Kapur<sup>9</sup> and TAH Khan<sup>1</sup>

<sup>1</sup>Spine Service, Indian Spinal Injuries Center, Vasant Kunj, New Delhi, India; <sup>2</sup>Neuropathology Laboratory, Department of Neurology, Hospital de Egas Moniz, Lisbon, Portugal; <sup>3</sup>Department of ENT Surgery, Fortis Hospital, Noida, Uttar Pradesh, India; <sup>4</sup>Department of ENT Surgery, Modi Hospital, Saket, New Delhi, India; <sup>5</sup>Department of Neurosurgery, Indian Spinal Injuries Center, Vasant Kunj, New Delhi, India; <sup>6</sup>Research Department, Indian Spinal Injuries Center, Vasant Kunj, New Delhi, India; <sup>7</sup>Rehabilitation Department, Indian Spinal Injuries Center, Vasant Kunj, New Delhi, India; <sup>8</sup>Department of Radiology, Indian Spinal Injuries Center, Vasant Kunj, New Delhi, India and <sup>9</sup>Department of Radiology, Goyal MRI and Imaging Centre, Safdarjung Enclave, New Delhi, India Study design: Prospective Pilot Study.

**Objectives:** To determine the safety and feasibility of autologous olfactory mucosal transplantation into the spinal cord in chronic spinal cord injured using the technique developed by Carlos Lima et al.

**Setting:** Spinal Injury Center, New Delhi.

**Methods:** Five chronic, motor complete, traumatic spinal cord injury (SCI) patients with neurological level C5–T12 underwent the procedure. Participants were assessed at baseline and at 6 monthly intervals. Safety and tolerability were evaluated through monitoring for any adverse events and tests including magnetic resonance imaging (MRI) evaluation. Efficacy assessment was done through neurological, functional and psychological evaluation, electrophysiological studies and urodynamics.

**Results:** Surgery was tolerated well by all American Spinal Injury Association (ASIA) Impairment Scale (AIS) A participants. The only AIS B participant lost sensory scores significantly after surgery but is gradually regaining it. MRI evaluation revealed a syrinx

Correspondence: Dr HS Chhabra, Spine Service, Indian Spinal Injuries Center, Vasant Kunj Sector-C, New Delhi 110070, India.

E-mails: drhschhabra@isiconline.org, issicon@isiconline.org

Received 13 October 2008; revised 23 March 2009; accepted 8 April 2009;

published online 2 June 2009

in one participant and increase in length of myelomalacia in four participants. There were no other adverse findings on MRI evaluation. There was no significant improvement in any of the neurological, electrophysiological or urodynamic efficacy variables. Statistically significant improvement was seen in functional scores as evaluated by Spinal Cord Independence Measure, Beck Depression Inventory scores and life impact scores on International Spinal Cord Injury Scale.

**Conclusions:** The procedure is relatively safe and feasible in AIS A participants with thoracic level injuries at 18 month follow-up. No efficacy could be demonstrated which could be attributed to the procedure. *Spinal Cord* (2009) 47, 887–895; doi:10.1038/sc.2009.54; published online 2 June 2009

**Keywords:** spinal cord injury; chronic; human trial; autologous mucosal transplantation

## Introduction

The enthusiasm of the media for the potential clinical benefits of cell transplant technologies has generated increased interest by people living with a spinal cord injury (SCI) for obtaining a 'cure'. In turn, the relative ease of cell culture technologies has led a number of professionals to offer various forms of cellular therapies as treatment for SCI and many other neurological disorders. There is concern within the medical and scientific community about the current validity of these technologies as therapeutic treatment for SCI. To date, there is no evidence of any cellular transplant for SCI having completed a valid clinical trial program. Amongst the few published human clinical studies<sup>1–9</sup> most have either been pilot studies or had limitations with respect to the study design, number of participants and/or duration of follow-up. This prompted us to plan a more rigorous human study to assess outcomes after cell transplant in participants with complete motor loss after SCI (American Spinal Injury Association (ASIA) Impairment Scale (AIS) A and B).

There are enough scientific publications to suggest that cell transplants can promote functional benefits in animal models of SCI. Several studies have used autologous olfactory ensheathing glial cells (OECs) to promote spinal cord repair.<sup>10,11</sup> These cells have similar properties to Schwann

cells and developmentally promote and guide the growth of axons.<sup>12</sup> They also have the unique property of residing both within and outside the central nervous system.<sup>13</sup> This may be the reason for the increasing use of OECs for various preclinical studies in the last 10 years.<sup>14</sup> OECs can be extracted in a relatively simple and reliable manner from the olfactory mucosa.<sup>15</sup> Olfactory mucosa also has 'stem-like progenitor cells'<sup>16</sup> which have been suggested to be useful in neural repair.<sup>17</sup> In addition, growth factors

within the connective tissue layers of the mucosa have been demonstrated to support neuronal multiplication and differentiation.<sup>18</sup> Studies have suggested that transplantation of olfactory mucosal tissue gives results similar to transplantation of purified populations of OECs<sup>19</sup> or stemlike progenitor cells.<sup>20</sup> In a recent rat study, Iwatsuki et al.<sup>21</sup> have demonstrated that transplantation of olfactory mucosa containing OECs can repair the injured spinal cord.<sup>21</sup> Advantages of using autologous olfactory mucosal transplant as a source of cells and other factors for enhancing neurological recovery after SCI have been highlighted comprehensively by Lima et al.<sup>2</sup>

Three of the few published human clinical trials used cultured fetal OEC transplantation,<sup>4–6</sup> one has been a phase I/II a trial using cultured autologous OECs<sup>1</sup> and one other has been a pilot study which demonstrated the safety and feasibility of autologous olfactory mucosal transplant.<sup>2</sup>

We decided to study the outcomes in chronic SCI (CSCI) after autologous olfactory mucosal transplantation into the spinal cord following detethering of the cord using the technique developed by Lima et al.<sup>2</sup> Both detethering of spinal cord and rehabilitation have been known to independently influence neurological recovery after SCI.<sup>22</sup> Thus, a randomized double blind study was planned to compare the outcomes of three groups—those undergoing detethering of the spinal cord, olfactory mucosal transplantation and rehabilitation; those undergoing detethering of the spinal cord and rehabilitation; those undergoing rehabilitation alone without any surgical intervention.

