Indian Spinal Injuries Centre

SCS SPINAL CORD SOCIETY

Under the Patronage of

ISCOS International Spinal Cord Society

Under the aegis of

Delhi Spine Society

John Grooms Working with Disabled People

ISICon 2008

International Spine and Spinal Injuries Conference

'Recent Advances in Spine Care'

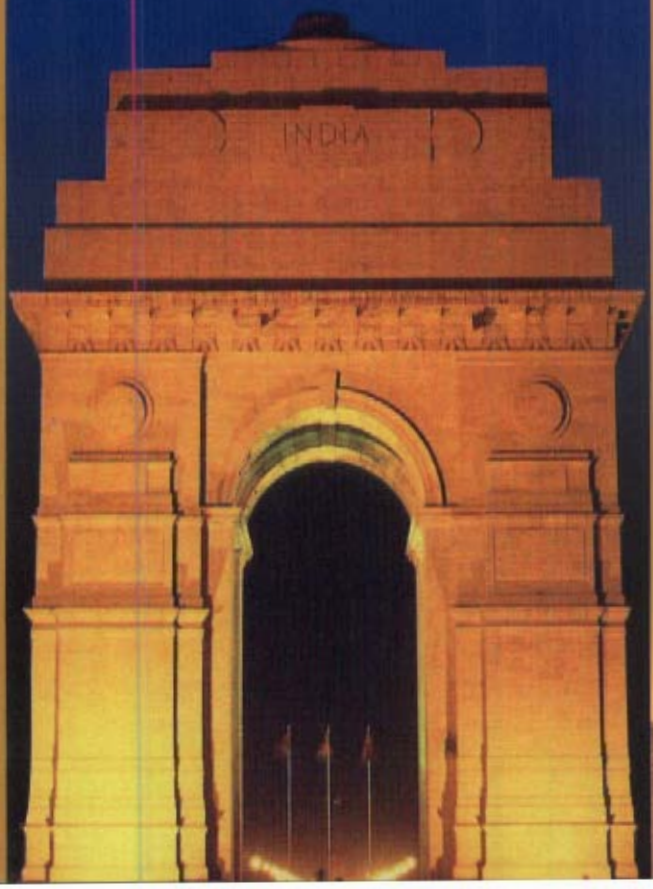
February 22 - 24, 2008

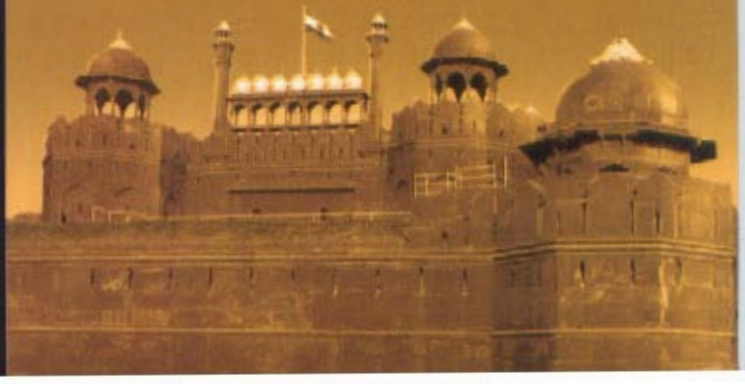
Commemorating 10 Years of commissioning comprehensive services at ISIC

Souvenir

Venue: Taj Palace Hotel, New Delhi, India

Organiser: Indian Spinal Injuries Centre, Delhi
http://scs-isic.com/issicon2008.htm





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Smt. Meira Kumar

Minister of Social Justice & Empowerment
Government of India

MESSAGE

Spinal ailments have always plagued the Society and spinal injuries, especially, is one of the most devastating calamity that can afflict mankind.

It is most appropriate that Indian Spinal Injuries Center and Spinal Cord Society are organizing International Spine and Spinal Injuries Conference (ISSICON- 2008) where faculty and delegates from all over the world will get together to focus attention on these challenging ailments. I am sure that the deliberation of this conference and the post conference workshop will be very thought provoking and will come out with ideal solutions for management of these ailments and especially adapting them to local conditions in the developing countries.

I complement the Indian Spinal Injuries Center for planning an excellent academic event which would benefit the society in general.

I welcome all delegates and faculty members and wish the organizers all success in their endeavour.

Smt. Meira Kumar
Minister of Social Justice & Empowerment
Government of India

Maj HPS Ahluwalia
Padmabhushan, Padmashri and Arjuna Award

Chairman
Indian Spinal Injuries Centre
New Delhi

MESSAGE

India is fast emerging as the global hub of technology. There has been a revolution in the health industry in the last decade in India and rapid progress has been made in the field of health services. Indian Spinal Injuries Centre, is recognized by the Government of India as the tertiary level centre for management of spinal injury.

Celebrating ten years of service of our institution is an important event which helps to foresee the future growth and the direction it is going to take. When I look back on these ten years of our institute, it seems that we have had our share of hardships, hurdles, difficulties and also the pleasure of overcoming them. Today we see the fruits of our efforts blossoming. Our institute has been founded on principles of compassion and service to society. . I attribute this success to the extra ordinary dedicated team of both medical and others specilists. We are also grateful to our foreign friends who have supported our endeavour.

On behalf of Indian Spinal Injuries Centre, Spinal Cord Society and the organizing committee of International Spine and Spinal Injuries Conference, it is a privilege to extend a very warm welcome to all the delegates and faculty members.

Major HPS Ahluwalia
Chairman
Indian Spinal Injuries Centre
New Delhi

Dr. A. K. Mukherjee

Director General, ISIC,
New Delhi

MESSAGE

I welcome all the International and National delegates for this International Spine and Spinal Injuries Conference to be held on February 2008 by the Indian Spinal Injuries Centre, New Delhi. The deliberation of this Conference will increase our understanding about the complex issues related to spine injury patients.

I wish the Conference a great success.

(Dr. A. K. Mukherjee)
Director General, ISIC, New Delhi

MESSAGE

It gives me great pleasure to welcome all of you to ISSICON-2008. The success of ISSICOn-2008 was largely due to the contribution of our friends and colleagues from around the globe and we are happy that they have come to our support once again.

The concept of comprehensive management of spinal injuries was brought to the country after the developed countries had developed it well. However having learnt from the experience, we should not lag behind in introducing the recent advances. Hence the deliberations during this conference would be very useful. We hope that all of you would contribute to the success of the conference through your active participation and help in dissipating the message in your part of the country.

With regards,

Air Marshal A.S. Chahal,
Director General, (Emeritus),
ISIC, New Delhi

Dr. William H. Donovan

President of the International Spinal Cord Society (ISCoS)

MESSAGE

Nearly 5,000 years have passed since the great pharaoh/physician Imhotep advised in the Edmund Smith papyrus that the treatment for Spinal Cord Injury (SCI) should be no treatment ("an ailment not to be treated").

Sadly, this approach continued to prevail until the middle of the 20th Century until people like Donald Munro, Sir Ludwig Guttmann, Sir George Bedbrook, Ernest Bors, Estin Comarr, John Young and others independently proved that this nihilistic attitude was no longer tenable.

Advances in medicine and technology and increased awareness by the public and governmental officials have now improved the lives of those living with SCI. Yet while these improvements are needed and must be furthered, they still fall short of the ultimate goal of unlocking the secrets of CNS regeneration so that normal function can be restored.

It is heart warming to see the approaches now underway in laboratories around the globe pursuing this goal along various avenues:
a) Reducing the effects of the damage; b) encouraging correct neuron function with cells, matrix modifiers or nerve bridges; c) enhancing axon growth; d) replacing lost nerve cells; e) inhibiting gliosis formation and; f) reducing neurocircuit deficits Most investigators feel the solution to the enigma will come from a multi-pronged approach since very likely, genes, molecules and milieu all play some role.

With perseverance by the scientists and support from the consumers and ideas and challenges generated at conferences such this, I remain hopeful that the ultimate goal will soon be visible on the horizon.

On behalf of ISCoS, I wish you every success in your deliberations.

Sincerely,

William H. Donovan, M.D.
President, ISCoS

MESSAGE

It is a pleasure to write this message to the organisers and the participants of the ISSICON 2008 congress in Delhi. I was fortunate to be part in several meetings in India over the last decade. I have seen the SCI management steadily grow and spread in this huge continent and admire what is being achieved. The problems you face are not small but the way you deal with them are outstanding. The Journal Spinal Cord is the international journal dealing with all aspects of spinal cord medicine care and management. We offer a forum for publicizing the results of research, clinical observations , case stories and comprehensive reviews. We are fortunate to have so many excellent submissions from around the world and to see high quality submissions. We encourage you to submit your work for review. Do not hesitate to contact our office if you have questions or to discuss your work before formally submitting it. We wish the ISSICON congress and the following workshop much success.

Prof. Jean Jacques Wyndaele,
Editor Spinal Cord

Dr. Ziad .M. Al Zoubi

Secretary
General Pan Arab Spine Society

MESSAGE

THIS IS THE SECOND TIME IAM PARTICIPATING IN ISSICON, IT IS NOT ONLY VERY SUCCESSFUL BUT ALSO STRENGTHEN THE SCIENTIFIC RELATIONS BETWEEN THE EAST AND WEST , WE LEARN A LOT FROM YOUR EXPERIENCE IN ADDITION TO ENJOY THE MAGIC OF THE EAST. AND GENEROUSITY OF YOU.

Dr. Ziad .M. Al Zoubi
Consultant Spinal and Ortho. Surgery
Secretary General Pan Arab Spine Society
CHAIRMAN , WORLD SPINE FELLOWSHIP

MESSAGE

The magnitude of the problem of spinal cord injury with its accompanying pathophysiological, clinical, physical, psychological, rehabilitative & social impact needs to be addressed in a multi- disciplinary approach. It is hence most encouraging that Spinal Cord Society (SCS) and Indian Spinal Injuries Centre (ISIC) are organizing ISSICON-2008. As President of Association of Spine Surgeons of India (ASSI) and Spine Society Delhi Chapter, and Vice-President of Spinal Cord Society (SCS), I extend a warm welcome to all participants.

I wish the very best to Dr.H.S. Chhabra, his team & ISSICON 2008 and I am looking forward to this meeting & its significant outcome.

Dr. Arvind Jayaswal
Prof. of Orthopaedics, AIIMS
President Association of Spine Surgeons of India (ASSI)
President Spine Society - Delhi Chapter
Vice President Spinal Cord Society (SCS)

Dr. Shankar Acharya

Secretary
Spine Society (Delhi Chapter)

MESSAGE

Please accept my best wishes and the best wishes from all the members of Delhi spine Society for your forthcoming International Conference on Spinal injuries form 24-26 feb08. Your previous meetings have been extremely successful and I wish you and your team.

An even greater success this year. These multispeciality meeting on the future of Spinal cord injured are extremely beneficial to all and give a new direction various modalities of treatment The Delhi Spine Society is extremely proud to be associated with this event with kind regards yours sincerely.

Dr. Shankar Acharya
Secretary
Spine Society - Delhi Chapter.

From the Editor's Desk

Management of spinal ailments has been revolutionised in the last few decades. We can understand and hence manage these ailments much better. However the long list of unanswered questions and controversies suggests that a lot of work still needs to be done. Thus a lot of research is being done across the globe resulting in rapid advances in the management of spinal ailments.

There is a strong need to disseminate information about these recent advances. It was with this in mind that the theme of the conference was kept as **"Recent Advances in Spine Care"**. Deliberations amongst 35 eminent faculty members from around the globe and 85 from around India would provide an excellent forum for trying to achieve these objectives. The scientific programme has shaped up well and the conference promises be an academic feast. We hope that the cultural and social events will help in establishing bondages and linkages amongst the fraternity.

As the Organizing Secretary of ISSICON-2008 and the editor of the Souvenir, it is my privilege to thank all the faculty, delegates, the whole organizing committee and all others who have contributed towards this event.

I would also want to thank International Spinal Cord Society (ISCoS), Asian Spinal Cord Network (ASCoN), Spine Society- Delhi Chapter, Association of Spine Surgeons of India (ASSI) and John Grooms Overseas (JGO) for having extended their patronage to the conference.

We seek you wholehearted support in making this endeavor a success. Simultaneously we will strive to live up to your expectations so that we could justify the efforts put in by all of you for the success of the conference.

Hoping to see you again in ISSICON-2009 at Coimbatore and at the Combined ISCoS, ASCoN and Spinal Cord Society (SCS) Meeting in October 2010.

With regards,

Harvinder Singh

Dr. H.S. Chhabra,
Chief of Spine Service &
Medical Director
Organizing Secretary, ISSICON-2008
Chairman Education Committee (ISCoS)
Secretary, Spinal Cord Society,
Executive Member, Asian Spinal Cord Networking
Jt. Secretary, Association of Spine Surgeons of India

LIST OF INTERANTIONAL FACULTY MEMEBRS FOR ISSICON-2008

1	Prof. Alfredo Gorio	Professor of Pharmacology, Director, Clinical Pharmacology IRCCS Humanities, University of Milan	Italy
2	Dr. Amit Bhanti	Prosthetist and Orthotist, University of Illinois College of Medicine	USA
3	Dr. Andrei Krassioukov	Associate Professor, Div. Phys .Med. & Rehab., Scientist, ICORD, Adjunct Professor, School of Rehabilitation, University of British Columbia	Canada
4	Dr. Anil Shreshtha	Orthopaedic Surgeon, Kathmandu	Nepal
5	Dr. Ashwini Sharan	Department of Neurosurgery, Thomas Jefferson University	USA
6	Dr. Avinash G. Patwardhan	Department of Orthopaedic Surgery and Rehabilitation, Loyola University Stritch School of Medicine	USA
7	Prof. Cesare Maffei	Professor, Clinical Psychology, University Vita, Hospital San Raffaele	Milan
8	Prof. Dajue Wang	Aylesbury, Bucks	UK
9	Dr. Douglas Brown	Medical Director, Spinal Injuries Centre, Melbourne	Australia
10	Mr. Eric Weerts	Programme Coordinator SCI Project, Handicap International	Vietnam
11	Dr. Erkan Kaptanoglu	Associate Professor, Department of Neurosurgery, Ankara Numune Education and Training Hospital, Ankara	Turkey
12	Dr. Fazlul Hoque	Consultant Orthopaedic Surgeon, Bangladesh, Vice President South East Asia, ISCoS	Bangladesh
13	Mr. Gurpreet Singh	Urologist	UK
14	Dr. Hans Joseph Erli	Deputy Chair of the Department of Trauma Surgery, Aachen	Germany
15	Dr. James Middleton	Senior Lecturer, Rehabilitation Studies Unit, Faculty of Medicine, University of Sydney	Australia
16	Prof. Jean Jacques Wyndaele	Editor - Spinal Cord, Professor of Urology	Belgium
17	Dr. John Steeves	Professor and Director of ICORD, Professor of Zoology, Anatomy, and Surgery, University of British Columbia and Vancouver Hospital	Canada
18	Dr. Julio Gallego	Spinal Surgeon, Memphis	USA
19	Prof. Kamal Ibrahim	Clinical Professor, Loyola University, Chicago	USA

20	Dr. Lisa Harvey	Senior Lecturer, Northern Clinical School, Rehabilitation Studies Unit, Faculty of Medicine, University of Sydney	Australia
21	Ms. Maggie Muldoon	Secretary, Asian Spinal Cord Network	
22	Prof. med. Manfred Stohrer	Urologist	Germany
23	Dr.Nazirah Physiatrist	Malasia	
24	Prof. Nobert Passuti	Head of the Department - Orthoapedics & Spine, Hotel Dieo Nantes	France
25	Dr.Patrick Kluger	Ex - Chief Spine Surgeon, Stoke Mandeville Hospital	UK
26	Dr.Ralf Gahr	Leipzig	Germany
27	Dr.Rob Campbell	Coordinator Local Organizing Committee, Aurora Hospital, Port Elizabeth	South Africa
28	Dr.Rory Cooper	Distinguished Professor and FISA/PVA Chair, University of Pittsburgh	USA
29	Prof. Rosemarie Cooper	Director of Clinical Services for Assistive Technology, University of Pittsburgh	USA
30	Mr. Sanjeev Sharma	Consultant Gynaecologist, Specialist in Reproductive Gynaecology and Infertility, Head, Post Graduate School of Obstetrics and Gynaecology, Liverpool	UK
31	Dr.Stanley Ducharme	Andrologist, Spinal Injuries Centre, Boston	USA
32	Mr. Stephen Muldoon	John Groom Overseas	
33	Dr.Steven Ronald Cumings	Professor of Medicine and Epidemiology (Emeritus) at the Unviersity of California San Francisco and Director of the San Francisco Coordinating Center	
34	Dr.Vinod Sahgal	Professor of Medicine, University Hospitals, Case Medical Centre	Cleveland
35	Dr.Ziad Al-Zoubi	Consultant Orthopaedics and Spine Surgery, General Secretary, Pan Arab Spine Society	Jordan

LIST OF INDIAN FACULTY FOR ISSICON-2008

1	Dr.A. K. Sahani	Consultant Neurologist, Indian Spinal Injuries Centre	New Delhi
2	Prof. A.K. Jain	Prof. of Orthopaedics (UCMS and GTB Hospital)	New Delhi
3	Dr.A.K. Mukherjee	Director General, Indian Spinal Injuries Centre	New Delhi
4	Dr.A.K. Singh	Neurosurgeon, Director Neurosciences, Fortis Hospital	NOIDA
5	Dr.A.N. Malaviya	Consultant Rheumatologist, Indian Spinal Injuries Centre	New Delhi
6	Dr.Abhay Nene	Associate Spine Consultant, P.D. Hinduja National Hospital	Mumbai
7	Dr.Abhishek Srivastava	PhD Scholar (Neurological Rehabilitation), Dept. of Pychiatric & Neurological Rehabilitation, NIMHANS, Bangalore	Bagalore
8	Dr.Ajay Bhutani	Neurosurgeon, Ganga Ram Hospital	New Delhi
9	Dr.Ambrish Mithal	Endocrinologist, Apollo Hospital	New Delhi
10	Dr.Anil Kumar Gaur	Assistant Director, All India Institute Of Physical Medicine & Rehabilitation	Mumbai
11	Dr.Anil Kumar Gupta	Dept. of PMR, AIIMS, Ansari Nagar	New Delhi
12	Dr.Anita Agarwal	Radiologist, ISIC	New Delhi
13	Prof. Arvind Jayaswal	All India Institute of Medical Sciences, New Delhi, President, Association of Spine Surgeons of India	New Delhi
14	Dr.Ashish Suri	Neurosurgeon, All India Institute of Medical Sciences	New Delhi
15	Dr.Bipin Walia	Consultant Neurosurgeon, Max Hospital	New Delhi
16	Dr. (Capt.) Dilip Sinha	Assistant Professor Orthopaedics, Patna Medical College Hospital	Patna
17	Dr.Dinesh Suman	Consultant Urologist, Indian Spinal Injuries Centre	New Delhi
18	Dr.G.P. Dureja	Consultant, Pain Clinic, Indian Spinal Injuries Centre	New Delhi
19	Dr.Gautam Zaveri	Consultant Spine Surgeon, Zaveri Clinic	Mumbai
20	Dr.Geeta Jotwani	Senior Research Officer, Division of Basic Medical Sciences	New Delhi