As a prelude to the study, a pilot study was conducted to determine the safety and feasibility of autologous olfactory mucosal transplantation therapy in India. This is a report of the pilot study.

## **Materials and methods**

### ***Inclusion and exclusion criteria***

Inclusion Criteria: AIS A or AIS B traumatic SCI, neurological level C5–T12, aged between 18 and 40 years with CSCI more than 18 months after injury were eligible for this study if the length of spinal cord lesion as revealed on the magnetic resonance imaging (MRI) was less than 3 cm for cervical level injury and 4 cm for thoracic level injury in patients less than 35 years of age, and less than 2 cm for cervical level injuries and 3 cm for thoracic level injuries for participants between 35 and 40 years of age.

As the amount of autologous mucosa that can be harvested is limited, participants with myelomalacia only up to a certain defined length were included in the study.

Large areas of olfactory neuroepithelium are replaced by respiratory epithelium in adults.<sup>23</sup> Hence, participants, with spinal injury, less than 40 years of age only were included in our study. The same was the rationale for defining a smaller length of myelomalacia as inclusion criteria for participants aged between 35 and 40 years as opposed to participants less than 35 years of age.

Exclusion criteria: Participants with neurological level of injury above C4 and below T12; with inoperable nasal obstruction, more than 15 years after injury; with lower motor neuron injury; with pathological fracture; with ankylosing spondylitis; of less than 18 years or more than 40 years of age; with preexisting severe medical disease (severe diabetes, rheumatoid arthritis), which would effect the outcome; with psychological disorders, pregnancy or medical conditions requiring mechanical ventilation were excluded from the study.

### ***Surgical procedure***

The human surgical procedure of autologous olfactory mucosal transplantation was first developed by Carlos Lima and his colleagues.<sup>2</sup> These investigators provided guidance for the surgical procedures in this study and the procedures on the first three participants were performed in their presence. Prophylactic antibiotic (Cefazolin 1g IV) was given shortly before surgery and repeated once during surgery at 3 h. Surgery was performed under general anesthesia with endotracheal intubation with controlled ventilation. A lumbar intrathecal catheter was placed under fluoroscopic control before surgery to facilitate the healing of the dural surgical wound by reducing cerebrospinal fluid (CSF) pressure.

The surgical procedure was performed in three steps. The injured part of the spinal cord was exposed by the spinal surgeons via a standard posterior midline incision, posterior laminectomy and opening of the dura mater.

'Detethering' of the injured cord region was performed with use of a standard surgical microscope and involved removing any adhesions. Scar tissue at the lesion site was then removed to expose the residual spinal tissue on both sides. This left a cavity in the spinal cord at the site of the injury.

The surgical wound was then temporarily closed. The ENT surgeon then harvested the olfactory mucosal graft through a transnasal endoscopic approach. After cleaning the nasal and olfactory space with povidone-iodine solution, vasoconstrictors were injected into the mucosa.

A submucoperiosteal tunnel was created in the most posterosuperior region of the medial (septal) side of the olfactory groove, and sufficient tissue was collected to fill

the spinal cord cavity, and to enable subsequent histological examination, rough estimation of number of cells implanted and microbiological assessment. The amount of olfactory mucosal tissue collected depended on the length of the lesion and the cavity left after scar removal in that particular participant.

A pack was placed in the olfactory groove to reduce postoperative nasal bleeding. Before implantation, the graft was simply rinsed in CSF collected from lumbar drain and cut into small pieces to increase the surface area of the grafted tissue. It was then transplanted into the previously prepared spinal cord cavity at the site of injury. Closure was done using standard procedures.

The lumbar drain was removed on the third day. Participants were discharged from the hospital 7–10 days following surgery when they had recovered physical abilities to a level similar to that before surgery. All participants were carefully instructed to follow a defined and standardized physical rehabilitation program and have follow-up assessments every 6 months up to 24 months after surgery.

### ***Outcome measures***

**Safety variables.** Safety and tolerability were evaluated through monitoring of any intraoperative or postoperative adverse event (especially an increase in neurological deficit, any sign of aseptic/septic meningitis, rejection of the graft, decreased functional olfaction, neuropathic pain and others), vital signs, systemic examination and changes in hematology, serum chemistry, urine analysis and CSF tests.

All adverse events occurring during this study were separated into those due to systemic complications associated or unassociated with spinal injury, those due to surgery and idiopathic.

A sample of olfactory mucosa harvested during surgery was sent for histological and microbiological (viral, bacterial and fungal cultures) examination as well as quantification of cells comprising the tissue transplant. Estimation of the number of cells transplanted was to be done using a Flow Cytometer. However, difficulty was faced in doing this because the amount of olfactory mucosa that can be harvested is limited and the sample tissue available after transplantation was not enough. Only a rough estimation of the number of cells transplanted could be done by a Neubauer chamber.

MRI was done at each follow-up to look out for infection, hemorrhage, cyst/syrinx, tumor and increase in myelomalacia.

Healing of the nasal cavity (tissue donor region) was evaluated through endoscopic

examination at 6-month follow-up.

**Efficacy end points.** The Primary efficacy end point was to monitor for improvement in the AIS of at least one grade by 2 years (for example, conversion from AIS A to AIS B or better) or a change from baseline of X6 points in total ASIA motor score.

The secondary efficacy endpoints was the change in ASIA sensory examination, any voluntary movement by additional muscle groups not included in International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI), Walking Index of Spinal Cord Injury (WISCI), Modified Ashworth Spasticity Scale, Spinal Cord Independence Measure (SCIM), psychological evaluation by Beck Depression Inventory (BDI), electromyography (EMG), nerve conduction velocity (NCV), somatosensory evoked potential (SSEP), motor-evoked Potential (MEP), Urodynamic study and International Spinal Cord Injury Scale (ISICIS). Electrophysiological tests were done for all four limbs in tetraplegics and both lower limbs in paraplegics.

**Assessments.** The same assessor/reviewer were used throughout the study to obviate inter-rater variability. Neurological and functional evaluations were done by a trained physiotherapist and the findings reviewed by another senior physiotherapist. Electrophysiological and urodynamic studies were done by the same neurologist and urologist, respectively, whereas psychological assessment was done by the psychologist. MRI was reported by the same radiologist but the findings were validated by another radiologist.

Table 1 depicts the protocol for evaluation and assessment of the participants enrolled in the study.

Wilcoxon signed-rank test was used to assess the statistical significance of study parameters.

The study was approved by the Institutional Ethics Committee and the Indian Council of Medical Research, Govt of India. It was monitored by an international clinical advisory panel. We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research.

## **Results**

### ***Participant data***

Five participants met the eligibility requirements and were enrolled for this study (details in Table 2). The first procedure was done on 20 November 2006 and the last on

Follow-up data are available up to the eighteenth month after the procedure (third follow-up visit) for four participants and sixth month after the procedure (first follow-up visit) for one participant. However, one of the participants (participant 4) did not come for the follow-up at 6 months and 12 months after procedure but came subsequently for the eighteenth month follow-up.

### **Safety variables**

Viral, fungal and aerobic culture of the harvested material revealed positive culture for Epstein–Barr virus and *Alcaligenes* species in participant 1. Participant 3 had positive culture for *Aspergillus niger*. As the amount of autologous material harvested for transplant was barely enough to fill the cavity in the spinal cord in participant 4, a sample could not be spared for culture or cell quantification. A rough quantification of number of cells transplanted, as estimated in Neubauer chamber, is shown in Table 2.

Safety data revealed that surgery was tolerated well by all participants. None of the participants developed any graft-related problems at the donor or the recipient site, decrease in olfaction or signs and symptoms of meningitis. The participant who tested positive for Epstein–Barr virus and *Alcaligenes* species in the transplanted material, also developed serous discharge from the surgical site. The discharge was sterile and secondary closure was done at 3 weeks.

One participant had mild increase in neuropathic pain as revealed by ISCIIS evaluation.

MRI evaluation did not reveal any infection, hemorrhage, tumor cells or increase in cord diameter in any of the participants. A syrinx of 2.2 cms was noticed in one participant (participant 4) at 18-month follow-up. The length of myelomalacia increased in 4 participants (2, 3, 4, 5) as is evident from the details depicted in Table 3. Serial MRIs of participant 3 are depicted in Figure 1.

### **Efficacy end points**

Total ASIA motor scores of participants are depicted in Figure 2. None of the participants had a significant improvement in motor score. The increase in motor score of 4 points in participant 2 was due to increase in power in upper limb muscles, which had some power before. None of the muscles, which had a motor score of 0 at baseline showed any recovery.

There was no improvement in voluntary movement of any additional muscle group not included in ISNCSCI. Only one participant (2) improved by 1 point (from 0 to 1) on the

Table 1 Protocol for evaluation and assessment

Particulars	Prescreening	Screening	Timeline	Day of surgery	Month 6	Month 12	Month 18	Month 24
Demography/medical history	X	X	X		X	X		X
Inclusion-exclusion criteria	X	X	X	X				
Informed consent	X							
Physical examination	X	X	X	X	X	X	X	X
Vital Signs	X	X	X	X	X	X	X	X
Screening MRI/CT/myelogram of spinal cord					X	X	X	X
MRI of both thighs	X				X	X	X	X
EMG of four limbs	X				X	X	X	X
CT scan of nasal sinuses	X	X			X	X	X	X
Psychological assessment					X	X	X	X
Urodynamics study					X	X	X	X
SSEP					X	X	X	X
MEP					X	X	X	X
Preoperative Lab tests					X	X	X	X
PRO questionnaire					X	X	X	X
ISNCSCI examination	X				X	X	X	X
Voluntary movement in additional muscle groups not included in ISNCSCI	X	X	X		X	X	X	X
Modified Ashworth scale	X	X	X		X	X	X	X
WISC	X	X	X		X	X	X	X
SCIM	X	X	X		X	X	X	X
Investigational surgery				X				

Abbreviations: CT, computerized tomography; EMG, electromyography; ISNCSCI, International Standards for Neurological Classification of Spinal Cord Injury; MEP, motor evoked potential; MRI, magnetic resonance imaging; PRO, patient-reported outcome; SCIM, Spinal Cord Independence Measure; SSEP, somatosensory evoked potential; WISC, Walking Index of Spinal Cord Injury.

Vital signs include oral body temperature, systolic and diastolic blood pressure in sitting and supine position, and pulse rate.



Table 2 Data for all participants at baseline and 6 monthly follow-ups

Participant	Age (years)	Sex	Date Of injury	Vertebral level of injury	Previous surgery	Months after injury	Date of surgical procedure	Number of cells transplanted
1	38	M	19 June 2002	T7	Harrington instrumentation	48	20 November 06	9.3 × 1 000 000
2	23	M	06 June 2004	C6	Cervical locking screw plate system	29	21 November 06	13.6 × 1 000 000
3	26	M	25 July 2004	T6	Pedicle screw rod instrumentation	29	21 November 06	17.28 × 1 000 000
4	26	M	09 November 1998	T5-T6	Harrington instrumentation	99	5 January 07	Not enough sample available for tests
5	21	M	24 December 2005	T10	Anterior decompression and screw plate fixation	36	17 January 08	15.36 × 1 000 000

Table 3 Length of myelomalacia (cm) of all participants at baseline and 6 monthly follow-ups

Participant	Baseline	6 months	12 months	18 months
1	3.2	3.2	3.2	3.2
2	1.9	2.7	2.7	2.7
3	3.5	6.3	5.9	5.9
4	3.8	—	—	5.0
5	1.9	3.3	—	—

WISCI scale. Spasticity, as assessed by Modified Ashworth Spasticity Scale, decreased by two grades in one participant and one grade in three participants.