21	Dr. Gita Handa	Dept. of PMR, AIIMS, Ansari Nagar, Indian Council of Medical Research	New Delhi
22	Dr. H.C. Goyal	Head Deptt. of PMR, Safdarjung Hospital	New Delhi
23	Major H.P.S. Ahluwalia	Chairman, Indian Spinal Injuries Centre	New Delhi
24	Dr. (Lt. Col.) H.S. Bhatoe	Consultant Neurosurgeon, Research and Referral (Army Hospital)	New Delhi
25	Dr.H.S. Chhabra	Chief of Spine Service and Medical Director, Indian Spinal Injuries Centre	New Delhi
26	Dr.Harsh Bhargava	Orthoapedic Surgeon, Apollo Hospital	New Delhi
27	Dr.Harsh Mahajan	Consultant Radiologist, Mahajan Imaging Centre	New Delhi
28	Dr.K.L. Kalra	Sr. Orthoapedic & Spine Surgeon, Sir Ganga Ram Hospital	New Delhi
29	Dr.Kalidutta Das	Consultant Orthopaedics, Indian Spinal Injuries Centre	New Delhi
30	Dr.M.K. S. Swamy	Rehabilitation Department, Safdarjung Hospital	New Delhi
31	Dr.Manoj Sharma	Orthopaedic Surgeon, Jaipur Golden Hospital	New Delhi
32	Dr.Mathew Verghese	Orthopaedic Surgeon, St. Stephen Hospital	New Delhi
33	Dr.Mihir Bapat	Orthoapedic Surgeon, PD Hinduja Hospital	Mumbai
34	Dr.Navnender Mathur	Head of Deptt. of Physical Medicine and Rehabilitation, SMS Medical College and Hospital	Jaipur
35	Mr. Nekram Upadhyay	ISIC	New Delhi
36	Prof. Nikhil Tandon	Secretary, ISBMR	New Delhi
37	Dr.P.K. Dave	Director, Rockland Hospital	New Delhi
38	Dr. (Col.) P.K. Sahoo	Neurosurgeon, Command Hospital	Pune
39	Dr.P.S. Bawa	Neurosurgeon, Chanan Devi hospital	New Delhi
40	Dr.P.S. Ramani	Senior Consultant, Neuro and Spine Surgeon, Lilavati Hospital and Research Centre	Mumbai
41	Dr.R.K. Singh	Orthopaedic Surgeon,	Kanpur
42	Dr.Raghava Dutt Mulukutla	Consultant Orthopaedic and Spine Surgeon, UDAI Clinic	Hyderabad
43	Dr.Raj Bahadur	Director & Orthopaedic Surgeon, GMCH	Chandigarh
44	Prof. Raj Kumar	Associate Professor, Department of Neurosurgery, Sanjay Gandhi Postgraduate Instiute Of Medical Sciences]	Lucknow

45	Dr. Rajagopalan	St. John's Medical College and Hospital	Bangalore
46	Dr.Rajender Sharma	Senior Specialist(PMR), Rehabilitation Department, Safdarjung Hospital	New Delhi
47	Dr.Rajendra Prasad	Neurosurgeon, Apollo Hospital	New Delhi
48	Dr.Rajesh Malhotra	Orthopaedic Surgeon, AIIMS	New Delhi
49	Dr.Ram Chaddha	Spine Surgeon, K.J. Somaiya Hospital	Mumbai
50	Dr.Rana Patir	Sr. Consultant, Department of Neurosugery, Sir Ganga Ram Hospital	New Delhi
51	Dr.Ravi Kumar	Clinical Director R & D. Stem Cell Research Unit, Lifeline Hospitals	Chennai
52	Dr.Rushma Tandon	Orthopedic & Spine Surgeon, Northern Railway Hospital	New Delhi
53	Dr.S. K. Kame	Sr. Consultant Orthopaedics, Indian Spinal Injuries Centre	New Delhi
54	Dr.S. Rajasekaran	Director and Head of Department, Orthopaedics, Spine and Trauma Surgery, Ganga Hospital Coimbatore,	Orissa
55	Dr.S.L. Yadav	Psychiatrist, All India Institute of Medical Sciences	New Delhi
56	Dr.S.M. Tuli	Consultant Orthopaedic Surgeon, VIMHANS	New Delhi
57	Dr. (Lt. Col.)	S.N. Bhaduri Medical Officer, PMR, RR Hospital	New Delhi
58	Dr.S.Y. Kothari	Consultant, PMR, Safdarjung Hospital	New Delhi
59	Dr.Sajan Hegde	Consultant Orthopaedic Surgeon, Apollo Hospital,	Chennai
60	Dr.Samir Dalvie	Consultant Spine Surgeon, Bombay Hospital and Medical Research Centre	Mumbai
61	Dr.Sanjay Wadhwa	Assistant Professor, Deptt. of PMR, All India Institute of Medical Sciences	New Delhi
62	Dr.Sanjeev Dua	Sr. Consultant of Neurosurgeon, Fortis Hospital	New Delhi
63	Dr.Satish Chandra Gore	Spine Surgeon, Kamla Regency	Pune
64	Dr.Satish Rudrappa	Consultant Neurosurgeon, White House Clinic	Bangalore
65	Dr.Satnam Chhabra	Neurosurgeon, Sir Ganga Ram Hospital	New Delhi
66	Dr.Shankar Acharya	Consultant Spine Surgeon, Sir Gangaram Hospital	New Delhi
67	Dr.Sharad Shashank Kale	Assistant Professor, Neurosurgery, All India Institute of Medical Sciences	New Delhi
68	Prof. S.S. Sangwan	Head of Rehabilitatin Department	Chandigarh

69	Dr. Sudhir Kapoor	HOD and Consultant Orthopaedic Surgeon, Lady Hardinge Medical College	New Delhi
70	Dr. Surya Prakash Rao	Associate Professor and Spinal Surgeon, Nizam's Institute of Medical Sciences	Hyderabad
71	Dr. U. Singh	Professor and Head, Deptt of PMR, AIIMS	New Delhi
72	Dr. V. Srikumar	Dept. of PMR, AIIMS, Ansari Nagar,	New Delhi
73	Dr. V. T. Ingalhalikar	Consultant and Surgeon for Spinal Affections Thane,	Maharashtra
74	Dr. V.K. Rajoria	Neurosurgeon, ISIC	New Delhi
75	Dr. V.P. Sharma	Director Professor & Head, Deptt. Of Physical Medicine & Rehabilitation (RALC), K.G.'s Medical University,	New Delhi
76	Dr. (Col.) V.S. Madan	Sr. Neuro & Spine Consultant, Sir Ganga Ram Hospital	New Delhi
77	Dr. Vijay Kulkarni	Consultant Urologist	New Delhi
78	Dr. Vikas Gupta	Neurosurgeon, Fortis Hosptial	New Delhi
79	Dr. Vishal Nigam	Consultant of Orthopaedic and Spine Surgeon, Indian Spinal Injuries Centre	New Delhi
80	Dr. Yash Gulati	Sr. Orthopaedic and Spine Surgeon, Apollo Hospital	New Delhi

SESSION LAYOUT

Day 1 - Friday, 22nd February 2008

Time	Hall A	Hall B
8:00 9:00	I EVALUATION Of SCI	
9:00 10:00	II -ACUTE MANAGEMENT OF SCI	
10:00 10:30	INAUGURATION CEREMONY	
10:30 11:30	III OSTEOPOROSIS	
11:30 12:30	IV - EDUCATION AND RESEARCH	
12:30 13:00	V - ISIC ORATION	
13:00 14:00	BREAK	
14:00 15:00	VI CONSERVATIVE MANAGEMENT Of SCI	VII- SURGICAL MANAGEMENT OF SCI
15:00 16:00	VIII REHABILITATION MANAGEMENT OF SCI	IX- SPINAL INSTRUMENTATION / STABILIZATION
16:00 16:30	BREAK	
16:30 18:00	X BLADDER MANAGEMENT, SEXUALITY & FERTILITY	XI - SPINAL DEFORMITIES
Auditorium ISIC		CONFERENCE HALL ISIC
18:30 20:00	XII - WORKSHOP ON NEUROMODULATION	SPINAL CORD SOCIETY GENERAL BODY MEETING
20:00 22:00	BANQUET DINNER	

Day 2 - Saturday, 23rd February 2008

Time	Hall A	Hall B
8:00 9:00	XIII - IMPROVING OUTCOME / OF COMPLICATIONS IN SPINE SURGERY	XIV - REHABILITATION PREVENTING MANAGEMENT OF SCI
9:00 10:00	XV - NON-FUSION TECHNOLOGIES	XVI - COMPLICATIONS IN SCI
10:00 10:30	BREAK	
10:30 11:05	XVII - SPINAL CORD SOCIETY ORATION	
11:05 12:00	XVIII - DISC ARTHOPLASTY	
12:00 13:00	XIX - DEGENERATIVE SPINE DISEASE	
13:00 14:00	BREAK	
14:00 15:00	XX - SPINAL TUMORS	XXI PREVENTION & PROMOTION OF SCI IN DEVELOPING COUNTRIES
15:00 16:00	XXII - MINIMAL ACCESS SURGERY	XXIII - OUTCOME ASSESSMENT AND FOLLOW-UP
16:00 16:30	BREAK	

Time	Hall A	Hall B	Hall C
16:30 18:00	XXIV - BEST POSTER AND FREE PAPER SESSION	XXV - BEST POSTER AND FREE PAPER SESSION	XXVI ADVANCEMENT IN UNDERSTANDING AUTONOMIC DYSFUNCTIONS IN SCI
Auditorium			
18:30 20:00	XXVII CASE DISCUSSIONS HOW THE MASTERS WOULD MANAGE THEM		
20:00 22:00	CEREMONY COMMEMORATING 10 YEARS OF COMMISSIONING OF ISIC & WELCOME DINNER		
20:30 22:00	WELCOME DINNER		

Day 3 - Sunday, 24th February 2008

Time	Hall A	Hall B
8:00 9:00	XXVIII CELLULAR THERAPIES	
9:00 10:30	XXIX - BACK PAIN	
10:30 11:00	XXX - BEST PUBLISHED PAPER AWARD SESSION	
11:00 11:55	XXXI SPINAL TUBERCULOSIS	
11:55 12:15	XXXII Navigation In Spine Surgery	
12:15 13:15	XXXIII - ROLE OF CELLULAR THERAPY FOR SCI IN HUMAN BEINGS CURRENT SCENARIO PANEL DISCUSSION	
13:15 14:00	XXXIV - CRANIOVERTEBRAL AND CERVICAL DEGENERATIVE	
14:00 15:00	XXXV - ASSISTIVE TECHNOLOGY	
15:00 16:00	XXXVI FREE PAPER SESSION	
16:00 16:30	BREAK	
16:30 17:30	XXXVII SCS BEST PAPER AWARD SESSION FOR BEST POSTER PRESENTER IN THE FIELD OF SURGICAL AND REHABILITATION MANAGEMENT	
17:30 18:00	CLOSING CEREMONY	

CONFERENCE PROGRAMME
FROM 22ND TO 24TH FEBRUARY 2008
AT
TAJ PALACE HOTEL, NEW DELHI

Day 1 - Friday, February 22, 2008

08:00 - 09:00 Shah Jehan Hall	Talk no.	I - PLENARY SESSION - EVALUATION OF SCI **Chairpersons**: Dr. Douglas Brown, Dr. S.Y. Kothari
8:00 - 8:15	1	ICF based data gathering, communication, planning and monitoring system **Dr. Rob Campbell**, Aurora Hospital, Port Elizabeth, South Africa
08:15 -08:30	2	Development of international standards for assessment of autonomic dysfunctions following SCI **Dr. Andrei Krassioukov**, Associate Professor, Div. Phys .Med. & Rehab., Scientist, ICORD, Adjunct Professor, School of Rehabilitation, University of British Columbia, Vancouver, Canada
08:30 - 08:45	3	Recent Advances in radiological evaluation of SCI **Dr. Harsh Mahajan**, Consultant Radiologist, Mahajan Imaging Centre, New Delhi
08:45 - 09:00		Discussion
09:00 - 10:00 Shah Jehan Hall		II - ACUTE MANAGEMENT OF SCI - [session sponsored by Pfizer] **Chairpersons**: Dr. U. Singh, Dr. Ajay Bhutani
09:00 -09:15	4	Management of respiratory problems in acute quadriplegia **Dr. Douglas Brown**, Medical Director, Spinal Injuries Centre, Melbourne, Australia
09:15 -09:30	5	Advances in rehabilitation management of acute spinal cord injury **Dr. Sanjay Wadhwa**, Prof and Head of Physiotherapy and Rehabilitation Department, PGI, Chandigarh
09:30 - 09:45	6	Advancements in Understanding Neuropathology of SCI and its Clinical Relevance **Dr. V. Srikumar**, Dept. of PMR, AIIMS, New Delhi
09:45 - 10:00		Discussion
		INAUGURATION CEREMONY
10:00 - 10:30 Shah Jehan Hall		INAUGURATION CEREMONY
10:30 - 11:30 Shah Jehan Hall		III - PLENARY SESSION - OSTEOPOROSIS (session co-hosted by ISBMR) **Chairpersons**: Dr. Ambrish Mittal, Prof. Nikhil Tandon
10:30 - 10:55	7	Recent advances in evaluation and management of osteoporosis **Dr. Steven Cummings**, Professor of Medicine and Epidemiology (Emeritus) at the Unviersity of California, San Francisco and Director of the San Francisco Coordinating Center
10:55 - 11:07	8	Advances in surgical management of osteoporosis **Dr. Shankar Acharya**, Consultant Spine Surgeon, Sir Gangaram Hospital, New Delhi
11:07 - 11:30		Panel Discussion
11:30 - 12:30 Shah Jehan Hall		IV - PLENARY SESSION - EDUCATION AND RESEARCH **Chairpersons**: Dr. Rob Campbell, Dr. Sanjeev Dua
11:30 - 11:45	9	Ways and Means of Postgraduate Education in Spinal Surgery **Dr. Patrick Kluger**, ex - Chief Spine Surgeon, Stoke Mandeville Hospital, UK
11:45 - 12:00	10	Evidence-based practice: are we advancing? **Dr. Lisa Harvey**, Senior Lecturer, Northern Clinical School, Rehabilitation Studies Unit, Faculty of Medicine, University of Sydney
12:00 - 12:15	11	Research opportunities, especially as they relate to the need for international collaboration **Dr. Rory Cooper**, Distinguished Professor and FISA/PVA Chair, University of Pittsburgh, USA
12:15 - 12:30		Discussion
12:30 - 13:00 Shah Jehan Hall		V - PLENARY SESSION - ISIC Oration **Chairpersons**: Major HPS Ahluwalia
12:30 - 12:35	12	Introduction

12:35 - 13:00	13	Dynamics of Disability definition - a Global Perspective **Dr. A.K. Mukherjee**, Director General, ISIC, New Delhi
13:00 - 14:00		LUNCH
14:00 - 15:00 Mumtaz Mahal Hall		VI - CONSERVATIVE & REHABILITATION MANAGEMENT OF SCI **Chairpersons**: Dr. H.C. Goyal, Prof. Rosemarie Cooper
14:00 - 14:15	14	Current Trends in Conservative Management of Vertebral Fracture **Dr. Navnender Mathur**, Head of Deptt. of Physical Medicine and Rehabilitation, SMS Medical College and Hospital, Jaipur
14:15 - 14:30	15	Reducing Secondary Complications of SCI - New Developments **Dr. Rajender Sharma**, Senior Specialist(PMR), Rehabilitation Department, Safdarjung Hospital New Delhi.
14:30 - 14:45	16	Advancements in management of tetraplegic hand **Dr. Deepak Raina**, Hand Service, Department of Orthopaedics, ISIC, New Delhi
14:45 - 15:00		Discussion
14:00 - 15:00 Shah Jehan Hall		VII- Surgical Management of SCI **Chairpersons**: Air Marshal A.S. Chahal, Dr. Hans Joseph Erli
14:00 - 14:15	17	What's new in Surgical Management of Thoracolumbar Trauma **Dr. Samir Dalvie**, Consultant Spine Surgeon, Bombay Hospital and Medical Research Centre, Mumbai
14:15 - 14:30	18	What's new in Surgical Management of Cervical Spine Trauma **Dr. Manoj Sharma**, Orthopaedic Surgeon, Jaipur Golden Hospital, New Delhi
14:30 - 14:45	19	Recent advances in management of spinal injury in Geriatric patients **Dr. Ashwini D. Sharan**, Department of Neurosurgery, Thomas Jefferson University, USA Discussion
14:45 - 15:00		Discussion
15:00 - 16:00 Mumtaz Mahal		VIII - REHABILITATION MANAGEMENT OF SCI #1 **Chairpersons**: Dr. Lisa Harvey, Dr. James Middleton
15:00 - 15:15	20	Advances in Physical Rehabilitation of SCI **Dr. Anil Kumar Gupta**, Dept. of PMR, AIIMS, Ansari Nagar, New Delhi
15:15 - 15:30	21	Plasticity in spinal cord after injury **Dr. Vinod Sahgal**, Professor of Medicine, University Hospitals, Case Medical Centre, Cleveland
15:30 - 15:45	22	Body weight supported treadmill training **Dr. Abhishek Srivasatava**, Department of physiatrist, Neurology and Rehabilitation, NIIMHANS, Bangalore
15:45 - 16:00		Discussion
15:00 - 16:00 Shah Jehan Hall		IX- SPINAL INSTRUMENTATION / STABILIZATION **Chairpersons**: Dr. Ralf Gahr, Dr. Sajan Hegde
15:00 - 15:15	23	Recent advances in surgical hardware for degenerative spine surgery **Dr. Yash Gulati**, Sr. Orthopaedic and Spine Surgeon, Apollo Hospital, New Delhi
15:15 - 15:30	24	First experience with the minimal-invasive reduction plate system ArcoFix **Dr. Hans Josef Erli**, Deputy Chair of the Department of Trauma Surgery, Aachen, Germany
15:30 - 15:45	25	Modern uses of cement in spine surgery **Dr. Abhay Nene**, Associate Spine Consultant, P.D. Hinduja National Hospital, Mumbai
15:45 - 16:00		Discussion
16:00 - 16:30		TEA BREAK
16:30 - 18:00 Mumtaz Mahal		X - BLADDER MANAGEMENT, SEXUALITY & FERTILITY **Chairpersons**: Dr. Jean Jacques Wyndaele, Mr. Gurpreet Singh
16:30 - 16:43	26	"Urological Management: Current Trends on When to operate and Which Operation". **Jean Jacques Wyndaele**, Editor - Spinal Cord, Professor of Urology, Belgium
16:43 - 16:56	27	Proposed guidelines in the bladder management for the spinal cord injured patient **Mr. Gurpreet Singh**, Urologist, UK
16:56 - 17:09	28	Intravesical therapy options for neurogenic detrusor over activity **Prof. Dr.med. Manfred Stohrer**, Urologist, Germany