The details of sensory scores for light touch and pinprick are provided in Figures 3 and 4, respectively. The slight improvement in scores in participants 1, 3 and 4 were in the zone of partial preservation (ZPP). However, it reduced in two participants. The significant reduction of score by 38 points in participant 2 resulted in loss of one grade on AIS



Figure 1 Magnetic Resonance Images of the spine of participant 3: (a) Sagittal T2-weighted image at baseline, (b) Sagittal T2-weighted image 6 months posttransplantation, (c) Sagittal T2-weighted image 12 months posttransplantation, (d) Sagittal T2-weighted image 18 months posttransplantation.

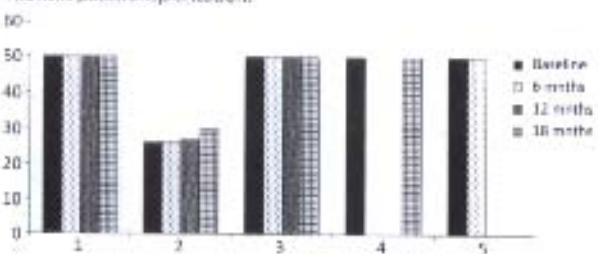


Figure 2 American Spinal Injury Assessment (ASIA) Motor Scores of all participants at baseline and 6 monthly follow-ups.

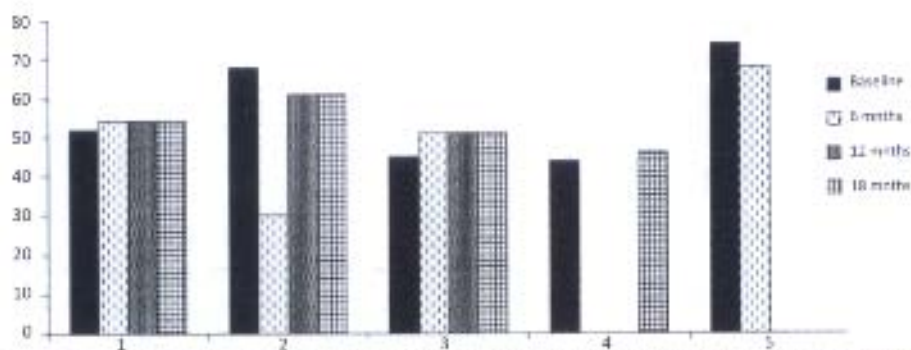


Figure 3 International Standards for Neurological Classification of Spinal Cord Injury Sensory Examination (light touch) of all participants at baseline and 6 monthly follow-ups.

Scale (AIS B at baseline to AIS A). Though sensory scores are gradually recovering in participant 2 and have reached almost preoperative levels at latest follow-up, there is still no recovery in S4/5 segments. SCIM scores improved in all five participants (details in Figure 5). The results of psychological assessment as done by BDI are provided in Table 4.

Three participants reported slightly better and two reported slightly worse outcomes on ISCIS (details in Table 5). There was no change in EMG, SSEP or MEP in any of the participants. There was no significant change in any variables of the urodynamic assessment in all participants, except for reduced compliance in two participants.

## Discussion

The procedure of autologous olfactory mucosal transplantation was tolerated well and there were no major adverse events except for MRI findings of syrinx formation in one participant and increase in length of myelomalacia in four participants. It appears to be a feasible procedure and was relatively safe in AIS A participants up to an 18-month

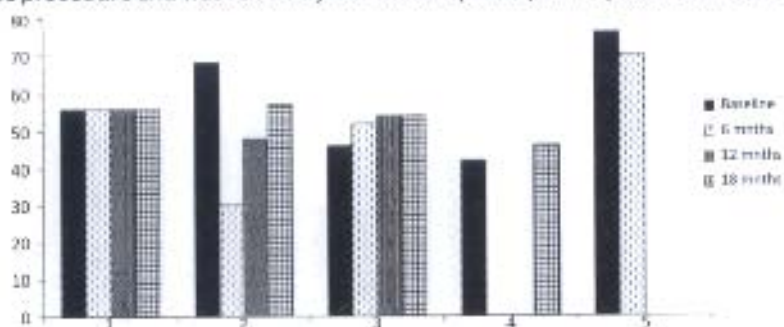


Figure 4 International Standards for Neurological Classification of Spinal Cord Injury Sensory Examination (pinprick) of all participants at baseline and 6 monthly follow-ups.

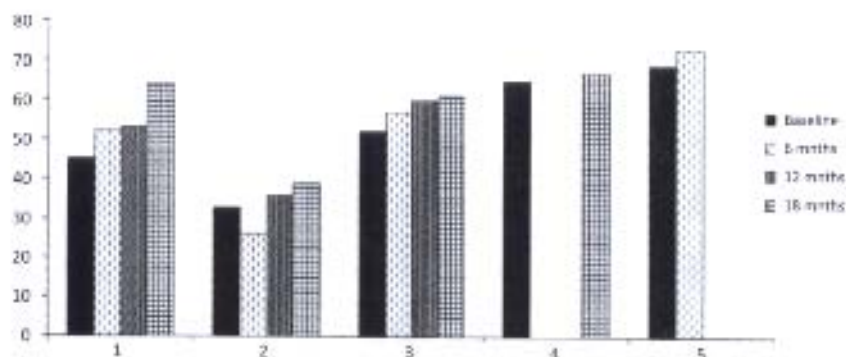


Figure 5 Spinal Cord Independence Measure (SCIM) of all participants at baseline and 6 monthly follow-ups.

Table 4 Beck Depression Inventory (BDI) of all participants at baseline and 6 monthly follow-ups.