17:09 - 17:21	29	Unanswered questions in the management of the neurogenic bladder **Dr. Dinesh Suman**, Urologist, ISIC, New Delhi
17:21 - 17:33	30	New Developments in Sexuality Management of SCI **Dr. Stanley Ducharme**, Andrologist, Spinal Injuries Centre, Boston, USA
17:33 - 17:45	31	Advances in Fertility Management of SCI **Dr. Sanjeev Sharma** Specialist in Reproductive Gynaecology and Infertility, Head, Post Graduate School of Obstetrics and Gynaecology, Liverpool, UK
17:45 - 18:45		Discussion
16:30 - 18:00 Shah Jehan Hall		XI - SPINAL DEFORMITIES Chairpersons: Prof. Kamal Ibrahim, Dr. Nobert Passuti
16:30 - 16:42	32	Latest Trends in Management of Scoliosis - CAD Approach and Case studies **Dr. Amit Bhanti**, Prosthetist and Orthotist, University of Illinois College of Medicine, USA
16:42 - 17:00	33	Vertebral posterior osteotomies in management of spinal deformities **Prof. Kamal Ibrahim**, Clinical Professor, Loyola University ,Chicago, USA
17:00 - 17:18	34	Adult Thoracolumbar and lumbar scoliosis: Current concepts and strategies for surgical treatment **Dr. Nobert Passuti**, Head of the Department - Orthoapedics & Spine, Hotel Dieo Nantes, France
17:18 - 17:30	35	Advances in the Management of early onset spinal deformities **Dr. Surya Prakash Rao**, Associate Professor and Spinal Surgeon, Nizam's Institute of Medical Sciences, Hyderabad
17:30 - 17:42	36	Current Trends in Management of Kyphotic Deformities **Dr. Mihir Bapat,** Orthopaedic Surgeon, PD Hinduja Hospital, Mumbai
17:42 - 18:00		Discussion
Conference Hall-ISIC 18:30 - 19:00		SPINAL CORD SOCIETY - GENERAL BODY MEETING
Auditorium - ISIC 19:00 - 20:15		XII - Workshop on Neuromodulation Chairpersons: Dr. Ashwani Sharan, Dr. Abhay Nene
19:00 - 19:12		Pathophysiology and consevative management of pain in various spinal disorders **Dr. S.Y. Kothari**, Consultant, PMR, Safdarjang Hospital, New Delhi
19:12 - 19:24		Spinal cord stimulation - by percutaneous technique **Dr. G.P. Dureja**, Consultant, Pain Clinic, Indian Spinal Injuries Centre, Delhi
19:24 - 19:49		Spinal cord stimulation - by surgical laminotomy technique **Dr. Ashwani Sharan**, Department of Neurosurgery, Thomas Jefferson University, USA
19:49 - 20:15		Panel Discussion Dr. S. Y. Kothari, Dr. G.P. Dureja, Dr. Ashwani Sharan, Prof. Arvind Jayaswal, Dr. Rana Patir, Dr. Shankar Acharya, Dr. Bipin Walia, Dr. Abhay Nene
20:00 - 22:00		BANQUET DINNER

Day 2 - Saturday, February 23, 2008

8:00- 9:00 Mumtaz Mahal	Talk no.	XIII - IMPROVING OUTCOME / PREVENTING COMPLICATIONS IN SPINE SURGERY **Chairpersons**: Dr. Julio Gallego, Dr. Samir Dalvie
8:00 - 8:12	37	Thrombophophylaxis in Spine Surgery **Dr. Rajagopalan**, St. John's Medical College and Hospital, Bangalore
8:12 - 8:24	38	Is Fusion necessary after revision discectomy for Lumbar Intervertebral Disc Prolapse? **Prof. Rajkumar,** Dept. of Neurosurgery, SGPGI Lucknow
8:24 - 8:36	39	Does instrumentation and fusion rate improve outcome and reduce Complications? - current thinking **Dr. Rushma Tandon,** Orthopaedic and Spine Surgeon, Northern Railway Hospital, New Delhi
8:36 - 8:48	40	Biological enhancement of fusion **Dr. Julio Gallego**, Spinal Surgeon , Memphis, USA
8:48 - 9:00		Discussion
8:00 - 9:00 Shah Jehan Hall		XIV - REHABILITATION MANAGEMENT OF SCI #2 **Chairpersons**: Dr. Stanely Ducharme, Dr. Nazirah

8:00 - 8:15 41 Psychological and psychopathological aspects of rehabilitation in spinally injured subjects: findings from a cross-cultural project.
Prof. Cesare Maffei, Professor, Clinical Psychology, University Vita, San Raffaele, Milan

8:15 - 8:30 42 FES after SCI current use, therapeutic effects and future directions
Dr. (Lt Col) S.N. Bhaduri, Medical Officer, PMR, RR Hospital New Delhi

8:30 - 8:45 43 Brain Gate neural interface system
Dr. A.K. Sahani, Consultant Neurologist, Indian Spinal Injuries Centre, New Delhi

08:45 - 09:00 Discussion

09:00- 10:00 Mumtaz Mahal Hall XIII - -NON FUSION TECHNOLOGIES
Chairpersons: Dr. V.T. Ingalhalikar, Dr. Harsh Bhargava

09:00 - 09:15 44 Biomechanics of Dynamic Stabilization
Dr. Avinash Patwardhan, Department of Orthopaedic Surgery and Rehabilitation, Loyola University Stritch School of Medicine, USA

09:15 - 09:30 45 Dynamic Stabilisation - From Concepts to Clinical Applications.
Dr. Sajan Hedge, Consultant Orthopaedic Surgeon, Apollo Hospital, Chennai

09:30 - 09:45 46 Interspinous process distraction for spinal stenosis (DIAM)
Prof. P.S. Ramani, Senior Consultant, Neuro and Spine Surgeon, Lilavati Hospital and research Centre, Mumbai

09:45 - 10:00 Discussion

09:00 - 10:00 Shah Jehan Hall XVI - COMPLICATIONS IN SCI - [session sponsored by Pfizer]
Chairpersons: Dr. S.K. Kame, Dr. Fazlul Hoque

09:00 - 09:15 47 Advances in Pain Management: Taking a Biopsychosocial Approach".
Prof. James Middleton, Senior Lecturer, Rehabilitation Studies Unit, Faculty of Medicine, University of Sydney

09:15 - 09:30 48 Reticular Formation - the Battlefield of all SCI complications
Dr. Dajue Wang, Aylesbury ,Bucks, UK

09:30 - 09:45 49 Medical risks in SCI
Dr. Nazirah, Physiatrist, Malasia

09:45 - 10:00 Discussion

10:00 - 10:30 BREAK

10:30 - 11:05 Shah Jehan Hall XVII - PLENARY SESSION - SPINAL CORD SOCIETY ORATION
Chairpersons: Dr. A.K. Mukherjee, Dr. H.S.

50 Spinal cord management - what we have learned in the last 50 years
Dr. Jean Jacques Wyndaele, Editor - Spinal Cord, Professor of Urology, Belgium

11:05 - 12:00 Shah Jehan Hall XXV - DISC ARTHOPLASTY
Chairpersons: Dr. P.K. Dave, Dr. Ram Chadha

11:05 - 11:15 51 Patient Selection for Disc Replacement: the dilemmas
Dr. Rajendra Prasad, Neurosurgeon, Apollo Hospital, New Delhi

11:15 - 11:30 52 Lumbar Disc Arthroplasty: Current Evidence
Dr. A K Singh, Neurosurgeon, Director Neurosciences, Fortis Hospital, Noida

11:30 - 11:45 53 Cervical disc replacement
Dr. H.S. Chhabra, Chief of Spine Service and Medical Director, Indian Spinal Injuries Centre, New Delhi

11:45 - 12:00 Discussion

12:00 - 13:00 Shah Jehan Hall XVII - PLENARY SESSION - DEGENERATIVE SPINE DISEASE
Chairpersons: Dr. Ziad Al-Zoubi, Dr. K.L. Kalra

12:00 - 12:15 54 Laminoplasty for lumbar canal stenosis- a biological method of maintaining stability and mobility
Dr. S.M. Tuli, Consultant Orthopaedic Surgeon, VIMHANS, New Delhi

12:15 - 12:30 55 Degenerative spondylolisthesis; review of current trends and controversies
Dr. Ram Chadha, Spine Surgeon, K.J. Somaiya Hospital, Mumbai

12:30 - 12:45 56 Cervical Discoplasty
Dr. P.S. Ramani, Senior Consultant, Neuro and Spine Surgeon, Lilavati Hospital and research Centre, Mumbai

12:45 - 13:00 Discussion

13:00 - 14:00 LUNCH

14:00 - 15:00 Mumtaz Mahal XIX - SPINAL TUMORS
Chairpersons: Col. V.S. Madan, Dr. Raghava Dutt Mulukutla

14:00 - 14:15 57 Current trends in the management of spinal metastatic disease
Dr. Gautam Zaveri, Consultant Spine Surgeon, Zaveri Clinic, Chetan Building, Ghatkopar, Mumbai

14:15 - 14:30	58	Current Trends In Surgical Management Of The Primary Sacral Tumours **Dr. Ziad.M. Al Zoubi**, Consultant Orthopaedics and Spine Surgery, General Secretary, Pan Arab Spine Society, Jordan
14:30 - 14:45	59	Current trends of predictors of surgical outcome of patients with intramedullary spinal cord tumors **Dr. (Col.) H.S. Bhatoe**, Consultant Neurosurgeon, Research and Referral (Army Hospital), New Delhi
14:45 - 15:00		Discussion
14:00 - 15:00 Shah Jehan Hall		XX - PREVENTION OF SCI IN DEVELOPING COUNTRIES **Chairpersons** - Mr. Ashish Goyal, MOSJE, Govt. of India, Dr. Douglas Brown
14:00 - 14:15	60	"Prevention of Spinal Cord injuries in developing countries of ASIA" **Mr. Eric Weerts**, Programme Coordinator SCI Project, Handicap International, Vietnam
14:15 - 15:00		Panel Discussion Dr. Fazlul Hoque (Bangladesh), Dr. Anil Shrestha (Nepal), Ms. Esha Thapa, Dr. Nazirah (Malasia), Mr. Stephen Muldoon (Ireland), Maggie Muldoon (Ireland), Sri Lanka, Eric Weerts (Vietnam), Dr. H.S. Chhabra, Dr. V.P. Sharma, Dr. S.K. Kame
15:00 - 16:00 Mumtaz Mahal Hall		XXI - MINIMAL ACCESS SURGERY **Chairpersons**: Dr. S. Rajasekaran, Dr. Satnam Chhabra
15:00 - 15:15	61	Percutaneous posterior spinal fusion and fixation techniques **Dr. Ralf Gahr**, Leipzig, Germany
15:15 - 15:30	62	Microendoscopic disc surgery procedures **Dr. Raghava Dutt**, Consultant Orthopaedic and Spine Surgeon, UDAI Clinic, Hyderabad
15:30 -15:45	63	Laser in transforaminal disc surgery and lateral foraminoplasty technique and my results in lateral canal stenosis **Dr. Satish Chandra Gore**, Spine Surgeon, Kamla Regency, Pune
15:45 - 16:00		Discussion
15:00 - 16:00 Shah Jehan Hall		XXII - OUTCOME ASSESSMENT AND FOLLOW-UP Chairpersons: Dr. John Steeves, Dr. Rajinder Sharma
15:00 - 15:15	64	Ageing after SCI **Dr. Anil Kumar Gaur**, Assistant Director, All India Institute Of Physical Medicine & Rehabilitation, Haji Ali Park, Mahalaxmi, Mumbai-400006
15:15 - 15:30	65	Current understanding on Predictors of neurological recovery after SCI **Dr. Fazlul Hoque**, Consultant Orthopaedic Surgeon, Bangladesh, Vice President - South East Asia, ISCoS,
15:30 -15:45	66	Assessing Satisfaction after SCI - Current Trends **Dr. S.L. Yadav**, Psychiatrist, All India Institute of Medical Sciences, New Delhi
15:45 - 16:00		Discussion
16:00 - 18:00 Mumtaz Mahal Hall		XXIII - SCS GOLD MEDAL AWARD SESSION FOR BEST PAPER PRESENTER IN THE FIELD OF SURGICAL MANAGEMENT **Judges**: Dr. Nobert Passuti, Dr. Prof. Kamal Ibrahim, Dr. Patrick Kluger, Dr. Ziad M. Al Zoubi, Dr. Ralf Gahr, Dr. S. Rajasekaran, Dr. V.T. Ingalhalikar, Prof. P.S. Ramani **Chairperson** - Prof. Arvind Jayaswal, Air Marshal A.S. Chahal
16:00 - 16:06	1	Morphometric measurement of cadaveric thoracic spine in Northern India and its clinical implications **Dr. Roop Singh**
16:06 - 16:12	2	Recent advances in Paediatric Congenital Atlantoaxial Dislocation: some new concepts **Dr. Samir Kumar Kalra**
16:12 - 16:18	3	Association of methylenetetrahydrofolate reductase genetic polymorphisms with atlantoaxial dislocation **Dr. Sanjay Panwar**
16:18 - 16:24	4	Paediatric Cervical Trauma - patterns of injury and management **Dr Arvind G Kulkarni**
16:24 - 16:30	5	Correlation of prehistoric care and functional outcome in thoracolumbar spinal trauma patients **Dr. Pankaj Kandwal**
16:30 - 16:36	6	Shortening in Acute Thoracolumbar Burst Fracture - alternatives to posterior short segmental stabilization **Dr. Gautam Zaveri**, Consultant Spine Surgeon, Zaveri Clinic, Chetan Building, Ghatkopar, Mumbai
16:36 - 16:48		Discussion

16:48 - 16:54	7	Reduction of Adult Isthimic Spondylolisthesis - Our Experience **Dr. Vikas Tandon**
16:54 - 17:00	8	Outcome study of MISS vs Open surgery in low grade spondylolisthesis **Dr. Ram Kinkar**
17:00 - 17:06	9	Prospective analysis of 129 patients operated for cervical spondylotic myelopathy (CSM) **Dr. Vishal Kundanani**
17:06 - 17:12	10	Clinical significance of Electro diagnosis in lumbar disc herniation **Dr. Narkeesh. A.**
17:12 - 17:18	11	Discectomy in lumbar canal stenosis.When to do it? **Dr Uday Pawar**
17:18 - 17:28		Discussion
17:28 - 17:34	12	Craniovertebral Tuberculosis Treated Conservatively **Dr. Manish Chadha**
17:34 - 17:40	13	"Potts Spine: the role of interferoni in diagnosis of Potts Spine: A prospective study" **Dr.Rupant Kumar Das**
17:40 - 17:46	14	TLIF for lumbosacral tuberculosis **Dr. Satyen Mehta**
17:46 - 17:52	15	Spinal Intradural Lesions and Management-359 cases,12 years **Dr. Suresh M Dugani**
17:52 - 18:00		Discussion
16:00 - 18:00 Shah Jehan Hall		XXXIII - SCS GOLD MEDAL AWARD SESSION FOR BEST PAPER PRESENTER IN THE FIELD OF REHABILITATION MANAGEMENT **Judges**: Dr. Douglas Brown (Australia), Dr. John Steeves, Dr. Vinod Sahgal, Prof. Manfred Stohrer (Germany), Dr. Dajue Wang (UK), Dr. Rory Cooper, Dr. Jean Jacques Wyndaele, Dr. U. Singh **Chairperson** - Dr. A.K. Mukherjee, Dr. H.C. Goyal
16:00 - 16:06	1	Traumatic vs. Non-Traumatic Spinal Cord Lesion: Comparison of Neurological and Functional Outcome after Inpatient Neurological Rehabilitation **Dr. Anupam Gupta**
16:06 - 16:12	2	Patterns of morbidity in spinal cord injured earthquake victims and its implications in Activities of Daily Living **Ms. Sarah Milton**
16:12 - 16:18	3	Long Follow-up in Spinal Cord Injury **Dr. Navin Kumar**
16:18 - 16:24	4	QUALITY OF LIFE OF PEOPLE WITH SPINAL CORD INJURY IN NORTHERN INDIA **Dr. Roop Singh**
16:24 - 16:30	5	Out come of vocational training in electronics for people with complete paraplegia after returning to community. **Md. Iqbal Hossain**
16:30 - 16:40		Discussion
16:40 - 16:46	6	Bladder Management Outcome after Spinal Cord Injury: A Prospective Study **Dr. Abhishek Srivastava**
16:46 - 16:52	7	Effect of Pharmacological agents on Neuropathic pain following Spinal cord injury **Dr. Nitin Pandey**
16:52 - 16:58	8	Influence of Helium - Neon laser photo stimulation on pressure ulcer in spinal cord injury patients **Dr. G. Arun Maiya**
16:58 - 17:04	9	Effect of medially linked and unlinked knee immobilizer on paraplegic gait performance **Dr. Meenakshi Singh**
17:04 - 17:12		Discussion
17:12 - 17:18	10	Assistive Technology on the threshold of the New Millennium - Shaping the future and enabling self-determination for people with spinal injuries **Ms. Jyoti Vidhani**
17:18 - 17:24	11	Core Training for Neck Stabilization: **Mr. Rajendra Thapa**
17:24 - 17:30	12	Factors influencing Asian Indian Students Attitudes toward people with disabilities: A conjoint Analysis **Dr. Divya Parashar**
17:30 - 17:36	13	Dilutional Hyponatraemia (DH) during skull traction: Diagnosis and management **Dr. Sayeed**
17:36 - 17:42	14	Rehabilitation Period Of Spinal Cord Injury **Ms. Anshu Bhalla**
17:42 - 18:00		Discussion
Hall C Sheesh Mahal 16:30 - 18:00		XXV - Advancements in understanding Autonomic Dysfunctions in SCI **Chairpersons**: Dr. Andrei Krassikouv, Dr. Stanley Ducharme

16:30 - 16:45	67	Introduction **Dr. Andrei Krassikouv**, Associate Professor, Div. Phys .Med. & Rehab., Scientist, ICORD, Adjunct Professor, School of Rehabilitation, University of British Columbia, Vancouver, Canada
16:45 - 17:05	68	What do we know, and what don't we know, about blood pressure control in patients with spinal cord injury? From spaceflight and animal experiments, to the patient's bed **Dr. Andrei Krassikouv**, Associate Professor, Div. Phys .Med. & Rehab., Scientist, ICORD, Adjunct Professor, School of Rehabilitation, University of British Columbia, Vancouver, Canada
17:05 - 17:25	69	Implications of cardiovascular research relative to sexual functioning for patient and staff and how this new knowledge should be applied in rehabilitation setting **Dr. Stanley Ducharme**, Andrologist, Spinal Injuries Centre, Boston, USA
17:25 - 17:40	70	Understanding other autonomic dysfunction in SCI **Dr. Gita Handa**, Dept. of PMR, AIIMS, Ansari Nagar, New Delhi
17:40 - 18:00		Discussion
Auditorium - ISIC 18:30 - 19:30		XXVI - CASE DISCUSSIONS - HOW THE MASTERS WOULD MANAGE THEM Panelists: Dr. Nobert Passuti (France), Dr. Douglas Orr, Dr. Patrick Kluger, Dr. Prof. Kamal Ibrahim (USA), Dr. Ziad M. Al Zoubi (Jordan), Dr. Ralf Gahr, Prof. Arvind Jayswal, Dr. S. Rajasekaran (Chennai), Dr. V.T. Ingalhalikar, Prof. P.S. Ramani (Mumbai), Dr. Erkan Kaptanoglu (Turkey), Dr. Sajan Hedge Case Presenters: Dr. Vishal Nigam, Consultant Orthopaedics and Spine Surgeon, Indian Spinal Injuries Centre, New Delhi Dr. Kalidutta Das, Consultant Orthopaedics, Indian Spinal Injuries Centre, New Delhi
19:30 - 22:00		CEREMONY COMMEMORATING 10 YEARS OF COMMISSIONING OF ISIC & WELCOME DINNER

Day 3 - Sunday, February 23, 2008

8:00- 9:00 Shah Jehan Hall	Talk no.	XXVII - PLENARY SESSION - CELLULARY THERAPIES **Chairpersons**: Dr. Vinod Sahgal, Dr. Geeta Jotwani
8:00 - 8:15	71	What's new in Neuronal Regeneration **Dr. Erkan Kaptanoglu**, Associate Professor, Department of Neurosurgery, Ankara Numune Education and Training Hospital, Ankara, Turkey
8:15 - 8:30	72	Plasticity and Repair of the Injured Mammalian Spinal Cord. The Potential Role of Transplanted Adult Neural Stem Cells in the Restoration of Function **Prof. Alfredo Gorio**, Professor of Pharmacology, Director, Clinical Pharmacology IRCCS Humanities, University of Milan, Italy
8:30 - 8:45	73	Strengths and limitations of cell transplants for the treatment of Spinal disorders **Dr. John Steeves**, Professor and Director of ICORD, Professor of Zoology, Anatomy, and Surgery, University of British Columbia and Vancouver Hospital, Canada
8:45 - 9:00		Discussion
9:00 - 10:30 Shah Jehan Hall		XXVIII - PLENARY SESSION - BACK PAIN **Chairpersons**: Dr. P.S. Ramani, Prof. Sudhir Kapoor
9:00 - 9:19	74	Mind and Back Pain **Dr. V.T. Ingalhalikar**, Consultant and Surgeon for Spinal Affections, Thane, Maharashtra
9:19 - 9:30	75	Advances in Conservative Management of Back Pain **Dr. U. Singh**, Professor and Head, Deptt of PMR, AIIMS, New Delhi
9:30 - 9:42	76	Advances in Management of Inflammatory Back Pain **Dr. A.N. Malaviya**, Consultant Rheumatologist, ISIC, New Delhi Advances in neurointervention for
09:42 - 09:53	77	Advances in neurointervention for Management of Back Pain **Dr. G.P. Dureja**, Consultant, Pain Clinic, Indian Spinal Injuries Centre, Delhi
09:53 - 10:04	78	Advances in Surgical Management of Back Pain **Dr. Bipin Walia**
10:04 - 10:15	79	Advancements in Management of Failed Back **Brig. P.K. Sahoo**, Neurosurgeon, Command Hospital, Pune
10:15 - 10:30		Discussion
10:30 - 11:00 Shah Jehan Hall		XXIX - PLENARY SESSION - BEST PUBLISHED PAPER AWARD SESSION **Chairperson**: Dr. Patrick Kluger, Air Marshal A.S. Chahal