<i>Participant</i>	<i>Baseline</i>	<i>6 months</i>	<i>12 months</i>	<i>18 months</i>
1	7	0	0	4
2	18	30	33	17
3	45	38	25	26
4	23	—	—	17
5	20	19	—	—

follow-up. However, due to various limitations of the study it was not possible to come to a conclusion with regard to the efficacy of the procedure.

Most of the neurological recovery after SCI occurs in the first 3 months, but a small amount of recovery can continue up to 18 months.<sup>24</sup> Hence only participants with CSCI (more than 18 months after injury) were included in the study. Most of the neurological recovery in AIS A and AIS B participants is likely to occur within the ZPP. Also as compared to motor incomplete SCI participants (AIS C and AIS D), motor complete SCI participants (AIS A and AIS B) have fairly limited and predictable neurological recovery.<sup>24</sup> Hence only AIS A and AIS B participants were included in the study.

The histopathology of the sample from the harvested material in participant 1 suggested that it was predominantly respiratory mucosa. Incidentally this participant showed the maximum improvement in SCIM score and no increase in myelomalacia. A conclusion can't be drawn on the basis of one participant. However, participants of the age group 35–40 years may not be taken up for the procedure till further studies are able to establish availability of olfactory mucosa in this group.

The study design was in conformance with the 'Guidelines for the conduct of clinical

trials for spinal cord injury' as developed by the International Campaign for Cures of SCI Paralysis panel.22,24–26

The stringent inclusion–exclusion criteria resulted in a slow recruitment of participants. This problem had also been faced by another similar study with similar inclusion–exclusion criteria.<sup>14</sup> Another factor that slowed down the recruitment in our study was that participants, who initially showed interest in our study, later opted for one of the numerous other centers in the country offering some form of cellular transplantation 'cure'. The pilot study was conducted to study the safety and feasibility of the procedure. Like the previous similar study,<sup>2</sup> the procedure was found to be safe on most counts except for MRI findings of syrinx formation in one participant and increase in length of myelomalacia in four participants. The surgery was tolerated well. Despite one sample from the transplanted material testing positive for Epstein–Barr virus

Table 5 International Spinal Cord Injury Scale (ISCI)

Participant	1				2				3				4				5		
	B	A	12	18	B	A	12	18	B	A	12	18	B	A	12	18	B	A	
Bladder	1.6	1.4	1.4	1.0	.21	.21	.22	.19	.18	.15	.14	.14	.18	—	—	.17	.12	.8	.8
Bowel	1.3	1.2	1.0	1.2	.21	.20	.25	.12	.13	.12	.12	.12	.14	—	—	.9	.16	.13	.13
Injury-related pain	1.2	1.0	.8	.4	.5	.5	.5	.14	.14	.20	.21	.18	.9	—	—	.5	.15	.10	.10
Physical function	32	34	36	40	62	60	60	58	56	75	75	80	54	—	—	24	39	34	34
Life impact	15	14	13	13	39	34	34	21	.25	.32	.32	.18	.31	—	—	.8	.25	.22	.22
Sexual function	.9	.2	.2	.2	.3	.3	.2	.5	.22	.27	.26	.21	.2	—	—	.2	.4	.2	.2
Total	37	36	35	31	136	133	137	134	148	219	222	152	118	—	—	19	128	91	91

and *Alcaligenes* species (participant 1) and another for *Aspergillus niger* (participant 3), none of the participants developed either signs and symptoms of meningitis or had any CSF changes postoperatively. Participant 1 had some surgical site-healing problem. However, despite the initial sterile discharge, wound closure was achieved uneventfully at 3 weeks. There were no problems with olfaction in any participant and the donor site healed well.

The loss of sensation immediately after surgery in participants 2 and 5 may have been a complication of the myelotomy and scar removal procedure. In the previous similar study<sup>2</sup> also one participant had loss of sensation, which according to the authors was due to the sensory axons getting damaged during the surgical procedure because of difficulty in locating the lesion site. Even though participant 2 recovered the sensation almost fully, it may suggest that the procedure should be done cautiously and only by very experienced surgeons. AIS B participants may also be initially excluded from such studies. We accordingly narrowed down the inclusion criteria to AIS A participants with neurological level T1–T12 till such time the safety of the procedure could be adequately demonstrated for sensory incomplete participants.

Harvest of the olfactory mucosal transplant also is a technically demanding procedure and requires a very skilled and experienced ENT surgeon. Skilled manpower is thus the key for the successful conduct of this procedure.

Follow-up MRIs revealed fresh findings of syrinx in one participant and increase in length of myelomalacia in four participants. No other changes were seen. These findings were in contrast to that of the previous similar study.<sup>2</sup> The findings were also in contrast to that of Mackay-Sim et al.<sup>1</sup> However, this study did not require myelotomy or scar excision, which may have been responsible for the increase in length of myelomalacia in our study. Even though the findings were not associated with any deterioration in neurological function, it does suggest caution in performance of the procedure as also mentioned before.

The development of syrinx in one participant 8.5 years after injury suggests that the procedure was more likely to be responsible for this change rather than the natural progression of spinal injury. However, as it was associated with a significant increase in myelomalacia, it reinforces the suggestion of caution in performance of the procedure as described above.

Neuropathic pain also increased mildly in one participant as depicted by ISCI. However, the other variables in the ISCI also had an unfavorable outcome in this participant. This was not accompanied by any unfavorable outcome on variables as assessed by objective outcome measures in the participant. Psychological assessment suggested that the participant was depressed. Hence the finding of neuropathic pain has to be interpreted accordingly.

Preference was given to use the harvest for transplantation. No tissue was thus available for analysis in participant 4. In another participant, the histopathology of the specimen revealed predominantly respiratory mucosa. This participant was 38 years of age and hence most of the olfactory mucosa may have been replaced by respiratory mucosa. The specimen sent for histopathology may also not have been representative of the transplanted material.

There was no significant improvement in the primary efficacy variable, that is, ASIA motor score of the participants. Such an outcome corresponds to natural history of complete SCI.<sup>27</sup>

There was also no significant improvement in the secondary efficacy variables other than SCIM, ISCI or BDI. The statistically significant improvement in functional examination (SCIM) scores without any significant change in clinical (ASIA motor or sensory score) or electrophysiological (EMG, SSEP or MEP) examination suggest that the improvements in SCIM may have been due to compensation and exploitation of neuronal plasticity by functional training and not because of regeneration. Curt et al.<sup>27</sup> have postulated this mechanism for improvement in activities of daily living of participants which occur without any change in neurological condition. The fact that the histopathology of the harvested material sample from the participant who showed

the maximum increase in SCIM scores (participant 1), revealed predominantly respiratory mucosa, may also suggest that the improvements in SCIM were not due to regeneration. The functional recovery could be responsible for the statistically significant improvement in scores of Life Impact (as demonstrated through ISICIS questionnaire) and BDI.

These findings of efficacy variables were similar to those in the study conducted by Mackay-Sim et al.<sup>1</sup> except that in their study there was no improvement in functional examination scores as well. This may be due to the fact that in their study, participants were not instructed to follow any particular exercise regime whereas in our study the participants were advised to follow a specified rehabilitation protocol as it was thought to be important for modulation of neuroplastic mechanisms to overcome supraspinal atrophy and neuronal death associated with CSCI.<sup>28</sup> However, the findings in our study were in contrast to those of the study conducted by Lima et al.<sup>2</sup> Various factors as under could have influenced the outcome:

- Only CSCI participants (18 months after SCI) were included for this study. However, most of the participants in the previous study were also CSCI but were reported to have shown improvement from the procedure.
- The transplantation of olfactory mucosa could be clearly established by histopathology in only three participants. None of these three participants showed any improvement. But this small number may not be enough to conclude the efficacy of the procedure.
- The estimation of the number of cells transplanted could also not be properly done. The outcome may have been affected by an inappropriate number of transplanted cells.
- The follow-up of 18 months in four participants and 6 months in one participant may be inadequate to see a benefit.
- All participants were asked to follow a specified rehabilitation protocol. However, due to the outpatient nature of the recovery period, compliance in this regard may have been low. All participants reported they maintained their rehabilitation training as described to them. On the other hand, if the recovery was due to cell transplantation then one may expect some functional improvement even without rehabilitation training. It is also established that rehabilitation by itself can influence neurological recovery and thus our full study envisages comparing outcome between the groups.
- The surgical procedure is technically demanding. Thus the difference in outcomes could also be due to differences in surgical skills.

Besides the limitations mentioned above, there were other obvious limitations of this pilot study. Only five participants were enrolled for the study. Like most other pilot

studies, there was no control group and hence the results can only be compared with historical and anecdotal data.

## Conclusions

The findings of the pilot study suggest that the procedure of autologous mucosal transplantation is relatively safe and feasible in AIS A participants with thoracic level injuries at 18 month follow-up. A full follow-up of 2 years in all five participants will further reinforce this. No efficacy could be demonstrated which could be attributed to the procedure. However, it may not be possible to conclude regarding the efficacy of the procedure due to the limitations of the study. Considering the other limitations of the study and the fact that efficacy of the procedure could not be demonstrated, it may warrant extension of the pilot study to enroll additional participants. The inclusion criteria may be modified to meanwhile include only AIS A participants, 18–35 years of age with T1–T12 level injuries. This has the sanction of Indian Council of Medical Research.

## Acknowledgements

We acknowledge the contribution of Dr Jose<sup>o</sup> Pratas-Vital, Dr Pedro Escada, Dr Clara Capucho and Dr Maria Cristina Ferreira for visiting our center with Dr Carlos Lima, at their expense and familiarizing us with the detailed procedure. The first three procedures were conducted during their visit. We also acknowledge the contribution of the International Clinical Advisory Panel comprising of Professor John Steeves, Dr Jean Jacques Wyndaele and Dr Patrick Kluger for monitoring the study. We also thank the Indian Council of Medical Research for making valuable suggestions to the study protocol. We also convey our appreciation to Dr AK Sahani for conducting the electrophysiological tests for all the participants, Ms Chitra Kataria for reviewing the neurological and functional assessments, Ms Namita Bhutani as well as Dr Divya Parashar for psychological assessments and Dr Suman Kishore for coordination and valuable support to conduct the study.

## References

- 1 Mackay-Sim A, Fe<sup>o</sup>ron F, Cochrane J, Bassingthwaighe L, Bayliss C, Davies W et al. Autologous olfactory ensheathing cell transplantation in human paraplegia: a 3-year clinical trial. *Brain* 2008; 131(Pt 9): 2376–2386.
- 2 Lima C, Pratas-Vital J, Escada P, Hasse-Ferreira A, Capucho C, Peduzzi JD. Olfactory mucosa autografts in human spinal cord injury: a pilot clinical study. *J Spinal Cord Med* 2006; 29: 191–203.