10:30 - 10:32		Information about the award **Dr. Patrick Kluger**, ex - Chief Spine Surgeon, Stoke Mandeville Hospital, UK
10:32 - 10:50	80	Buckling collapse of Spine in Childhood Spine Tuberculosis **Dr. S. Rajasekaran**, Director and Head of Department, Orthopaedics, Spine and Trauma Surgery, Ganga Hospital, Coimbatore, Chennai
10:50 - 10:58		Discussion
10:58 - 11:00		Presentation of Award
11:00 - 11:55 Shah Jehan Hall		XXX - PLENARY SESSION - Spinal Tuberculosis **Chairpersons:** Dr. S.M. Tuli, Dr. Mathew Verghese
11:00 - 11:15	81	Review of Current Trends in Indications of Conservative and Surgical Management of Spinal Tuberculosis **Prof. A.K. Jain**, Prof. of Orthopaedics (UCMS and GTB Hospital New Delhi)
11:15 - 11:30	82	Minimally Invasive Options for Surgical Management of Pott's Spine **Prof. Arvind Jayaswal**, Professor & Head, Department of Orthopaedics, AIIMS, New Delhi
11:30 - 11:42	83	Craniovertebral tuberculosis **Dr. S.S. Kale**, Assistant Professor, Neurosurgery, All India Institute of Medical Sciences, New Delhi
11:42 - 11:55		Discussion
11:55 - 12:15 Shah Jehan Hall		Navigation in Spine surgery **Chairperson** : Dr. Erkan Kaptanoglu
11:55 - 12:10	84	Role of navigation in Spine Surgery **Dr. S. Rajasekaran**, Director and Head of Department, Orthopaedics, Spine and Trauma Surgery, Ganga Hospital, Coimbatore, Chennai
12:10 - 12:15		Discussion
12:15 - 13:15 Shah Jehan Hall		XXXI - PLENARY SESSION - ROLE OF CELLULAR THERAPY FOR SCI IN HUMAN BEINGS - CURRENT SCENARIO - PANEL DISCUSSION **Chairpersons:** Dr. John Steeves, Dr. Geeta Jotwani **Panelists** - Dr. Erkan Kaptanoglu, Prof. Alfredo Gorio, Dr. Raj Bahadur, Dr. H.S. Chhabra, Dr. R.K. Singh, Dr. Ravi Kumar, Dr. Rajesh Malhotra, Dr. Trivedi
13:15 - 14:00 Shah Jehan Hall		XXXII - CRANIOVERTEBRAL AND CERVICAL DEGENERATIVE DISORDERS **Chairpersons:** Col V.S. Madan, Dr. V.K. Rajoria
13:15 - 13:27	85	C1 2 TRANSARTICULAR FIXATION IN UPPER CERVICAL TRAUMA **Dr. Satish Rudrappa**, Consultant Neurosurgeon, White House Clinic, Bangalore
13:27 - 13:39	86	Newer techniques in management of Cervical degenerative spine disorders **Dr. Ashish Suri**, Neurosurgeon, AIIMS, New Delhi
13:39 - 13:51	87	Transforamial approach in management of various cervical spine ailments **Dr. Rana Patir**
13:51 -14:00		Discussion
14:00 - 15:00 Shah Jehan Hall		XXXIII - ASSISTIVE TECHNOLOGY **Chairpersons:** Dr. Rory Cooper, Mr. Nekram Upadhyay
14:00 - 14:15	88	Clinical application of Assistive Technology and related SCI Clinical Practice Guidelines. **Prof. Rosemarie Cooper**, Director of Clinical Services for Assistive Technology, University of Pittsburgh, USA
14:15 - 14:30	89	Recent advances in wheelchair securement systems in public transportation **Nekram Upadhayay / Nahom Boyene**
14:30 - 14:45	90	Role of Pressure mapping as an aid for seating cushion prescription in SCI patients **Dr. V.P Sharma**, Director Professor & Head, Deptt. Of Physical Medicine & Rehabilitation (RALC), K.G's Medical University, Lucknow
14:45 - 15:00		Discussion
15:00 - 16:00 Shah Jehan Hall		XXXIV - Free Paper Session Chairpersons: Dr. Raj Bahadur, Dr. P.S. Bawa
15:00 - 15:06	1	"CT- GUIDED" PERCUTANEOUS VERTEBROPLASTY :- A SUPERIOR TECHNIQUE Enhanced precision at lower cost **Dr. Vishal Kundanani**
15:06 - 15:12	2	Spontaneous migration of intradural bullet during surgery - a case report **Dr. Roop Singh**
15:12 - 15:18	3	Total lumbar Disc Replacement **Dr Arvind G Kulkarni**
15:18 - 15:24	4	Outcome based study of Anterior Column Reconstruction and instrumentation in Burst Fractures of thoraco-lumbar region **Dr. Lalit Sharma**
15:24 - 15:30	5	Structural adaptations for barrier - free movement for wheelchair users: literature review **Ms. Shruti Sharma**

15:30 - 15:36 6 Estimating perceived comfortability in chair sitting posture among medical students
Mr. Sridhar. D

15:36 - 15:42 7 How to establish an assistive technology centre in the existing medical and/or rehabilitation facilities?
Dr. Nekram Upadhyay

15:42 - 15:48 8 Role of Integrated Medicine (Homoeopathy) In Spinal Diseases
Dr. Deepti Aggarwal

15:48 - 16:00 Discussion

16:00 - 16:30 Break

16:00 - 17:30 Shah Jehan Hall

XXXIV - SCS GOLD MEDAL AWARD SESSION FOR BEST POSTER PRESENTER

Judges for best poster presenter in the field of rehabilitation management
Dr. Vinod Sahgal, Dr. Stanley Ducharme, Prof. James Middleton, Dr. Dajue Wang, Dr. Rory Cooper, Dr. Rob Campbell

Judges for best poster presenter in the field of surgical management
Dr. Erkan Kaptanoglu, Dr. Hans Josef Erli, Dr. Julio Gallego, Dr. Ashwini Sharan, Dr. Prof. Kamal Ibrahim, Dr. Samir Dalvie, Dr. Sajan Hedge

Chairpersons: Dr. S.K. Kame, Dr. Vikas Gupta

SURGICAL MANAGEMENT

1 Biological fixation of unstable sacral fracture with neurological deficit: a case report
Dr. Anil Kumar

2 Efficacy of anterior approaches in managing tubercular spine -72 cases long term follow up
Dr. Vishal Kundanani

3 Flap surgery in pressure ulcers in spinal cord injury: an outcome study
Dr. Roop Singh

4 Role of Decompression in Late presentation of cervical spinal cord injuries in rural India
Dr. Sandeep Shrivastava

5 A new laboratory test for diagnosis of Ankylosing Spondylitis with Estimation of Serum Sialic Acid & Glycosaminoglycans
Dr. Bidre Upendra

6 Vertical Atlanto-Axial Index: A New Craniovertebral Radiological Index
Dr Arvind G Kulkarni

SURGICAL PROTOCOL- CERVICAL

7 SURGICAL PROTOCOL- CERVICAL MYELOPATHY BASED ON PATTERN OF COMPRESSION
Dr. Vishal Kundanani

8 A case report - C1 fracture with transverse ligament injury
Dr. P.V. Thirumalai Murugan

9 Congenital butterfly sixth cervical vertebra with kyphotic deformity
Dr. Dharmendra

10 Primary spinal epidural non
Dr. Dharmendra

11 Transpedicular drainage of presacral abscess after failure of antitubercular treatment
Dr. Dharmendra

12 GCT spine -hunt for recurrences -long term follow up
Dr. Vishal Kundanani

13 Sacral root injury in spinal injury patient after spinal manipulation
Dr. Dharmendra

14 Patterns of Spine Involvement in tuberculosis of spine
Dr. Vikas Tandon

15 Dorsal Myelopathy: Interesting Case
Dr. Vikas Tandon

16 Technique for insertion of Pedicle Screws in Deformed spine : A concept
Dr. Vikas Tandon

17 Surgical Management of Pressure Ulcers in Spinal Cord Disease at Neurological Rehabilitation Set up
Dr. Abhishek Srivastava

18 Fornier Gangrene - a rare complication of SCI
Dr. Pradeep Singh

19 Correction of deformity in ankylosing spondylitis with traumatic paraplegia
Dr. Pradeep Singh
Favorably outcome in late decompression in

20 Favorably outcome in late decompression in incomplete thoracolumbar burst fractures
Dr. Pradeep Singh

21 Rehabilitation outcome in patients with compressive spinal cord diseases
Mr. Rajesh V.L.

22 Active rehabilitation of young spinal cord injured in Indian cities
Ms. Ketna Mehta

23 Prediction of Neurological Recovery in spinal cord injury
Dr. Astha Patni

24 Recovery and substitution of functions after a severe spinal injury
Dr. Mark A. Leontiev

25 Rehabimageineering: Spinal cord injury & me
Mr. Ravi Shankar

26 Aquatic Rehabilitation of Spinal Cord Injured patients
Shefali Walia, Co-Author: Shallu Sharma

27 Role of Wheelchair Skills Training in Rehabilitation of Spinal Cord Injured patients
Shefali Walia, Co-Author: Shallu Sharma

28 Neuroprosthetics for restoring functions after spinal cord injury
Jitendra Narayan, Lecturer(P&O), ISIC Institute of Rehabilitation Sciences

29 Intervertebral lumbar spine accessory motion assessment: a clinical perspective
Ms. Shallu Sharma, Co-Author - Ms. Shefali walia

30 Whiplash associated disorders (grade I and II): Motor and sensory alterations in a rehabilitation perspective
Ms. Shallu Sharma, Co-Author - Ms. Shefali walia
Is your computer workspace spine friendly?

31 Is your computer workspace spine friendly?
Ms. Sonia Goel, Lecturer(M.O.T), ISIC Institute of Rehabilitation Sciences

17:30 CLOSING CEREMONY

Basic Workshop on SCI Management

SCIENTIFIC PROGRAMME

WORKSHOP FOR COMBINED TEAM

Venue: Auditorium, ISIC, New Delhi

Monday, 25th February 2008 - Day - 1

08:30 hrs - 08:35 hrs	Welcome
08:35 hrs - 11:00 hrs	Anatomy & Assessment Chairperson: Dr. Vinod Sahgal Moderator: Dr. Nazirah
08:35 hrs - 09:00 hrs	Anatomy & Physiology Dr. Vishal Nigam
09:00 hrs - 09:30 hrs	Clinical Assessment of Patients with SCI Dr. U. Singh
09:30 hrs - 10:00 hrs	International Standards for Neurological Classification of SCI Mrs. Chitra Kataria
10:00 hrs - 10:30 hrs	International SCI Data Sets Dr. Rob Campbell
10:30 hrs - 11:00 hrs	Panel Discussion: Vietnam representative, Dr.Muzharul Mannan (Bangladesh representative), Dr Deepthi Perera (Sri Lanka representative), Dr. Yubaraj Kharel (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Rob Campbell, Dr. Roop Singh, Stephen, Eric, Dr. Nazirah, Dr. Patrick Kluger, Dr. Jean Jacques Wyndaele
11:00 hrs - 11:30 hrs	Break
11:30 hrs - 13:00 hrs	Chairperson: Dr. U. Singh Moderator: Dr. Rob Campbell
11:30 hrs - 12:00 hrs	Approach to SCI care Outcomes Orientation, CBR Dr. James Middleton
12:00 hrs - 12:30 hrs	Team-based Care Roles, Synergies & responsibilities Dr. Nazirah
12:30 hrs - 13:00 hrs	Panel Discussion: Vietnam representative, Dr.Muzharul Mannan Bangladesh representative, Dr Deepthi Perera (Sri Lanka representative), Dr. Yubaraj Kharel (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Roop Singh, Dr. James Middleton, Dr. Nazirah, Stephen, Eric, Dr. Patrick Kluger, Dr. Jean Jacques Wyndaele, Dr. S.Y. Kothari
13:00 hrs - 14:00 hrs	Break
14:00 hrs - 15:30 hrs	Chairperson: Dr. Douglas Brown Moderator: Dr. Vishal Nigam
14:00 hrs - 14:30 hrs	Role of Medical & Paramedical Professionals in Prevention Mr. Eric Weerts
14:30 hrs - 15:00 hrs	Pre-hospital and Acute Care of SCI Management Dr. Vinod Sahgal

15:00 hrs - 15:30 hrs	Panel Discussion: Vietnam representative, Dr.Muzharul Mannan Bangladesh representative, Dr Deepthi Perera (Sri Lanka representative), Dr. Anil Shrestha (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Roop Singh, Dr. Nazirah, Stephen, Eric Weerts, Dr. Vinod Sahgal, Dr. Patrick Kluger, Dr. Jean Jacques Wyndaele, Dr. S.Y. Kothari
15:30 hrs - 16:00 hrs	Break
16:00 hrs - 18:30 hrs	Chairperson: Dr. Jean Jacques Wyndaele Moderators: Dr. Dinesh Suman, Ms. Divya Parashar
16:00 hrs - 16:30 hrs	Individual and Family Adjustment in Spinal Cord Injury Care Dr. Stanley Ducharme
16:30 hrs - 17:00 hrs	Management of Neurogenic Bladder Dr. Jean Jacques Wyndaele
17:00 hrs - 17:30 hrs	Sexuality & SCI Dr. Dinesh Suman
17:30 hrs - 18:00 hrs	Panel Discussion: Vietnam representative, Dr.Muzharul Mannan Bangladesh representative, Dr Deepthi Perera (Sri Lanka representative), Dr. Yubaraj Kharel (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Roop Singh, Dr. Nazirah, Stephen, Eric, Dr. Stanley Ducharme, Dr. Jean Jacques Wyndaele, Dr. Dinesh Suman, Dr. S.Y. Kothari

Tuesday, 26th February 2008 - Day - 2

08:30 hrs - 09:30 hrs	Chairperson: Dr. V.P. Sharma Moderator: Sis. Neetu
08:30 hrs - 09:00 hrs	Nursing Perspectives of SCI Management Sis. Neetu
09:00 hrs - 09:30 hrs	Panel Discussion: Vietnam representative, Bangladesh representative, Dr Deepthi Perera (Sri Lanka representative), Dr. Yubaraj Kharel (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Roop Singh, Dr. Nazirah, Stephen, Eric, Sis. Neetu
09:30 hrs - 10:30 hrs	Chairperson: Capt. Dilip Sinha Moderator: Dr. Kalidutta Das
09:30 hrs - 10:00 hrs	Management of Vertebral Lesion Dr. Patrick Kluger
10:00 hrs - 10:30 hrs	Panel Discussion: Vietnam representative, Dr.Md. Mostafa Kamal (Bangladesh representative), Dr Deepthi Perera (Sri Lanka representative), Dr. Yubaraj Kharel (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Roop Singh, Dr. Nazirah, Stephen, Eric, Dr. Patrick Kluger, Dr. H.S. Chhabra, Dr. Kalidutta Das, Dr. S.Y. Kothari
10:30 hrs - 11:00 hrs	Break

11:00 hrs - 13:00 hrs	Chairperson: Dr. Rory Cooper Moderator: Dr. Lisa Harvey
11:00 hrs - 11:30 hrs	Physical Therapy Perspectives on Rehabilitation Dr. Lisa Harvey
11:30 hrs - 12:00 hrs	Modifying The Environment Mobility & Seating Dr. Rory Cooper
12:00 hrs - 12:30 hrs	Modifying the Environment Activity & Participation Dr. Rajinder Sharma
12:30 hrs - 13:00 hrs	Panel Discussion: Vietnam representative, Mr.Md.Sohrab Hossain Bangladesh representative, Dr Deepthi Perera (Sri Lanka representative), Rajendra Thapa (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Roop Singh, Dr. Nazirah, Stephen, Eric, Dr. Lisa Harvey, Dr. Rory Cooper, Dr. Rajinder Sharma, Mrs. Chitra Kataria
13:00 hrs - 14:00 hrs	Break
14:00 hrs - 15:40 hrs	Chairperson: Dr. James Middleton Moderator: Dr. Roop Singh
14:00 hrs - 14:30 hrs	Early and Late Complications in SCI Dr. Douglas Brown
14:30 hrs - 14:50 hrs	Bowel Care and Management Capt. Dilip Sinha
14:50 hrs - 15:10 hrs	Vocational Rehabilitation Dr. S.Y. Kothari
15:10 hrs - 15:40 hrs	Panel Discussion: Vietnam representative, Dr.Md.Mostafa Kamal (Bangladesh representative), Dr Deepthi Perera (Sri Lanka representative), Rajendra Thapa (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Roop Singh, Dr. Nazirah, Stephen, Eric, Dr. Douglas Brown, Mrs. Chitra Kataria, Dr. S.Y. Kothari
15:40 hrs - 16:00 hrs	Break
16:00 hrs - 17:30 hrs	Wrap-up session for the whole team (moderators of each panel discussion to present conclusions on each aspect)

BASIC WORKSHOP ON SCI MANAGEMENT FOR DOCTORS

Day-3

09:00 - 11:00 hrs	Chairperson: Dr. Patrick Kluger Moderator: Dr. Rob Campbell
09:00 - 09:30 hrs	Evaluation of a SCI patient Dr. U. Singh
09:30 - 10:00 hrs	Acute management Dr. Vinod Sahgal
10:00 - 10:30 hrs	Radiological Evaluation of SCI Dr. Anita Agarwal

10:30 - 11:00 hrs	Panel Discussion: Vietnam representative, Dr.Md.Mostafa Kamal Bangladesh representative, Sri Lanka representative, Dr. Anil Shrestha (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Rob Campbell, Dr. Roop Singh, Dr. Nazirah, Dr. Patrick Kluger, Dr. Vinod Sahgal, Dr. Anita Agarwal, Dr. Douglas Brown
11:00 - 11:30 hrs	Break
11:30 - 13:00 hrs	Chairperson: Dr. Vinod Sahgal Moderator: Dr. H.S. Chhabra
11:30 - 12:00 hrs	Conservative management of vertebral lesions Dr. Rob Campbell
12:00 - 12:30 hrs	surgical management of vertebral lesions Dr. Patrick Kluger
12:30 - 13:00 hrs	Panel Discussion Vietnam representative, Dr.Md.Mostafa Kamal Bangladesh representative, Sri Lanka representative, Dr. Yubaraj Kharel (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Rob Campbell, Dr. Roop Singh, Dr. Nazirah, Dr. Patrick Kluger, Dr. Vinod Sahgal, Dr. Douglas Brown, Dr. S.Y. Kothari
13:00 - 14:00 hrs	Break
14:00 - 15:15 hrs	Chairperson: Dr. James Middleton Moderator: Dr. Dinesh Suman
14:00 - 14:25 hrs	Bladder management Dr. Dinesh Suman
14:25 - 14:50 hrs	Fertility and sexuality in SCI Dr. Kulkarni
14:50 - 15:15 hrs	Discussion Vietnam representative, Dr.Md.Mostafa Kamal Bangladesh representative, Sri Lanka representative, Nepal representative, Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Rob Campbell, Dr. Roop Singh, Dr. Nazirah, Dr. Vinod Sahgal, Dr. Dinesh Suman, Dr. Vijay Kulkarni, Dr. Douglas Brown
15:15 - 15:30 hrs	Break
15:30 - 17:00 hrs	Chairperson: Dr. Anil Shrestha Moderator: Dr. Roop Singh
15:30 - 16:00 hrs	Early complications and its management Dr. Vishal Nigam
16:00 - 16:30 hrs	Management of Spasticity & Pain Dr. Douglas Brown
16:30 - 17:00 hrs	Panel Discussion: Vietnam representative, Dr.Md.Mostafa Kamal Bangladesh representative, Sri Lanka representative, Dr. Yubaraj Kharel (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Rob Campbell, Dr. Roop Singh, Dr. Nazirah, Dr. Vinod Sahgal, Dr. Douglas Brown, Dr. Vishal Nigam