- 3 Sykova E, Homola A, Mazanec R, Lachmann H, Konradova SL, Kobyłka P et al. Autologous bone marrow transplantation in patients with subacute and chronic spinal cord injury. *Cell Transplant* 2006; 15: 1–100.
- 4 Huang H, Chen L, Wang H, Xi H, Gou C, Zhang J et al. Safety of fetal olfactory ensheathing cell transplantation in patients with chronic spinal cord injury. A 38-month follow-up with MRI. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi* 2006; 20:439–443.
- 5 Huang H, Chen L, Wang H, Xiu B, Li B, Wang R et al. Influence of patients' age on functional recovery after transplantation of olfactory ensheathing cells into injured spinal cord injury. *Chin Med J (Engl)* 2003; 116: 1488–1491.
- 6 Huang H, Wang H, Chen L, Gu Z, Zhang J, Zhang F et al. Influence factors for functional improvement after olfactory ensheathing cell transplantation for chronic spinal cord injury. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi* 2006; 20: 434–438.
- 7 Park HC, Shim YS, Ha Y, Yoon SH, Park SR, Choi BH et al. Treatment of complete spinal cord injury patients by autologous bone marrow cell transplantation and administration of granulocyte-macrophage colony stimulating factor. *Tissue Eng* 2005; 11:913–922.
- 8 Knoller N, Auerbach G, Fulga V, Zelig G, Attias J, Bakimer R et al. Clinical experience using incubated autologous macrophages as a treatment for complete spinal cord injury: phase I study results. *J Neurosurg Spine* 2005; 3: 173–181.
- 9 Yoon SH, Shim YS, Park YH, Chung JK, Nam JH, Kim MO et al. Complete spinal cord injury treatment using autologous bone marrow cell transplantation and bone marrow stimulation with granulocyte macrophage-colony stimulating factor: phase I/II clinical trial. *Stem Cell* 2007; 25: 2066–2073.
- 10 Ramon-Cueto A, Nieto-Sampedro M. Regeneration into the spinal cord of transected dorsal root axons is promoted by ensheathing glia transplants. *Exp Neurol* 1994; 127: 232–244.
- 11 Mackay-Sim A. Olfactory ensheathing cells and spinal cord repair. *Keio J Med* 2005; 54: 8–14.
- 12 Doucette R. Olfactory ensheathing cells: potential for glial cell transplantation into areas of CNS injury. *Histol Histopathol* 1995; 10: 503–507.