17:00 - 18:00 hrs	Chairperson: Dr. S.Y. Kothari Moderator: Dr. V.P. Sharma
17:00 - 17:20 hrs	Pressure Sore prevention and management Dr. Rajinder Sharma
17:20 - 17:40 hrs	Late complications and its management Dr. Douglas Brown
17:40 - 18:00 hrs	Panel Discussion: Vietnam representative, Dr.Md.Mostafa Kamal Bangladesh representative, Sri Lanka representative, Dr. Anil Shrestha (Nepal representative), Capt. Dilip Sinha, Dr. V.P. Sharma, Dr. U. Singh, Dr. Rob Campbell, Dr. Roop Singh, Dr. Nazirah, Dr. Vinod Sahgal, Dr. Douglas Brown, Dr. Rajinder Sharma, Dr. S.Y. Kothari

DISCIPLINE SPECIFIC WORKSHOP FOR NURSES

09:00 - 11:00 hrs	Chairperson: Ms. Lalita Sahay
09:00 - 09:30 hrs	Role of Nursing in Management of SCI Sis. Neetu Maitra
09:30 - 09:50 hrs	Barrier nursing Dr. Monika
09:50 - 10:15 hrs	Patient positioning, lifts and turns Sis. Neetu Maitra
10:15 - 11:00 hrs	Demonstration of Patient positioning, lifts and turns Sis. Neetu and team
11:00 - 11:30 hrs	Break
11:30 - 13:00 hrs	Chairperson: Dr. Smitha Moderator: Ms. Jyoti Sharma
11:30 - 12:00 hrs	The nursing care of the acutely ill / newly injured patient Ms. Jyoti Sharma
12:00 - 12:30 hrs	Management of Tracheostomised and ventilated patients Dr. P.K. Mangla
12:30 - 13:00 hrs	Panel Discussion: Vietnam representative, Bangladesh representative, Sri Lanka representative, Dr. Yubaraj Kharel (Nepal representative), Sis Neetu Maitra
13:00 - 14:00 hrs	Break
14:00 - 15:15 hrs	Chairperson: Dr. Chiranjeev Sobti Moderator: Dr. Kalidutta Das
14:00 - 14:25 hrs	Prevention and management of pressure sore Ms. Lalita Sahay
14:25 - 14:50 hrs	Other complications of SCI Dr. Kalidutta Das
14:50 - 15:15 hrs	Panel Discussion Vietnam representative, Bangladesh representative, Sri Lanka representative, Bishnu Ghimire (Nepal representative), Sis Neetu, Dr. K. Das

15:15 - 15:30 hrs	Break
15:30 - 18:00 hrs	Chairperson: Capt. Dilip Sinha Moderator : Sis. Neetu Maitra
15:30 - 16:00 hrs	Bladder Management Dr. Dinesh Suman
16:00 - 16:30 hrs	Sterile and clean intermittent catheterization techniques Dr. Dinesh Suman
16:30 - 17:00 hrs	Bowel Management Capt. Dilip Sinha
17:00 - 17:30 hrs	Sexuality and Fertility Dr. Vijay Kulkarni
17:30 - 18:00 hrs	Panel Discussion Vietnam representative, Bangladesh representative, Sri Lanka representative, Dr. Yubaraj Kharel (Nepal representative), Sis Neetu, Dr. Dinesh Suman, Capt. Dilip Sinha, Dr. Vijay Kulkarni

Workshop for Therapists
Day 3

09:00 - 10:30 hrs	Chairperson: Dr. Lisa Harvey Moderator: Ms. Chitra Kataria
09:00 - 09:30 hrs	ASIA Assessment Dr. Lisa Harvey
09:30 - 09:50 hrs	Functional Independence Measure Dr. Lisa Harvey
09:50 - 10:10 hrs	Setting goals Mrs. Chitra Kataria
10:10 - 10:30 hrs	Panel Discussion: Vietnam representative, Mr.Md.Sohrab Hossain Bangladesh representative, Sri Lanka representative, Rajendra Thapa (Nepal representative), Mrs. Chitra Kataria, Dr. Lisa Harvey, Ms Mausam, Ms. Anshu Bhalla
10:30 - 11:00 hrs	Break
11:00 - 13:00 hrs	Chairperson: Dr. Lisa Harvey Moderator: Mr. Rajendra Thapa
11:00 - 11:25 hrs	Teaching motors skills Dr. Lisa Harvey
11:25 - 11:45 hrs	Understanding how people with paralysis move Dr. Lisa Harvey
11:45 - 12:10 hrs	Bed mobility and transfers Dr. Lisa Harvey / Rajendra Thapa
12:10 - 12:30 hrs	Gait Dr. Lisa Harvey

12:30 - 13:00 hrs	Panel Discussion: Vietnam representative, Mr.Md.Sohrab Hossain Bangladesh representative, Sri Lanka representative, Rajendra Thapa (Nepal representative), Mrs. Chitra Kataria, Dr. Lisa Harvey, Ms Mausam, Ms. Anshu Bhalla
13:00 - 14:00 hrs	Break
14:00 - 15:15 hrs	Chairperson: Dr. Lisa Harvey Moderator: Ms. Anshu Bhalla
14:00 - 14:30 hrs	Upper limb function Ms. Anshu Bhalla
14:30 - 14:55 hrs	Prevention and management of complications (especially respiratory, cardiovascular and musculoskeletal) the physiotherapist's perspective Dr. Lisa Harvey
14:55 - 15:15 hrs	Panel Discussion: Vietnam representative, Mr.Md.Sohrab Hossain Bangladesh representative, Sri Lanka representative, Kshetra Gurung (Nepal representative), Mrs. Chitra Kataria, Dr. Lisa Harvey, Ms Mausam, Ms. Anshu
15:15 - 15:30 hrs	Break
15:30 - 16:45 hrs	Chairperson: Mr. Nekram Upadhyay Moderator: Ms. Jyoti Vidhani
15:30 - 15:50 hrs	Wheelchair assessments & prescription Mr Nekram Upadhyay
15:50 - 16:10 hrs	Seating Ms Alexandra / Mr Nahom / Ms Jyoti Vidhani
16:10 - 16:30 hrs	Wheelchair skills Mr Arun Sondhi / Ms Alexandra
16:30 - 16:45 hrs	Panel Discussion: Vietnam representative, Mr.Md.Sohrab Hossain Bangladesh representative, Sri Lanka representative, Kshetra Gurung (Nepal representative), Mrs. Chitra Kataria, Dr. Lisa Harvey, Ms Mausam, Ms. Anshu Bhalla, Mr. Nekram, Mr. Arun Sobdhi, Ms. Alexandra, Ms. Jyoti Vidhani, Mr. Nahom
16:45 - 18:00 hrs	delegates will be split into four groups and will go to each demonstration by rotation of 15 minutes each i.e. 16:45 to 17:00 hrs, 17:05 to 17:20 hrs, 17:25 to 17:40 hrs and 17:45 to 18:00 hrs Nekram Upadhyay/ Alexandra / Jyoti / Nahom/ Anshu / Mausam

	Demonstration of Manual wheelchairs	Demonstration of Powered wheelchairs	Demonstration Wheelchair seating	Demonstration MAT Assessment

Spinal Cord Society Oration

Spinal cord management - what we have learned in the last 50 year

Jean-Jacques Wyndaele MD DSci PhD
FISCOS FEBU
University Antwerp Belgium

More than a century ago very important scientists as Claude Bernard and Sherrington inflicted spinal cord trauma on animals to better understand the physiological mechanisms in healthy men. Fifty years ago the great majority of spinal cord injured died fairly quickly from their complications. Now many survive and the life expectation has reached almost normal levels.The management has thus improved as well as the knowledge of neurophysiology overall.

What has been a critical breakthrough ? The two World Wars with their enormous numbers of SCI patients. Already in 1917 in the report of an interallied conference on the treatment of war invalids Dr Camus and Mrs Dejerine put forward what was needed: specialised centres, specific care, functional re-education, professional re-adaptation, even the intermittent catheterization of the bladder was described.

However it took more than 25 years before the management following these principles got going in the US, England and Canada with pioneers as Munro, Bors, Guttmann, Abrahamson, Davis, Freeman, Jousse, Talbot. A few years later Houssa, Tricot, Grossiord, Benassy and many others followed. In the last decades of the twentieth century the world has seen a real growth of interest with the creation of specialised centres in most countries of the world, an evolution that is not over yet. Many names of pioneers in their own right can be mentioned here.

The techniques used in spinal cord medicine are based not only on an increasing knowledge but for a big part on common sense, attention for detail, perseverance and good will. These things are found to a high level in rehabilitation which has made spinal cord care one of the main examples of this approach. Spinal cord medicine has in fact almost become a speciality in its own right with its International Society, many national societies, its journals and especially Spinal Cord, and a specialised group of carers.

Everywhere one can see a strong evolution: initial mortality that has greatly diminished due to the better acute care and transport, the better reanimation etc. The consequences are clear: the better acute care not only increases the total number of patients that survive but also the relative number with tetraplegia. The complete lesions have diminished by better manipulations.

All aspects of the treatment have seen great evolutions. This is the case f.e. in neurosurgical/ortopedic fixation or conservative spine care, respiratory, bowel, bladder, skin and cardiovascular care. Sexuality and procreation have become an integral part of rehabilitation. There is a continuous evolution in knowledge about wheelchairs, other techniques for motion. The importance of sports has been demonstrated decades ago and specialised games and the World Paralympics have taken the sport for SCI patients to a Olympic level. There has been a great change in all kinds of available medication, appliances, catheters.

Repair of the injured spinal cord by regeneration therapy remains an elusive goal so far though attempts have been made to restore some nerve function. In contrast, progress in medical care and rehabilitation has

resulted in improved health and function of persons with spinal cord injury. In the absence of a cure, raising the level of achievable function in mobility and self-care depend on creative use of the rapidly advancing technology. As a clear example of evolution, rehabilitation medicine scientists building on achievements in microelectronics, microprocessing and neuroscience have succeeded in developing functional electrical stimulation (FES) systems that enable certain individuals with SCI to use their paralyzed hands, arms, trunk, legs and diaphragm for functional purposes and gain a degree of control over bladder and bowel evacuation. Many more examples can be given of the evolution. One major point of attention will be the continuous research on restoration of the spinal cord and nerves. But one should not confuse SCI rehabilitation with a shop full of fancy gadgets. The core business is still comprehensive management with the best of available local means, good care from start, the knowledge of the danger of fragmentation of care, the attention for the relatives and all this based on knowledge of the solid basic principles that the last 50 years have brought us. Much has been done, much needs to be done still.

Buckling Collapse of the Spine in Childhood Spinal Tuberculosis.

Dr. S. Rajasekaran, PhD

Abstract:

We prospectively followed 61 children under 15 years of age at the time of diagnosis to identify the risk factors for deformity progression. The children had 63 lesions and a minimum of 15 years followup. All exhibited an increase in deformity during the active disease phase, but 26 of 63 (41%) continued to progress during the quiescent phase until the growth was complete. In 21 of those 26, there was an increase in angular kyphosis with a final deformity < 90[degrees]. In the other five, the deformity resembled a buckling collapse analogous to failure of an axially loaded slender column; the deformity was more than 100[degrees] and associated with facet dislocation at multiple levels. These patients' vertebral segments above the level of destruction underwent severe sagittal rotation resulting in horizontal vertebrae with vertical growth plates, which resulted in longitudinal overgrowth of the vertebral segments. Risk factors for buckling collapse included an age of less than 7 years at the time of the disease, thoracolumbar involvement, loss of more than two vertebral bodies, and presence of radiographic spine-at-risk signs. Children at risk for buckling collapse must be carefully watched and the spine stabilized to avoid a massive increase in deformity.

Level of Evidence: Level II, prognostic study. See the Guidelines for Authors for a complete description of level of evidence.

FACULTY LECTURES

1. Development of international standards for assessment of autonomic dysfunctions following SCI.

Andrei Krassioukov MD, PhD, FRCPC,
Associate Professor, Div. Phys. Med. & Rehab., Scientist,
ICORD, Dep. of Medicine, University of British Columbia,
Vancouver, BC

Spinal cord injury (SCI) is associated with devastating, often intractable, clinical conditions. Patients with SCI, in addition to readily recognized and reasonably well-understood somatic motor deficiencies, often suffer chronic pain that is severe, refractory to treatment, and obscure in etiology. In addition, many SCI patients suffer from poorly-understood autonomic pathology. Autonomic dysfunction after 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. Unfortunately we still do not fully understand pathophysiology of the autonomic dysfunctions following SCI.

Over the last decade we have developed and significantly improved the assessment of individuals with SCI. However, the current International Standards for Neurological Classification of Spinal Cord Injury (INCSCI) **only evaluates motor and sensory deficits and does not evaluate autonomic function. The lack of standards for the assessment of autonomic function following SCI led to the ASIA/ISCoS initiative to** design a set of autonomic standards that would describe the impact of SCI on autonomic function. For the last three years the International (ASIA/ISCoS) Autonomic Committee focused on developing of autonomic standards and evaluation of the variety currently available autonomic assessments that could potentially be utilized for the evaluation of individuals with SCI. The information on the progress of development of Autonomic Standards following SCI will be presented.

2. Advancements in Understanding Neuropathology of Spinal Cord Injury and Its Clinical Relevance

Dr Srikumar V, Prof U Singh
Department of Physical Medicine and Rehabilitation
All India Institute of Medical Sciences
New Delhi, India

Abstract

Neuropathology of Spinal Cord Injury (SCI) is complex, and our understanding is limited but evolving. Many advances have been made in the recent decade which has contributed significantly in evolving therapeutic and rehabilitation strategies. Study of cellular and molecular responses to SCI is a fascinating field and each new discovery instills hope to find a cure or bring functional improvement. Understanding the normal function of cells in the Central Nervous System, namely the neurons (motor neurons, sensory neurons, autonomic neurons and interneurons), astrocytes, oligidendrocytes, endothelial cells, neutrophils, monocytes, microglia and T lymphocytes, and their response to injury is a difficult task.

Post mortem studies in humans and rodent SCI models show that there is a triphasic response to SCI acute, secondary and chronic. In the acute phase cell death arises from mechanical and ischaemic damage, electrolyte shift, hemorrhage and edema. In the secondary phase the injury spreads with continuing edema, ischaemia and electrolyte shift. Major damage in this phase occurs from the release of cytokines and chemokines from neutrophils and lymphocytes leading to lipid peroxidation and free radical production. In the chronic phase worsening of injury may occur due to cyst formation, demyelination, scarring and tethering, and alteration in receptors and ion channels. The aim of this interlocution is to look at recent advances in our understanding of neuropathology of cord injury and how this may contribute to device novel therapeutic strategies.

3. Postgraduate education in Spine Surgery

Patrick J. Kluger

1 Problem

Newly introduced methods triggered, worldwide, an enormous increase in surgical procedures on the spine during the past 25 years, and still counting. Spine surgery undisputedly requires specific skills and training, but nowhere a formalised educational curriculum has been established yet, which would lead to an acknowledged specialist registration in the sub-speciality which has its roots equally in neurological surgery and in orthopaedic surgery this again divided in trauma management and in the management of non-traumatic deformities and instabilities-, not to forget the knowledge and experience from the life-long management of SCI persons. Moreover, a great part of all sine surgery is done single handed from neurosurgeons or orthopaedic surgeons within larger departments of their speciality, or even in private setups. Even specialised departments of considerable size, with numerous surgeons, hardly ever cover all different methods and indications in surgical procedures on the spine. To become a spine surgeon of desirable competence and skills can therefore hardly be achieved by in-house training alone.

2 Solutions

2.1 Attachments / Fellowships

One could ideally imagine a travelling program for postgraduate students, or preferably for registered orthopaedic surgeons and neurosurgeons, which could close the knowledge gaps left by their previous training.

Possibly international attachments of at least two months each would then be required for training exposure in specialised neurosurgical, in trauma-focussed orthopaedic, in deformity-focussed orthopaedic, and in comprehensive SCI-centres. Considering the life situation and the age of the persons in question, this imagination does not appear very practicable, especially with its expenses in mind. Language barriers and growingly restrictive national regulations in medical practise pose further obstacles against the idealistic imagination.

2.2 Educational courses

In the situation described numerous training courses have evolved for the purpose. The lecture given is an attempt to characterise different types of courses / workshops of educational value in spinal surgery, and to describe their requirements in equipment and in staffing.

Four main groups of courses can be differentiated:

1. Clinical courses
   Operations with assistance from participants, with or without video-transmission to a larger audience, focussed on one or more pathologies

2. Cadaver courses
   Anatomical work with and without use of fluoroscopy and/or computer navigation, with and without insertion of implants, and with or without the use of endoscopy

3. Specimen course
   Course using animal specimen, sheep or bovine, to practise the placement of pedicle screws based on CT-scans or on computer assisted navigation.

4. Workshop with plastic models
   Course to practise the handling and assembly of spinal systems for different indications, with plastic models (Sawbone®) provided accordingly.

For a specific educational event, two or more of the above courses can be blended together.

2 Discussion

All these types of course have their values, but to be aware of their specific objectives is crucial; cadaver courses are exemplarily not really helpful in learning the techniques of pedicle screw insertion as they are widely perceived, though.

Up to now, the vast majority of educational courses are driven and sponsored by the industry. Obviously this can cause further problems. Therefore, the national medical councils and the scientific societies have an important role to play in acknowledging and in supervising the courses, and in attributing adequate CME-points to them.

4. International Research & Development: Indian Spinal Injuries Centre University of Pittsburgh Collaboration

Rory A. Cooper,
PhD, FIEEE, FRESNA, FAIMBE, FBMES

Co-Authors : Jonathon Pearlman, PhD, Rosemarie Cooper, MPT, ATP

Departments : Department of Rehabilitation Science & Technology, University of Pittsburgh and Human Engineering Research Laboratories, Veterans Healthcare Administration Pittsburgh Healthcare System.

Institution : University of Pittsburgh and U.S. Department of Veterans Affairs.

Address : Department of Rehabilitation Science & Technology
5044 Forbes Tower
University of Pittsburgh
Pittsburgh, PA 15260
USA

ABSTRACT

Through advances in technology in various sectors the ability to create a world-wide research community that collaborates on addressing critical world issues or that transfer knowledge rapidly from one region of the world to another becomes increasingly crucial. The rehabilitation and long-term community reintegration of individuals with spinal injuries, as well as other disabilities, is an area of critical need around the globe. In order to advance the development and deployment of appropriate mobility technology, the Indian Spinal Injuries Centre and University of Pittsburgh have been collaborating on a number of research projects and on the establishment of an Assistive Technology program at ISIC. To date, the research and development activities have focused on: (1) development of low-cost adjustable manual wheelchair; (2) flexible pediatric wheelchair design; (3) design of a low-cost highly functional electric powered wheelchair; (4) a consumer directed ethnographic study of wheeled mobility barriers using the world-wide-web; (5) wheelchair activity monitoring; (6) ISIC patient community reintegration survey; and (7) transportation selections in India and the United States. Several of these studies are ongoing, but have yielded interesting results and some initial publications. Although the focus of the collaboration has been on mobility, a critical area for people with SCI, it has also demonstrated benefits for advancing science and technology to benefit people with disabilities both in India and the United States.

5. Plasticity in the Spinal Cord after Injury

Vinod Sahgal, M.D.

Professor of Medicine, Chairman, Department of Physical Medicine and Rehabilitation, University Hospitals Case Medical Center Plasticity is defined as the capacity to continuously mold structure and/or function in response to experience or injury. Thus, plasticity is a dynamic state and effects behavior by changes in the anatomic, physiologic, and biochemical states.

Neural plasticity refers to this phenomenon as it relates to the nervous system and in this paper's context, to the spinal cord. The efficiency of this phenomenon is further restricted by the response of organisms of the same genotype to vary in phenotype and/or behavior according to variable environmental conditions. Neural function is modulated by a complex interplay of different afferent and efferent (neural and synaptic) inputs and outputs respectively. This is mediated by the neurotransmitters, which in turn are regulated by various growth factors and genes (Giovanni et al., 2004, Cameron et al., 2006) which in turn results in trans membrane ionic shifts leading to (increased long term potential or depression) synaptic transmission. This process ultimately forms the basis of neural activity and plasticity (Cai et al., 2006). Plasticity thus entails the association of function and structure to pathology (anatomic, biochemical, electrical, environment, and/or genetics).

The spinal cord provides the core, extro and proceptive afferent input which forms the basis for a precise and appropriate efferent response. Subhuman studies to date have established a strong connection between reacquisition of locomotor function, and synaptic activity (excitatory, and/or inhibitory). Thus, the following question arises: Is this relationship hard wired or plastic? If so, is it species or function dependent, or both?

Recent studies have shown that the acquisition and perfection of motor tasks or acquisition of new skills (learning) are a function of training during normal development as well as repair. Training works through the modification of the neural network. Activity dependent plasticity is driven by the peripheral input and cerebral output i.e. ballet, walking in a straight line, gymnastics (Wolpaw & Tennissen et al., 2001).

In the context of spinal plasticity the circuitry involved in standing and stepping is dynamic and is a function of neurons and synapses activated during stereotypical movements (step cycle). This is dependent on neural connectivity, which is activity regulated rather than anatomic (i.e. restoration of structure does not automatically result in function) (Wolpaw & Tennissen et al., 2001).

Activity dictates neural connectivity rather than vice versa, which can be regulated by training. In the sub human species (rodents and felines) there is a relatively limited role of the corticospinal input (locomotion is automatic and not learned) as there is a robust lumbosacral cental pattern generator, which is glycine as well as glutamate dependent and is modulated by noradrenergic and serotonergic neurotransmitters (Rodriguez Sahgal, 1977, Sahgal 1981, Grillner 2003, Edgerton et al., 2004).

Human and primate locomotor behavior is precise, goal directed, complex and skilled, thus under a much tighter level of cortical control and is also less automatic. This cortical control is a function of years of repetitions, which leads to patterned and precise input to the final motor neuron pool. This is exercised during development and relearning after injury, (skill learning i.e. typing, ballet, sports etc).

After a spinal cord injury the behavioral and physiologic plasticity is modulated by the tissue response to acute injury in parenchymal autodestruction secondary injury and lack of functional regeneration (Blight 2002).
These advances have resulted in the following principles of therapeutic approaches:

- Acute neuroprotection.
- Enhanced axonal regeneration.
- Restricting demyelination and promoting remylenation.
- Aggressive and precise rehabilitation strategies posture, mobility, and other skill sets.

6. Urological Management: Current Trends on When to operate and Which Operation

Jean Jacques Wyndaele
University Antwerp Belgium

Introduction

Neurologic urinary dysfunction may primarily result from dysfunction of the sphincter, the detrusor, or both in combination. Surgery may correct major shortcomings in pathophysiology, but it is indicated only after all conservative measures have been attempted and have proved to be ineffective.

Although preservation of renal function is a major goal of surgical treatment in this group, improvement in quality of life is the primary focus of therapy in most cases. Thus other factors to be considered in deciding on therapy will include: 1) social circumstances, 2) degree of disability, 3) cost effectiveness, 4) patient motivation and 5) possible complications of the treatment and the ways to handle these.

A comprehensive overview of techniques and experience with them can be read in the International Consultation on Incontinence reports. The last published in 2005 and a new upcoming to be published in 2009.

Tribute has to be made to Prof David Castro and Prof Anthony Stone for the information given hereunder.

Failure to empty

I-Surgery to Enhance Detrusor Contractility

Restoration of the bladder's reservoir function in combination with efficient voluntary emptying, has been the aim of the bladder stimulation over the past decades. A variety of implants have been used in patients with spinal cord injury or disease, with electrodes on the bladder wall, the splanchnic pelvic nerves, the conus medularis, the mixed sacral nerve and the sacral anterior roots. Direct bladder stimulation has produced poor results and has been abandoned as well as splanchnic pelvic nerves stimulation and stimulation at the conus medularis.

Sacral anterior root stimulation

Brindley, in London, started animal experiments in order to develop a system for intradural sacral anterior root stimulation in the 70's. The first successful sacral anterior root stimulator in a human subject with traumatic paraplegia, was implanted in 1978. Since then more than 3000 patients have been implanted worldwide. The technique of intradural sacral anterior root stimulation consists of the combination of complete posterior rhizotomies (S2, S3, S4) and simultaneous implantation of the Finetech-Brindley electrodes on the remaining anterior roots. Posterior rhizotomy promotes detrusor arreflexia and normal compliance, thus avoiding reflex incontinence. With this technique more than 80% of the patients were able to achieve sufficient intravesical pressure to produce efficient voiding. Several attempts, since then, have been made to improve this technique. These include surgical interruption of the somatic fibers, blockage of pudendal nerve transmission, fatiguing of the urethral sphincter, and selective small fiber activation. Some work has been done on the selective activation of the small diameter parasympathetic fibers on the ventral sacral nerve roots, using a selective anodal block. Other attempts to avoid the posterior rhizotomy, have used selective urethral sphincter blockade and reversible deafferentation using cryotherapy. Another technique recently described is that of combining sacral anterior root stimulation for electromicturition with electrostimulation of the posterior sacral roots to suppress the detrusor hyperreflexia (SPARSI).

Muscle augmentation

The use of the latissimus dorsi muscle wrapped around an artificial reservoir or wrapped around the atonic bladder, after division of its motor supply and its reanastomosis to an active nerve, or the use of the rectus abdominus has ended in failure to empty mostly related to electrode problems. Not in use for practice now.

II.-Surgery to decrease outlet resistance

Sphincterotomy

Transurethral Incision of the external urinary sphincter (TURS) has been used to promote bladder emptying and prevent urologic complications in the male spinal cord injured patients for nearly 50 years. It can be

performed with either a knife electrode or using a resection loop. Following electrosurgical TURS significant intraoperative and postoperative bleeding may occur. In addition, urethral strictures, and need for re-operation has been reported in 30 to 60%. Other failures reported are due to inadequate surgery, post TURS bulbous urethral strictures and poor detrusor contractility. In order to improve these results both contact and beam lasers have been used. Following TURS, some patients may have difficulty keeping the external condom in place. In practise, the use of sphincterotomy has significantly declined, over the past ten years due to indifferent results, lack of good outcome studies and increase d reliance on intermittent catheterisation.

Implantable stents

External sphincter stents have the potential to reduce dyssynergic external sphincter activity and reduce the incidence of recurrent obstruction. In addition some stents may be truly reversible. The positive conclusions in literature must be tempered with the fact that many need some further surgical intervention during follow-up. Overall stents have not been accepted as standard practise in the neurologic patient.

Failure to store

I. - Surgery to decrease detrusor contractility

Patients with neurologic lesions above the sacral micturition center will frequently exhibit neurologic detrusor over activity resulting in small bladder capacity and high intravesical pressure. Management of this will be directed at restoring storage function to as close to normal as possible, reducing the associated incontinence and possibility of upper tract changes. This management cannot be carried out in isolation as the patient's ability to empty may be compromised by the lesion itself or the therapy for the hyperreflexia, and must therefore also be considered. Surgery to decrease detrusor contractility by altering the sacral reflex arc has historically been unsuccessful. Mainly because of this, alternatives have achieved a 'gold standard' position in the management of these cases. These techniques are discussed in the following section.

1. Enterocystoplasty

It has been accepted practise for many years that patients with intractable detrusor hyperreflexia and or low compliance, with associated incontinence and/or upper tract deterioration, can be managed successfully by enterocystoplasty. The bladder is split and a bowel segment is implanted. The results are satisfactory in many. A universal theme is that complications are common. These include recurrent infection, stones, recurrent incontinence, bowel obstruction, and perforation. More remote complications include malignacy and metabolic abnormalities. The complication rate in some series reached more than 40%. Despite these observations, all authors refer to the overall success of this procedure. However, they do generally qualify this, in their conclusions, by commenting that careful patient selection is required along with life time follow up (LOE 4).

2. -Alternatives to enterocystoplasty

a) Gastrocystoplasty

Gastrocystoplasty was popularized as a more suitable segment for augmentation in the pediatric neurologic population. The absence of metabolic acidosis and thinner mucus were some of its advantageous characteristics. There are very few meaningful studies

b) Ureterocystoplasty

There are very few papers on the use of this technique in adults.

c) Detrusor myectomy (auto-augmentation)

Detrusor myectomy is intended to allow the bladder to enlarge when the functional capacity is reduced by detrusor overactivity or low compliance, in patients with neuropathology, who are refractory to anticholinergic medication. In this technique, a large part of the detrusor muscle is excised, leaving the mucosa intact and thereby creating an "artificial diverticulum". As a result the emptying contraction is reduced, and thus patients must use intermittent catheterisation. Bladder enlargement following detrusorectomy develops relatively slowly, taking about 1-2 years. During this period medical treatment with anticholinergics (mostly in a much lower dose then before surgery) may be beneficial). Occasionally, late reduction of capacity, caused by fibrosis, has been reported.

3. -Denervation techniques

Historically many techniques have been used and described in the literature to try and convert the overactive neurologic bladder (upper motor neuron lesion) to an underactive bladder (lower motor neuron lesion). In general they are rarely used now because of poor long-term results, and significant complications. Only Sacral rhizotomy has achieved the best success (as done in Brindly procedure) . In most series, presently, it is combined with implantation of sacral anterior root stimulator.

4. -Sacral nerve stimulation / neuromodulation.

Suppressing detrusor overactivity using a neuromodulation approach has been in the development stage for many years. Unfortunately there are no good studies on its use in the neurologic bladder patient. The exact mechanism, by which sacral nerve stimulation inhibits bladder contraction, is not fully understood. However it is thought that sacral nerve stimulation induces reflex mediated inhibitory effects on the detrusor through afferent and or efferent stimulation of the sacral nerves. In addition activation of the pelvic floor muscles may occur via stimulation of the somatic fibres of the nerves, causing further detrusor inhibition

Important remark

In general, surgical intervention to decrease detrusor contractility should still only be used when all conservative measures have failed. Choice of intervention at present will depend on many factors including the underlying pathogenesis of the condition, its natural history, the patients' mobility, motivation, age and home support to name the most significant.

II. -Surgery to increase sphincteric resistance

Patients with sphincteric incontinence due to neurologic disease or injury are candidates for surgical procedures to increase urethral resistance, assuming that associated detrusor compliance and contractility abnormalities can be satisfactorily managed. As all the procedures to increase urethral resistance in neurologic patients produce compression, urinary retention is not uncommon after the surgery. Patient selection and preoperative evaluation play a critical role in the process of increasing urethral resistance. The work-up should include history and physical examination, urine culture, cystourethroscopy, upper urinary tract imaging and urodynamics.

The minimal conditions that a neurologic patient should meet in order to be considered as a candidate for any of these procedures are: incontinence primarily due to intrinsic sphincter deficiency, a non contractile detrusor or controllable detrusor hyperactivity, a healthy, well-vascularized bulbar urethra or bladder neck, absence of significant vesicoureteric reflux. In addition the patient should have sufficient intelligence, motivation, compliance and manual dexterity and must be established on intermittent catheterisation. The rational for procedure selection depends on a number of patient's factors and the surgeon's preference and experience.

1. -Artificial urinary sphincter

There has not been a significant degree of popularity or success in the adult neurologic population. In most of the reported series, success rates reported range from 70% to 95% with a revision rate varying between 16% and 60% (66 to 76).

Close follow up is needed. When urodynamics reveals hyperreflexia not demonstrated preoperatively , anticholinergic therapy is needed. If maximal doses of anticholineregic drugs do not control the detrusor hyperactivity, bladder augmentation may be necessary.

2. - Sphincteric muscle augmentation.

Dynamic myoplasty
with an electrically stimulated Gracilis muscle flap (dynamic myoplasty) is, presently, only used in incontinent patients with severe sphincteric intrinsic deficiency who are not candidates for conventional treatment, including the artificial urinary sphincter, or in whom such treatment has failed.

Slings
There have been many reports on the success of pubovaginal slings for the treatment of intrinsic sphincteric deficiency in the neurologic population in both children and adults. The procedure is established in the neurologic female patient as an alternative to the artificial urinary sphincter. It should be assumed that following PV sling, patients will have to empty their bladders by intermittent catheterisation. The reported continence rate is generally high, with few complications, including difficulty with catheterisation, ventral hernia at the graft harvest site, bladder calculus and hyperreflexia. There have been a few reports on using slings to correct male neurologic urinary incontinence. Although some authors recommend its use in these patients, it is a procedure that has not gained much acceptance as yet.

Bulking agents

Periurethral injection of materials to provide bulk for urethral closure and continence has applicability for patients with neurologic bladder dysfunction, although this has not gained much popularity.

3. -Implantable valve/cath

Has been used in small series and the results are not very promising.

Important remark

There are several alternatives to surgically manage neurologic sphincteric deficiency. Increasing urethral resistance is possible only in those patients who have a good bladder capacity and accommodation or

pharmacologically controlled hyperreflexia. Otherwise when planning to increase the urethral resistance in these patients, bladder augmentation procedure should be considered. The implantation of an artificial urinary sphincter is the technique which has gained most popularity and which has passed the test of the time. As an alternative to the artificial sphincter a sling procedure might be use, assuming that the patient can perform intermittent catheterisation.

III.- Surgery to circumvent bladder

1 - Orthotopic bladder

This technique aims to create a low pressure reservoir in patients with severely damaged bladder wall by a partial cystectomy replaced by a substitution cystoplasty. A severely thick and fibrotic bladder wall can result from supra sacral neurologic bladder often complicated with recurrent infection or stones. Urodynamics usually shows hyperreflexia associated with high vesical pressure, severe low compliance and low capacity. Failure of conservative treatment is an indication for bladder surgery. In these cases, conventional augmentation cystoplasty cannot be used and the majority of the diseased bladder wall needs to be excised. The cystectomy in these cases is supratrigonal, leaving the bladder neck and the trigone intact. The ureters are left in place or reimplanted in the intestinal segment if high grade reflux or an abnormal urethrovesical orifice is identified.

Often this non-contractile reservoir and persistent dyssynergia require catheterisation to empty. The patient must be taught to perform catheterization before surgery. Urethral sphincter deficiency must sometimes be treated on top

2 - Continent diversion

Continent cutaneous urinary diversion provides an extra-anatomic bladder outlet associated with a valve for urinary continence, which is catheterised to empty. The urinary reservoir must have low pressure and good capacity. The continent catheterisable stoma can either be implanted into the native bladder or into an intestinal neo-reservoir. In most cases of supra sacral neurologic lesions and myelomeningocele, a bladder augmentation is carried out at the same procedure. In some cases the native bladder outlet needs to be closed to achieve continence. This is a difficult procedure, with recanalization observed in up to 25% . In men a secondary closure may be particularly difficult but in women a secondary closure can be carried out transvaginally. If the bladder outlet is suitable, it may be preserved, maintaining continence with either a sling or endoscopic transurethral injections, or just left as access to the bladder and as a pop-off mechanism.

Indications for a continent catheterisable stoma are: inability to perform self-catheterization through the normal anatomic route. In addition, in some tetraplegic patients, a continent abdominal stoma is much more accessible and requires less dexterity than catheterising the native urethra.

Unfortunately complications are relatively frequent,

3 - Conduit diversion

The indications for conduit (non-continent) supravesical diversion have been reduced significantly since the introduction of appropriate management, such as intermittent catheterisation, in these patients however this procedure may be considered in the case of intractable incontinence in bed bound patients, the devasted LUT

following multiple failed surgery or where the use of long bowel segments for reconstruction is contraindicated (short bowel syndrome). It may also be considered in patients who do not accept the potential complications of a continent diversion, who are not able to perform catheterisation, or where the upper urinary tract is severely compromised. Proper location of the stoma must be determined before surgery by stoma therapist and urologist. This location is especially important in patients who are chair bound or who have specific deformities, such as patients with severe kyphoscoliosis or a small abdomen. The most common technique is to use a short ileal segment with the ureters anastomosed directly end to side. There is no evidence that an antireflux procedure is required and this may in fact increase the risk of implantation stenosis. Patients should be followed up indefinitely as stomal stenosis and or ureteric anastomotic stricture can occur years after surgery. Renal impairment has been estimated to occur in 16.5% to 50% of patients with 10 years or more follow-up .

Recommendations

- Exhaust possibilities of conservative treatment before going to surgery
- Tailor surgical technique individually
  - Pathophysiology/medical condition
  - Quality of life
  - Patient's preference
  - General situation (social, financial,...)

Bladder reinnervation

A major step forward in the treatment of neurologic urinary incontinence would be the restoration of nerve and/or muscle function. Though only a very limide number of small series have been published so far they are interesting.

Intercostal nerve to spinal nerve root anastomosis in chronic spine-injured patients at the conus. In patients with hyperreflexic neurologic bladder and detrusor external sphincter dyssynergia (DESD) caused by complete suprasacral SCI, micro anastomosis between the L5 and S2/3 ventral roots has been done. Much more research is needed to further clarify the possible clinical value.

Final message

Surgery is not the first approach

Wait until hope of improvement or stabilization has shown ungranted

Almost no interventions within one year after new spinal cord lesion not taking into account surgery for urological complications as stone formation and trauma.

7. PROPOSED GUIDELINES FOR THE UROLOGICAL MANAGEMENT OF THE SPINAL INJURY PATIENTS

Gurpreet Singh

There is in the UK significant variation in the urological care of the spinal injury patient, dependant on where these patients are managed and essentially based on a patient centred approach. Representatives from each of the 11 spinal injury units in England were invited to join a think tank with the expressed purpose of producing treatment guidelines and accompanying set of notes. Following 3 meetings it became apparent

that there was little or no high quality evidence and the work produced had to be on the basis of expert opinion and based around the management protocols published by the American Paraplegia Society, the International Continence Society and the European Association of urology.

Management was divided into 4 stages:

1. Immediate
2. Early
3. Intermediate
4. Long-term management

Immediate management is essentially with a urethral catheter. A waist band/abdominal G strap is mandatory.

Early management - The patient should be informed of treatment possibilities, the indwelling catheter should be removed as soon as possible with intermittent catheterisation performed by the care team. There is a group of patients who are likely to require ongoing management with indwelling catheters, most specially women with tetraplegia and the frail elderly, this group needs identifying.

Intermediate management will be continued by the carer or intermittent self-catheterisation will be established. Voiding with control refers to a situation where there is continence without appliances. Controlled incontinence refers to a situation where the urine is collected in a penile sheath and then there are patients managed with an indwelling catheter which should be converted to supra pubic catheters as soon as possible.