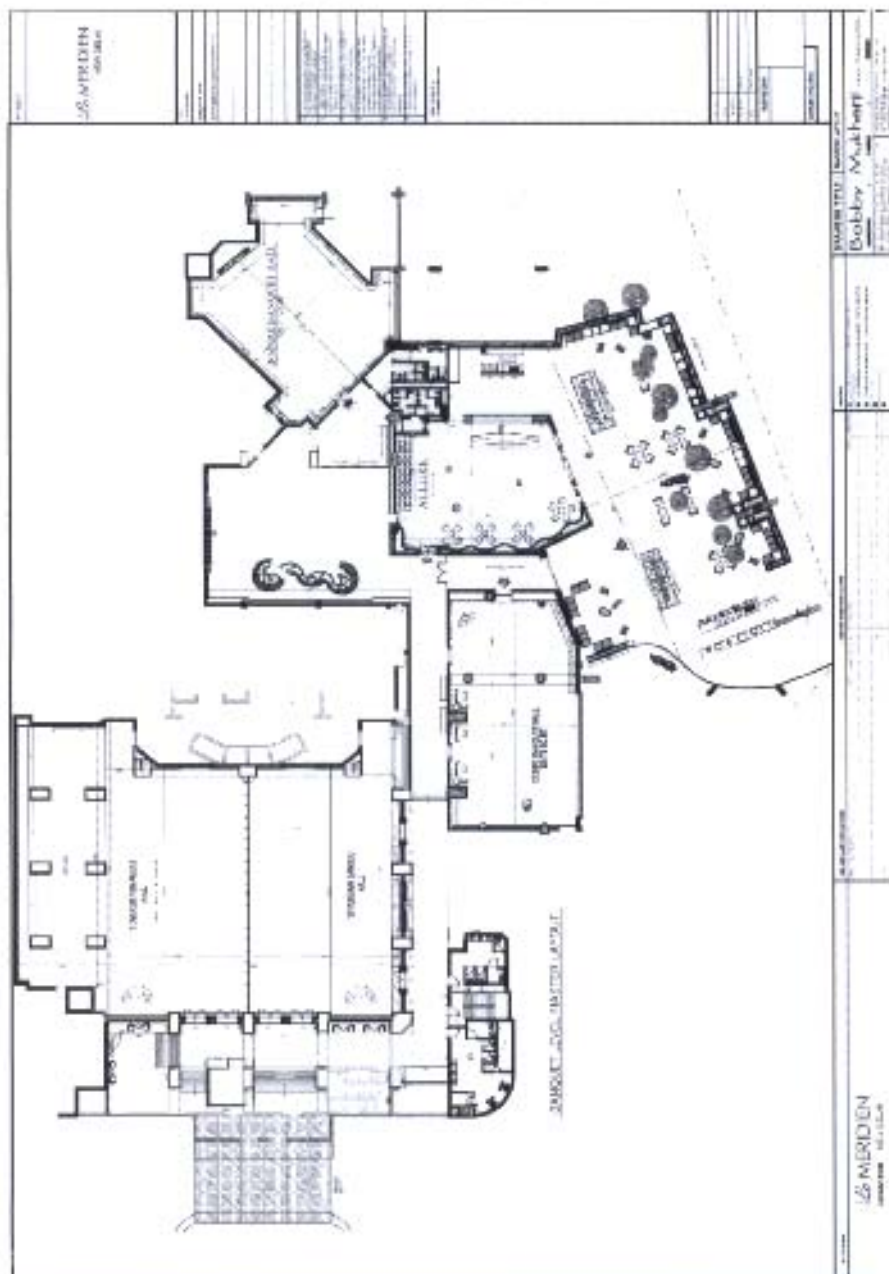


- 13 Gudino-Cabrera G, Nieto-Sampedro M. Schwann-like microglia in adult rat brain. *Glia* 2000; 30: 49–63.
- 14 Feron F, Perry C, Cochrane J, Licina P, Nowitzke A, Urquhart S et al. Autologous olfactory ensheathing cell transplantation in human spinal cord injury. *Brain* 2005; 128: 2951–2960.
- 15 Ronsyn MW, Berneman ZN, Tendeloo VFI, Jorens PG, Ponsaerts P. Can cell therapy heal a spinal cord injury? *Spinal Cord* 2008; 46: 532–539.
- 16 Roisen FJ, Klueber KM, Lu CL, Hatcher LM, Dozier A, Shields CB et al. Adult human olfactory stem cells. *Brain Res* 2001; 890:11–22.
- 17 Xiao M, Klueber KM, Lu C, Guo Z, Wang H, Roisen FJ. Human adult olfactory neural progenitors rescue axotomized rodent rubrospinal neurons and promote functional recovery. *Exp Neurol* 2005; 194: 12–30.
- 18 Mumm JS, Shou J, Calof AL. Colony-forming progenitors from mouse olfactory epithelium: evidence for feedback regulation of neuron production. *Proc Natl Acad Sci USA* 1996; 93:11167–11172.
- 19 Lu J, Feron F, Ho SM, Mackay-sim A, Waite PM. Transplantation of nasal olfactory tissue promotes partial recovery in paraplegic adult rats. *Brain Res* 2001; 889: 344–357.
- 20 Murrell W, Feron F, Wetzig A, Cameon N, Splatt K, Bellette B et al. Multipotent stem cells from adult olfactory mucosa. *Dev Dyn* 2005; 233: 496–515.
- 21 Iwatsuki K, Yoshimine T, Kishima H, Aoki M, Yoshimura K, Ishihara M et al. Transplantation of olfactory mucosa following spinal cord injury promotes recovery in rats. *Neuroreport* 2008; 19:1249–1252.
- 22 Tuszynski MH, Steeves JD, Fawcett JW, Lammertse D, Kalichman M, Rask C et al. Guidelines for the conduct of clinical trials for spinal cord injury (SCI) as developed by the ICCP Panel: clinical trial inclusion exclusion criteria and ethics. *Spinal Cord* 2007; 45:222–231.
- 23 Nakashima T, Kimmelman CP, Snow JB. Structure of human fetal and adult olfactory neuroepithelium. *Arch Otolaryngol* 1984; 110:641–646.
- 24 Fawcett JW, Curt A, Steeves JD, Coleman WP, Tuszynski MH, Lammertse D et al.

Guidelines for the conduct of clinical trials for spinal cord injury (SCI) as developed by the ICCP Panel: spontaneous recovery after spinal cord injury and statistical power needed for therapeutic clinical trials. *Spinal Cord* 2007; 45:190–205.

- 25 Steeves JD, Lammertse D, Curt A, Fawcett JW, Tuszynski MH, Ditunno JF et al. Guidelines for the conduct of clinical trials for spinal cord injury (SCI) as developed by the ICCP Panel: clinical trial outcome measures. *Spinal Cord* 2007; 45: 206–221.
- 26 Lammertse D, TuszynskiMH, Steeves JD, Curt A, Fawcett JW, Rask C et al. Guidelines for the conduct of clinical trials for spinal cord injury (SCI) as developed by the ICCP Panel: clinical trial design. *Spinal Cord* 2007; 45: 232–242.
- 27 Curt A, Van Hedel HJ, Klaus D, Dietz V. Recovery from a spinal cord injury: significance of compensation, neural plasticity, and repair. *J Neurotrauma* 2008; 25: 677–685.
- 28 Wrigley PJ, Gustin SM, Macey PM, Nash PG, Gandevia SC, Macefield VG et al. Anatomical changes in human motor cortex and motor pathways following complete thoracic spinal cord injury. *Cereb Cortex* 2009; 19: 224–232.

# MASTER PLAN - LE MERIDEAN



LE MERIDIEN  
HOTEL

PROJECT NO. 1000000000  
 DESIGNER  
 Bobby Mahaffey  
 ARCHITECTS

LE MERIDIEN  
HOTEL

## Important Events & Dates

Event	Venue	Date	Time
Presidential Lecture	Hall A	29th October,2010	11:30 hrs. to 12:00 hrs.
ISRT Lecture	Hall A	29th October,2010	12:00 hrs. to 12:30 hrs.
Sir Ludwig Guttman Lecture	Hotel Lalit	29th October,2010	19:30 hrs. - 20:15 hrs.
Inaugural Function	Hotel Lalit	29th October,2010	19:00 hrs. -19:30 hrs.
SCS Oration	Hall B	30th October,2010	10:30 hrs. to 11:00 hrs.
Gala Dinner	Hotel Taj	30th October,2010	20:00 hrs. onwards
Closing Ceremony	Hall A	31st October,2010	15:20 hrs. onwards

## Important Numbers

	Concerned Person	Contact No.
Accommodation related problems	Mr. Akash Nath Garg	0091-9910067703
	Mr. Sumit Saxena	0091-9899448813
	Mr. Alok Rawat	0091-9911000080
Transport related problems	Mr. Kabir Malhotra	0091-9810154492
	Mr. Shabi Hussain	0091-9999937311
	Mr. A.K. Bedi	0091-9810705134
Registration related problems	Mr. Akash Nath Garg	0091-9910067703
	Mr. Rohit Malik	0091-9650496688
	Mr. Alok Rawat	0091-9911000080
Scientific program related problems	Dr. Vikas Tandon	0091-9868886228
	Dr. Vivek Mittal	0091-9873954415
	Dr. Gururaj	0091-9899855831
Audio/Visual related problems	Dr. Kalidutta Das	0091-9810033094
	Dr. Ankur Nanda	0091-9717007717
	Dr. Darshan Gautam	0091-9968479869
Health related problems	Dr. B. Mohapatra	0091-9818797641
	Dr. Nishit Patel	0091-9999575201
Police		100
Indian Spinal Injuries Hospital		011-42255225
Ambulance Service		011-42255202
Hotel Le Meridian		011-23710101

## Editorial Committee

---

### Editorial Committee:-

- ❖ Dr. Vikas Tandon
- ❖ Dr. Ankur Nanda
- ❖ Dr. Vivek Mittal
- ❖ Dr. Gururaj Sangondimath
- ❖ Dr. Nishit Patel
- ❖ Dr. Darshan Gautam
- ❖ Mr. Mohit Arora
- ❖ Ms. Shashi Rautela
- ❖ Ms. Amita Kashyap
- ❖ Ms. Ishika Ahluwalia

### Editor:-

Dr. H S Chhabra











Sector - C, Vasant Kunj  
New Delhi, India

[www.isc@isiconline.org](http://www.isc@isiconline.org); [www.iscos2010.org](http://www.iscos2010.org)

*Le* MERIDIEN  
NEW DELHI