Long-term management the primary goal is upper tract safety, management follows one of 3 board options:

1. Continence
2. Controlled incontinence
3. Indwelling catheters or urostomy

Ongoing surveillance, renal function should be assessed at approximately 12 months. Urodynamics should be done as a baseline and as clinically indicated. Regular urine testing is not advised and finally the urologist taking care of the spinal injury patient should form a part of a devolved care team prepared to take responsibility for all aspects of patients care.

8. Spinal osteotomies for flat back syndrome

Kamal Ibrahim, MD, FRCS(C), MA
Clinical Professor of Orthopedics
Loyola University Chicago

Normal sagittal alignment of the spine:

- Normal thoracic kyphosis range 20-50 degrees
- Normal lumbar lordosis range 20-65 degrees
- Most of the lordosis occur between L3 and S1
- Sagittal vertical axis from center of C7 body should fall through S1 body

Flat back syndrome is a rigid loss of lumbar lordosis with sagittal axis anterior to L5-S1, associated with significant back pain and poor posture

Etiology:

- Iatrogenic 2ry to distraction instruments in lumbar spine (Harrington system, most common) or fusion in malalignment.
- Pseudoarthrosis with loss of lumbar lordosis or decompensation beyond a fusion segment
- Degenerative spondylosis

Prevention: proper evaluation of the global sagittal alignment, proper rod bending for lumbar instrumentation, pedicle screws, proper positioning on the table, adequate extension of the fusion and instrumentation.

Surgical correction:

- Preoperative planning to restore a vertical axis which intersect posterior end of S1
- Lumbar Osteotomies: at the site of maximal deformity
    - Smith Peterson osteotomy: limited correction but safer
    - Pedicle subtraction osteotomy (partial vertebral decancellation, egg shell procedure) three-column posterior wedge osteotomy: technically demanding but achieves significant correction and no pseudoarthrosis.
    - Combination osteotomies of the above: utilized in severe deformity, either multiple Smith Peterson or pedicle subtraction at one level and Smith Peterson at another level.
    - Vertebral column resection: for severe rigid sagittal and coronal deformities and imbalance
- Expected results: average correction 16-30 degrees, standing and walking straight without bend knees, marked improvement of pain, But complication rate range from 20% to 60%

Conclusion: flat back syndrome is a preventable condition. With the current knowledge and modern instrumentation with pedicle screws fixation, iatrogenic flat back should no longer occur

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9. Thromboprophylaxis in Spine Surgery

Dr Rajagopalan

Deep vein thrombosis (DVT), and its most feared complication, pulmonary embolism (PE), still have a high incidence with high risk for patients health. Proven prophylactic measures are available but are generally underused, and DVT is still considered the most common cause of preventable death among hospitalized patients. The rationale for prophylaxis of venous thromboembolism is based on the clinically silent nature of the disease, the relatively high prevalence among hospitalized patients and the potentially tragic consequences of a missed diagnosis.

Deep vein thrombosis (DVT) and pulmonary embolism (PE) are common complications of acute spinal cord injury (SCI) and a major cause of morbidity and mortality in this patient population. Many patients with SCI do not receive DVT prophylaxis in the acute care setting, perhaps secondary to concomitant medical problems that may enhance the risk of bleeding. In a recent retrospective study by Powell et al, 38.6% of patients admitted to a rehabilitation hospital were receiving prophylaxis. Clinically apparent DVT occurs in approximately 15% of patients with acute SCI, and PE develops in approximately 5% of these patients. The risk of DVT is highest in the first 2 weeks following injury, with peak occurrence between days 7 and 10. DVT has been detected as early as 72 hours postinjury; however, risk prior to this time appears to be low.

During the last 1520 years, spine surgery has changed radically, developing into a well-defined area of specialist surgery, and some attention is now being given to DVT events in spine surgery. The incidence of DVT during spine surgery is not documented in the literature, because only case reports or retrospective studies are reported.

In an article in 2005, high incidence of DVT following spinal surgery was reported. Without prophylaxis the incidence of DVT using venography was reported as 81% and the risk of symptomatic DVT as between 12 and 23%. The risk was much lower in elective spine surgery. After discectomy or laminectomy on less than two spine levels, the risk of DVT was reported less than 1%. After spinal fusion or extended laminectomy, the risk was estimated between 0.3 and 2.2%. A prophylaxis was recommended for all patients after spinal cord injury (grade A). The association of a mechanical method and heparin was recommended (grade B). The duration of prophylaxis of 3 months in patients with a motor deficit (grade C) was suggested. No prophylaxis

was recommended after discectomy or limited laminectomy in patients without additional risk factors. Mechanical methods were recommended after spinal fusion or extended laminectomy. For patients with additional risk factors a low molecular weight heparin was recommended.

Lee et al conducted a study on 313 patients who underwent major spinal surgery. They had four patients with positive findings of deep vein thrombosis on duplex ultrasonography, and there was only one with clinically symptomatic deep vein thrombosis. The overall incidence of thrombotic complications was 1.3%, and the incidence of symptomatic deep vein thrombosis was 0.3%.

Dearborn et al did a study on adult spinal surgery patients to determine the incidence of subclinical deep venous thrombosis. Duplex ultrasound appeared insensitive for diagnosing clots before embolization in this patient group. Simple mechanical prophylaxis for thromboembolism, which may be adequate for patients undergoing posterior procedures, may not be as protective for patients undergoing combined anterior/posterior spine surgery.

Platzer et al conducted a study on Thromboembolic complications after spinal surgery in trauma patients.The incidence rate of symptomatic thromboembolic complications was 2.2% (n 22). 17 patients showed clinical signs of deep venous thrombosis, with 4 of them developing pulmonary embolism subsequently. The other 5 patients developed pulmonary embolism without prior clinical signs of deep venous thrombosis. 6 patients died because of thromboembolic disease. Thromboembolic complications were more frequent in older patients and among males, as well as in patients with regular tobacco consumption and obesity. Thromboembolic complications were also seen more frequently in patients with surgical procedures at the lumbar spine, in patients with anterior spinal fusion, and in those with motor deficits in the lower extremities.

Maxwell et al evaluated whether routine placement of prophylactic inferior vena cava filters is indicated in SCI patients. There was an overall incidence of DVT and PE of 11.8% and 0.9%, respectively. There were 111 (1.3%) patients who sustained SCI, with an incidence of DVT and PE of 9.0% and 1.8%, respectively, and no deaths. Of these 111 patients, 41.4% were paraplegics and 58.6% were tetraplegics, and 17.1% of patients had severe closed-head injury. They comcuded that the incidence of DVT and PE in SCI patients was similar to that of the overall trauma population when appropriate DVT prophylaxis was used. Subgroup analysis demonstrated that SCI associated with long bone fracture significantly increases the incidence of DVT.

Oda et al conducted a study using venography to evaluate deep venous thrombosis after posterior spinal surgery. They concluded that deeep venous thrombosis after posterior spinal surgery is higher than generally recognized and they suggested that further study is necessary to clarify the appropriate method for screening and the effect of prophylaxis against thromboembolism after spinal surgery

We had conducted a study on the incidence of DVT after spinal surgery. s The patients were divided into 4 groups. Group A was only discectomy without laminectomy. Group B were laminctomies without instrumentation. Group C were posterior stabilizations and Group D were anterior stabilizations. Our results are presented.

10. Biological Enhancement of Spinal Fusion

Julio Gallego

For many years, spondylodesis using bone graft has been one the best ways to treat some spinal disorders such as instability and/or deformity.

The two major components of a spinal fusion are: **Tissue bed**, which ideally consists of healthy, bleeding, decorticated bone and **graft material**. The nature and quantity of bone graft are essential factors in a successful spinal fusion.

There are 3 basic ways in which bone graft can enhance the development of a fusion:

- Osteo**genesis**: The potential of some bone grafts to provide osteoprogenitor cells
- Osteo**conduction**: The graft can provide a scaffold on which host bone can be made
- Osteo**induction**: The ability of certain graft materials to induce pleuripotential mesenchymal stem cells to differentiate along osteogenic lines. There is a "de novo" bone formation.

Autograft bone is the best and most economic option. Autologous bone has the three features of enhancing bone formation because it is osteogenic, osteoconductive and osteoinductive.

Autologous bone graft can be harvested from:

- Iliac Crest, which it's the Gold Standard, because it is proven, predictable, and reliable.
- Local bone from the spinous processes and laminae that are removed to decompress neural structures. This bony tissue is not very vascular hence it has limited bone formation potential

Autologous bone graft has some limitations:

- It works, but not 100% effective
- Limited availability and variable quality (both patient dependent)
- Donor site morbidity
- Complications:
  - **Short term Complications:**
    - **Hematoma**
    - **False aneurysim**
    - **Nerve and arterial injuries**
    - **Fractures of the iliac wing**
    - **Peritoneal perforation**
    - **Infection**
    - **Sacroiliac instability**
  - **Long Term Symptoms:**
    - **Significant pain in 1/5 of patients at 2 years.** ***Mirovsky and Neuwirth (2000)***
  - **Persistent symptoms in 37% of patients at 10 years.** ***Frymoyer et al (1978)***

In situations in which either autologous or heterologous bone graft are not available, for whatever reason, it is recommended to look for some materials that can help to promote bone fusion. The two properties that are necessary in this process are:

- Conduction

Conduction of bone formation requires one parameter:

- A supporting matrix substratum.

- Induction

Induction of bone formation requires three parameters that interact in a highly regulated process:

- Soluble osteoinductive signals,
- Capable responding cells, and
- A supporting matrix substratum or insoluble signal.

Bone graft materials, other than Autologous Bone Graft, can de divided into two groups:

- **Bone graft extender**
  - Compounds that must be used *with* autograft; they *cannot* be used effectively on their own.
    - Osteoconductive or, at best, mildly osteoinductive.
    - **Bone graft replacement**
  - A compound that can be used entirely *in place of* autograft, *and* that will achieve fusion rates that are equivalent to or better than autograft.
    - Requires osteoinductivity.

The most commonly used grafting materials, especially in spine surgery, are:

Ceramics: Mimics human, cancellous bone.

Bone formation mechanisms: Osteoconductive only

Clinical uses:

- Extends/bulks autograft
- Used alone to back-fill bony defects

Limitations:

- No osteoinductivity
- Resorption characteristics
- Limited science
- No structural stability

Demineralized Bone Matrix (DBM): Type I Collagen (95%)/Growth Factor Composite (5%). The Grow Factor portion is composed of: IGF-II (64%), TGF-β (23%), IGF-I (5%), PDGF (4.5%), β-FGF (2.5%), and BMP (1%)

Bone formation mechanisms:

1. Osteoinductive
2. Osteoconductive

Clinical uses:

- Autograft extender
- Used alone to back-fill bony defects

Limitations:

- Mildly osteoinductive, OI donor variance
- Mildly osteoconductive
- Not osteogenic
- No structural stability

Bone Morphogenic Proteins (BMP):

Bone formation mechanism:

1. Osteoinductivity
2. Osteogenic

BMP binds to specific receptors on the stem cell surface causing them to differentiate into bone-forming osteoblasts. Comprehensive analysis of osteogenic activity of 14 types of BMPs have shown that BMP 2, 6, and 9 play an important role in inducing osteoblast differentiation of mesenchymal stem cells.

Clinical uses

- Autograft Replacement
- Spinal Fusions, Long Bone Fractures, especially if complicated,
  Oral and Maxillo-Facial Surgery.

Limitations:

- No compressive resistance
- No structural stability
-

With the introduction of BMP's in the daily practice, as the only material with actual ostoinductive capability, a new era is born. In dozens of animal studies in multiple species BMP's have been shown to be at least equivalent to and in most cases better than iliac crest autograft Published literature demonstrates the clinical capacity of BMP to induce fusion in a variety of surgical approaches with a variety of instrumentation.

Dr. Marshall Urist, who first identified Demineralized Bone Matrix (DBM) in 1965, and who years later, in 1977, found that BMP extracted from bone is inductive said: *BMP is destined to bring osteogenesis under the control of surgeons..."* Urist MR, J NIH Res,1997 .

11. Advances in Pain Management: Taking a Biopsychosocial Approach

James Middleton

Chronic pain is common following spinal cord injury ***(SCI), with a*** prevalence of between 65-80% of people with SCI experiencing pain and around one third reporting severe pain. ***Pain not only*** interferes with physical functioning and daily activities, but ***may contribute to poorer health and*** quality of life. Musculoskeletal pain is the most common type of pain experienced both acutely (related to trauma and healing) and chronically (secondary to postural abnormalities and overuse syndromes) in around 60% of persons with a SCI, although generally less severe than neuropathic and visceral pain, which occur less frequently in approximately 40% and 5% of SCI individuals, respectively. At-level neuropathic pain typically develops early after injury within weeks to months and then persists, whereas although below-level neuropathic pain can also occur early it often develops 2 years or more after SCI (Siddall et al, 2003). These varied time courses are likely to reflect different underlying processes and mechanisms of pain generation. ***Biological*** changes post-injury occur at both a spinal and supraspinal level, with structural reorganization, as well as increases in excitatory processes and loss of usual inhibitory processes contributing to functional changes in neuronal activity (Eide, 1998).

In broad terms, different types of SCI pain can be distinguished based on characteristics such as descriptors, location/distribution and response to posture, activity or other stimuli (Siddall, Yezierski and Loeser, 2000). Nociceptive pain can arise from musculoskeletal or visceral structures in a region of preserved (or partially preserved) sensation, often being described as "dull", "cramping" or "aching" in nature. Musculoskeletal pain is typically aggravated by movement or related to certain postures, whereas visceral pain occurs in the abdominal region, often being poorly localised, and is associated with underlying pathology or dysfunction in organ systems such as the bladder and bowel. By contrast, neuropathic pain arises from damage to nerves and/or the spinal cord, being experienced in a region of sensory disturbance or complete anaesthesia and may be described by terms such as continuous "burning", "squeezing" or "tingling" with or without intermittent "shooting", "piercing" or "electric shocks". There may be hyperalgesia (increased sensitivity), allodynia (pain produced by normally non-painful stimuli (e.g. touch) and hyperpathia associated clinically. At-level neuropathic (sometimes described as endzone or border zone) pain refers to a band of burning, electric or shooting pain and hypersensitivity in dermatomes close to level of injury. Below-level neuropathic pain refers to pain with same burning, shooting, electric qualities as described for at-level, but is located diffusely below the level of injury, usually bilaterally in the buttocks and legs. Above-level pain is not exclusive to SCI and includes other types of neuropathic pain that are commonly experienced, such as complex regional pain syndromes and compressive neuropathies (eg. carpal tunnel syndrome).

Previously viewed as being largely irrelevant in the presence of a clear patho-physiological mechanism, psychological and social environmental factors are increasingly being recognized as important mediators or moderators of SCI pain. After SCI, as for other chronic conditions and disorders, belief systems are very important where absence of a clear understanding about the "chronic pain" model (with person conceiving pain from acute perspective), negative cognitions or expectations about treatment efficacy and lack of perceived control influence outcome. Similarly, inconsistent use (or overuse) of medication, cycles of overdoing and underdoing activity or complete withdrawal from activities are frequent and unhelpful behaviours. Individual or family responses may be overly solicitous and reinforce disablement, punishing or lead to stress and anxiety about high, possibly unrealistic expectations of capacity. Commonly experienced emotions include feeling depressed about persistence of pain and functional limitation, being anxious and uncertain about the future, fearful that pain can not be relieved, angry because of "failure" to find a cause or an effective treatment, and frustrated by interference with life.

Identifying the type of pain provides a basis for further assessment, investigation and treatment. Siddall and Middleton (2006) proposed an algorithm based on the IASP Classification and existing levels of evidence to help guide clinical decision-making. Unfortunately, for many currently used treatments for SCI pain, particularly when neuropathic in nature, there is limited evidence of efficacy.

Chronic musculoskeletal pain affecting the shoulders, elbows, wrists and hands relates in most cases to overuse with transfers, wheelchair propulsion, self-care activities and ambulation, whilst back pain may be associated with post-traumatic deformity (eg. kyphoscoliosis) and/or abnormal postures. Treatment may include short-term rest, simple analgesics, non-steroidal anti-inflammatory medications or opioids and local steroid injections for symptomatic control. Physical treatments including exercise and hydrotherapy programmes, postural re-education, wheelchair and seating adjustments and possibly other physical modalities are often helpful in managing pain resulting from a mechanical cause.

For both chronic at-level and below-level types of neuropathic pain, first-line treatment with either Gabapentin or Pregabalin is now recommended. Commonly used older anticonvulsants such as Sodium Valproate have been shown to be no more effective than placebo in randomised controlled trials. If insufficient relief is

obtained using a single agent, then either a tricyclic antidepressant such as Amitriptyline or Nortriptyline, or alternatively a weak opioid, such as Tramadol Hydrochloride may be added. Due to concerns about serotonergic syndrome, the combination of a tricyclic and Tramadol should be avoided. Use of strong opioids, such as Oxycodone, Morphine and Methadone, is still somewhat controversial in treatment of SCI neuropathic pain, where sustained-release preparations are recommended. Side effects such as constipation are more problematic in individuals with SCI, who already have slow colonic motility, while usual issues of drug tolerance and dose escalation, as well as potential for developing physical dependence must be carefully considered. Of all types of SCI pain, neuropathic pain remains the least well understood and provides the greatest challenge to treatment, with only one in three experiencing greater than fifty per cent reduction in pain with biomedical interventions.

Treatable underlying pathology, such as local nerve root compression or post-traumatic syringomyelia with syrinx formation (cystic cavitation of the spinal cord) must be excluded. Other techniques, which have proved helpful in some cases, include anaesthetic blockade at various levels, namely sympathetic, epidural or spinal blockades, intrathecal administration of baclofen, clonidine and morphine via an implanted pump and spinal cord stimulation. Ablative surgical procedures generally have a very limited role in management, apart from DREZ lesions (performed by radio frequency or laser coagulation) for treatment of at-level neuropathic pain.

Effective management of chronic intractable SCI pain, as for rehabilitation in general, requires a comprehensive, interdisciplinary approach comprising pharmacological, physical and psychological interventions. Rehabilitation principles should underpin any pain management program with overall goals being to increase self-efficacy and promote greater activity and participation. To this end, the person must be engaged as an active participant to become an agent of change in a pain self-management program, involving medical, physical, educational and cognitive-behavioural components (Umlauf, 1992) to enhance well-being and function by rationalising use of medication, reactivating the person and modifying beliefs, expectations and coping abilities. Results from recent work comparing a specially modified cognitive-behavioural pain management programme for SCI-related pain to usual care received in a tertiary pain management clinic setting provide evidence for benefits in terms of mood and physical functioning, with reduced anxiety and pain catastrophizing, and improved pain self-efficacy.

12. Reticular Formation and Spinal Cord Injury

Dajue Wang

Introduction

Reticular Formation (RF) is a much less known but extremely important part of the human central nervous system (CNS). Neuroscientists have been sparing no effort on studying it intensively and extensively for the past 50 years. A recent electronic search of references for the past 20 years using the keyword "Reticular Formation" located around 3, 500 articles. It speaks volumes about the magnitude of its importance.

The purpose of this review is to provide ***clinicians*** working in spinal cord injury (SCI) with some basic knowledge of RF without overloading them with too many neuro-anatomical details. It is this part of the CNS that offers basic support of life and health of the patients, without which complications inevitably occur and aggravate. Despite its utmost importance, it is much less known, understood, taught and discussed than the somatic and autonomic systems.

Despite massive achievements for the past five decades, much remains to be known in neurosciences, particularly the RF. In publications of neurosciences, phrases like "it is believed", "it seems likely", "it requires a guess", "not yet understood", "remains unclear" etc. are common place. Clinicians are advised to use their experience and judgement when translating facts of basic researches to human beings. Moreover, the neuroscience is advancing so rapidly that clinicians need to update themselves regularly in order to keep pace with the new development.

After SCI, the following phenomena are observed. They are arranged below in order of degree of threat to life and health.

1. Lack of wakefulness in high cervical lesions
2. Malfunctions of viscerae and vascular systems
3. Hypersensitivity (pain)
4. Increased muscle tone (spasticity)
5. Impairment and loss of sensation
6. Impairment and loss of voluntary movement.

More often than not the last two groups of phenomena catch the attention of general public, the patients and even biomedical professionals in the first place because loss of voluntary movement and sensation are immediately visible and palpable, whilst understanding of the first four groups requires in-depth knowledge of their underlying neuro-anatomy and neuro-physiology that may not be adequate for many people. Of the first four, the second group of phenomena are well known to be related to malfunctions of the autonomic systems. However, their representations within the CNS and the links between themselves and other parts of the CNS are not sufficiently presented in biomedical literature.

No system is working in isolation in a living organism, let alone a human body. Even a simple muscle contraction works in a coordinative way. The contraction needs sensory input to trigger it. It also needs appropriate tone of its own and relaxation of antagonist muscle to allow it to happen. The blood supply is distributed in a way to offer sufficient oxygen and energy to the contracting muscle and to remove resultant metabolites. Obviously, these can happen only when there is a centre coordinating all these aspects with enormous complexity. Breakdown of such coordination, the above-mentioned problems of SCI will inevitably occur. Developments in neuro-anatomy for the past few decades have made known that functions of the entire nervous system are controlled by a special part of the CNS known as the RF. Hence RF can be thought as the "command centre" of the central nervous system. Such control is materialised through coordination and modulation.

What is Reticular Formation?

Although RF first received attention of Ramon Y Cajal, one of the founders of modern neuro-anatomy, in as early as 1909, it had not been studied adequately until recently. Classical neuroanatomy describes the CNS as consisting of neurons with one axon, one direction, one synapsis, one neuro-transmitter and one target neuron. The RF is mostly composed of another type of neurons known as the **interneurons** (neurons between neurons) that have **polysynaptic** connections (Figure 1). Each of these neurons has more than one axons, which go in different directions. Every interneuron connects with many secondary interneurons (primary connections). Many secondary neurons connect even more interneurons (secondary connections). This process goes on and on as the level of connection goes up. At the end of the day, the number of

connections increases geometrically and reaches astronomical figures of more than trillions. The projections of all neurons and interneurons together form a **network** like system, hence the name **Reticular Formation**, which means Net-shaped Structure.

The astronomical number of connections of the RF has made complete severance of their longitudinal connections almost impossible unless the *relevant* part of the central nervous system is **literally** completely transacted. This is why the system can hardly be studied by traditional method of degeneration used for somatic long tracts. As a result, it had never been properly studied and understood until recently when new techniques of studying neuro-anatomy such as electron microscopy, axon tracing, intracellular labelling, transmitter histochemistry, electrophysiology etc. appeared during the past five decades.

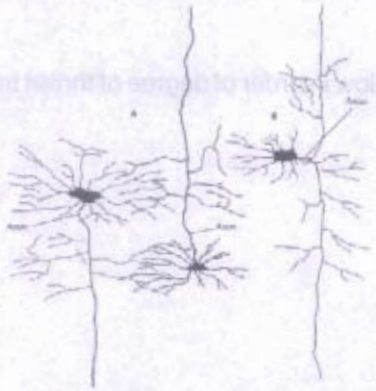


Figure 1 polyaxonal neuron

These techniques have immensely broadened our knowledge on neuroanatomy, or more accurately, on functional neuroanatomy. This is particularly true for RF. If we look at the entire human CNS as a whole, it can be compared to a highway system. The long tracts are like the trunk motorways whilst the RF a network with endless number of small roads. There are innumerable connections between various systems.

In the evolution of animals, highly specified long tracts are late phenomena to meet more sophisticated special needs whilst RF is phylogenetically ancient to support basic functions, without which they would not have survived. In addition to the basic feature of net-shaped structure of innumerable projections between various neurons and interneurons, there are further important morphological features that specifically distinguish RF from the other parts of the CNS

1. Many of its neurons are deeply located.
2. Its neurons are scattered and poorly defined and therefore it is difficult to name some small clusters of neurons as neuclei.
3. A single neuron may contain both ascending and descending components.
4. All its components contain crossed and uncrossed elements.

It is a common misconception that neurons of the RF are located only in the brain stem. In fact, they are also scattered throughout the entire length of the spinal cord in the intermediate zone of grey matter. **Correct understanding of this important anatomical fact is instrumental for the comprehensive management of SCI.**

Due to enormous difficulty in mapping out the exact pathways of trillions of interneuron connections, neuroscience has roughly worked them out the destinations pathways of the RF by using electrophysiological techniques and analysing neurotransmitters. The connections between the acting neurons and target neurons can be roughly established through electrophysiological techniques in which stimulation of one area triggers response of the other. Similar is true for neurotransmitters studies where the connections can be roughly established by locating the target neurons that are affected by the neuro-transmitters released by the acting neurons. Electrical stimulation has been a classical method for more than a century that does not need

much discussicn, whilst neurotransmitters are relatively new phenomena of the past 50 years that merit special attention.

Neuro-transmitters

As RF has projections to and from all parts of the CNS, it is essential to be familiar with the classification and names of all major neuro-transmitters, their locations and basic functions (Table 1). Commanding adequate knowledge of neurotransmitters is a lifetime career of a specialist whilst new knowledge keeps pouring in. Therefore, it is not the purpose of this section to discuss neuro-transmitters in details. It is only to offer a list that readers can refer to if a neurotransmitter in later discussion appears to be unfamiliar to them. Readers are also advised to refer to specific literature for more detail if necessary.

Neurotransmitters can also be hormones that are directly released into the blood stream and trigger neurons or other cells to work where there are relevant receptors. The classical distinction between neuro-transmitters and neuro-hormones is becoming blurred. It can be seen from the table that one area or one type of neuron may release more than one type of neurotransmitters whilst one type of neuro-transmitter can be synthesized by more than one area or one type of neurons. Therefore, strict rule of one type of neuron connected with one type of neuro-transmitter is no longer valid.

Table 1 Classification and names of major neurotransmitters

Description of neurotransmitters	Anatomical locations	Functions
Small molecule Acetylcholine	Somatic and parasympathetic motor neurons, myoneural junction, autonomic system and all major regions of the CNS, including RF.	Muscle contraction, functions of the autonomic system and all major regions of the CNS, including RF.
Exitatory amino acids Glutamate, precursor of GABA Aspartate	Almost all regions of the CNS. Almost all regions of the CNS.	Excitation, excitotoxicity → cell death. Glutamate is stronger than aspartate.
Inhibitory amino acids GABA (γ-amino-butyric acid) Glycine	Most parts of the CNS. All body fluids, spinal cord, lower brain stem, retina	Inhibition Inhibition, intermediate in protein metabolism
Biogenic amines Catecholamines Dopamine Norepinephrine Epinephrine	 Basal ganglia and limbic system Sympathetic neurons, locus ceruleus of the Pons. Medulla	 Muscle tone and mental status Mental status, exact mechanism unclear Not clear
Indoleamine Serotonin (5-hydroxytryptamine, [5-HT])	Raphe or midline nuclei of the brain stem	Wakefulness and sleep
Imidazole amine Histamine	Hypothalamus	Every part of the CNS
Purines ATP Adenosine	Spinal cord motor neurons, autonomic ganglia Not fully investigated	Excitation Not fully understood
Neuropeptides Opioid peptides Beta-endorphin Enkephalin Dynorphin Nociceptin (Orphanin FQ)	 Spinal cord, hypothalamus Spinal cord, raphe nuclei, striatum, limbic system, cerebral cortex Spinal cord, hypothalamus, amygdale, limbic system Many locations in the brain and spinal cord	 Pain suppressor Major pain suppressor Pain suppressor Pain enhancement and many others
Substance P	Trigeminal and dorsal ganglia, spinal cord, hippocampus, neocortex	Pain transmission
Gaseous neurotransmitter Nitric oxide	Hippocampus and many other regions of the brain	Memory, wakefulness and sleep, neuroprotective to neurotoxic and many more. New discoveries are emerging fast.

The core of neurons of the RF is located in the brain stem with afferent and efferent connections over the entire CNS. There are other regions which functions are closely connected to RF although they are not yet officially classified as such. Putting all of them together, they are composed of three parts.

1. Brain stem RF proper
2. Regions in the brain stem that are closely related to RF: red nucleus, inferior olivary nucleus and paraqueductal gray matter (PAG). They cannot be named RF because they are compact nuclei instead of being net-shaped.
3. Spinal cord RF

Brain stem RF

Complex connections between RF and cranial nerves are not discussed herein because they are not affected in SCI. There is no need for clinicians to memorise all the complex names of individual RF nuclei (Fig 2). Knowledge of grouping of nuclei according to their longitudinal arrangements would suffice. Luckily and logically, these arrangements are in line with their functions. From the lateral aspect toward the midline, the nuclei of RF and their functions are arranged in the following order.

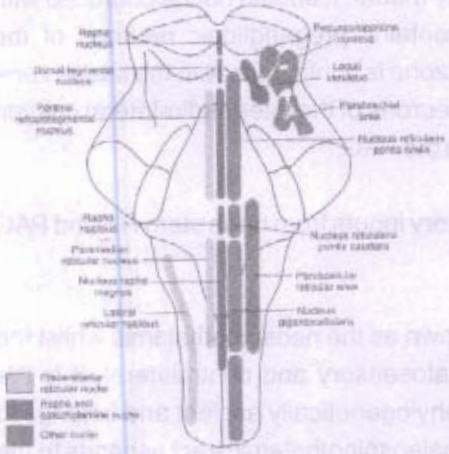


Figure 2 Brain stem RF

1. Lateral: parvocellular (small cell) zone. sensory.
2. Paramedian and medial: magnocellular (large cell) zone. efferent and motor
3. Median or midline zone: raphe nuclei. wakefulness and consciousness.

Lateral zone This area receives afferent fibres from neighbouring cranial nerves and t tracts. The signals are in turn transmitted to the paramedian and medial areas to modulate motor functions. Other collaterals ascend to the thalamus to modulate sensation or project to other higher centres (hypothalamus, limbic system) through medially located RF nuclei to sustain wakefulness and to modulate autonomic functions.

Paramedian and medial zone:

Neurons of these areas have reciprocal connections with almost all movement-related structures of cerebral cortex, diencephalons, basal ganglia, cerebellum and spinal cord. These connections contribute to the coordination of both voluntary and involuntary movements and adjustment of muscle tone.

Median or midline zone:

There are two types of neurons with different functions.

1. Serotoninergic neurons project to higher centres and are crucial to wakefulness and sleep. Damage to these neurons or lack of inputs may lead to diminished or loss of consciousness.
2. Other neurons that synthesize enkephalin and beta-endorphin project downwards to both spinal trigeminal nuclei and spinal dorsal horn nuclei to modulate and suppress nociception.

Other RF-related brain stem areas

Red nucleus projects to cerebellum via inferior olivary nucleus and precerebellar nucleus. Red nucleus has reciprocal connections with both motor cortex and cerebellum. It works as the mediator between the two structures. Its final common path after cerebral and cerebellar inputs is the rubospinal tract. It is highly developed in lower animals like cat but reduced to a thin tract below cervical level in humans, in which it mainly discharges flexor muscles of the upper limb.

Periaqueductal gray matter (PAG) has reciprocal connections with cerebral cortex, hypothalamus, limbic system, RF nuclei within the brain stem and the spinal cord. Such connections indicate its extremely important role of coordinating and modulating functions of autonomic and endocrine systems, emotion, memory and nociception. Its neurons projects to spinal cord via magnocellular zone of pons and medulla. Recent studies showed that they might also send signals directly to the spinal cord. Of these pathways, much attentions has been focused on micturition control. **PAG is probably the most important processing centre of all signals except those from the red nucleus motor system for skilled movements of upper limbs.**

Spinal cord RF

Neurons of spinal cord RF are located in the intermediate zone of gray matter. It should not be confused with the intermediolateral (lateral) column of the spinal cord, which contains preganglionic neurons of the sympathetic and parasympathetic nervous system. The intermediate zone is continuous with the lateral zone of the brain stem RF. Its neurons give rise to the spinoreticular tract. Neurons of the intermedio-lateral column receive inputs from the RF through reticulospinal tracts or directly from the PAG.

The dorsal horn does not belong to RF but it receives important inhibitory inputs from brain stem RF and PAG to suppress pain also via the reticulospinal tracts.

The spinothalamic tract is now known to contain two parts. One is known as the neospinothalamic whilst the other paleospinothalamic. The former is phylogenetically new somatosensory and contralateral. It is the direct pathway conducting pain stimuli to the thalamus. The latter is phylogenetically ancient and belongs to the RF. It is ipsilateral (major part) and contralateral (minor part). The paleospinothalamic tract ascends to the brain stem RF and through it back to the spinal cord to modulate its sensory inputs.

In summary, RF at the brain stem has reciprocal projections with all regions of the CNS. Such widespread connections not only make control of all regions by RF possible but also makes transmission of signals of one region of the CNS to other regions possible via the RF.

Clinical considerations

Multi-system damage and comprehensive management

The main feature of damage of the RF is lack of coordination and modulation within the entire CNS rather than isolating malfunctioning of its individual parts. In a muscle contraction, the antagonist muscle has to relax. However, in damage of the RF, such coordination and modulation are lost. The contracting muscle meets resistance of antagonist muscle and cannot contract normally as it should be. This ends up in ***spasticity*** as clinicians know it. This lack of coordination and modulation causes malfunctioning of peripheral organs with various severities depending upon the extent and intensity of the injury.

If there is a severe transverse lesion above high cervical level severely damaging the RF bilaterally, the patient cannot survive due to complete cardiac and respiratory failure and loss of consciousness. These functions are all heavily controlled by the RF. Those who survive this level of injury must have only localised lesions that cause mild to moderate damages to the RF so that sufficient cardiac and respiratory functions and consciousness remain.

With a severe transverse lesion from mid cervical level down, the RF supporting cardiac and respiratory functions and consciousness escapes destruction. The patients can survive but suffer from malfunctioning of other organs. Of all patients who survive with a neurological lesion, these patients suffer from the most severe damage to the RF. This is why SCI is such a uniquely difficult lesion to deal with in which malfunctioning of various periphery organs takes place.

Sir Ludwig Guttman's clinical observations and understanding of SCI were totally in line with facts and theory of modern neuro-anatomy about RF. That was why he successfully developed the system of comprehensive management that dealt with all malfunctioning in a coordinative and non-fragmented way under one roof. The entire management is aimed at resuming some sort of coordination and modulation either within the nervous system or at the peripheral organs. This comprehensive approach of management has saved SCI patients' life. Now, the majority of them can enjoy a relatively normal life and live almost as long as normal individuals if properly managed.

On the contrary, breakdown of SCI service and science into various disciplines without mutual understanding and close communications between them and without a mechanism to oversee all these disciplines working closely together will lead to breakdown of this coordination and modulation even further. With such a devastating breakdown of normal neuroanatomy and neurophysiology, the perception of SCI service and science only as rehabilitation within the concept of physical medicine is obviously not only inadequate and inaccurate but also fundamentally flawed. Either SCI service or science should be perceived as an independent branch of neuroscience as it focuses much more attention on the RF than any other branches of neurology. Only then could comprehensive management be possible and successful.

Moreover, the breakdown of coordination and modulation has such devastating effect on peripheral organs that they no longer work harmoniously together. In such circumstances, any complication may occur and aggravate at any time if the damage is not properly managed. Therefore, SCI should be seen as a potentially progressive disease even after initial neurological stabilisation. That is why perceiving SCI only as part of rehabilitation medicine is fatally flawed.

Definition of completeness of spinal cord injury

The deep location and scattered distribution, crossed and polysynaptical connections of the RF altogether provide this life-supporting structure of the human CNS with strong protective mechanisms. It is less vulnerable to injury in the first place. In case it is injured, complete cutting off of transmission of signals within the system and between the system and other parts of the nervous system is hardly possible unless it is literally damaged bilaterally and completely.

In spinal cord injury, the words complete (AIS/Frankel scale A) and incomplete (AIS/Frankel B, C and D) are used to indicate the degree of damage of spinal cord on a cross-section at a particular level. In fact they only refer to somatomotor and somatosensory systems. They are in no way to imply the degree of damage to the RF. In a complete somatic lesion, some parts of the RF may be spared. Such dissociation is particularly eminent in Brown-Squard Syndrome where somatic changes may be severe whilst malfunctioning of organs

of autonomic system is mild. This is because RF sends out crossed projections at all levels and damages of one side cannot sufficiently affect their functions. It might be advisable that SCI scientific community clarified the terminology of AIS/Frankel scale that only refers to the density of somatic systems rather than the entire spinal cord. An additional scale measuring functions of RF and autonomic functions are needed.

The lower urinary tract

In a transverse lesion of the spinal cord, the spinal cord below the lesion is no longer fully controlled, coordinated and modulated by the brain stem RF and the spinal cord below the lesion has to work by and large on its own. As a result, chaos and overactivity occur. Of all disorders, muscle movements appear to be most obvious. Sensory stimuli cannot be perceived but they can trigger problems through un- modulated reflexes. The threat to health and life is from malfunctioning of internal organs and vascular system. Cardiac and respiratory functions are less affected because there is dominating involvement of the vagus nerve and biochemical factors. As far as respiration is concerned, even in a surviving patient with a high lesion above C4, the management of respiration can focus more or less on the phrenic nerve to support sufficient ventilation from contraction of the diaphragm. The bowel has an intramural nerve network. Its movement is relatively manageable if proper diet and regime are followed.

The lower urinary tract (LUT) is not so lucky. It is innervated by the lowest segments (S2-4) of the spinal cord and it has no other nerve involvement like in cardiac function, respiration and bowel movement, Hence, the LUT cannot escape from being severely affected because it is always either below or at the level of the lesion. Depending upon the degree and pattern of the damage of the RF, various types of neuropathic bladder are presented. However, as mentioned before, the RF can hardly be totally destroyed due to its numerous polysynaptic connections, some sort of signal exchanges with higher centres and within the spinal cord may still exist and certain useful reflex activity of the lower urinary tract may remain. All above-mentioned have made bladder problems most common, complex and protracted. This is why an independent specialty known as neuo-urology is created as a particularly important part of SCI service and science.

Pressure sores

External mechanical pressure for a considerable time (>2 hours) on the skin can cause sores to develop. The underlying human factors are anatomical and patho-physiological. The key factor of maintaining normal skin trophic is its blood supply, in which arterioles and venules play key role. Both of them have smooth muscles in their walls to respond to the need of blood supply. The more vulnerable part is the venules. They have thinner walls and smooth muscles and hence are more susceptible to pressure. The lumen becomes more or less flat and blood flow is restricted under pressure. This causes venous stasis. In a normal individual, the situation will trigger a very complex mechanism involving many local substances. Some of the substances are vasoconstrictors (epinephrine, Ca^{++}). whilst others vasodilators (acids, CO^2, low O^2, potassium, acetylcholine, bradykinin, adenosine, nitric oxide etc). The whole complex of opposing mechanisms is regulated by the RF to achieve a net result of dilation. The arterioles and the precapillary sphincters open more widely to allow more blood to push through the capillaries and boost up the venules. When the RF is broken down, optimal net result of vasodilatation does not occur and venous stasis and arterial hypoxemia ensue leading to pressure sore.

Pain

Pain is a normal perception (nociceptive pain) of human self-defence mechanism. When an individual feels pain of a wound, the pain is normal. It reminds him or her of the existence of the wound that he or she should

be careful about and look after. Only when there is no obvious internal or external cause and the pain persists, or when the pain becomes disproportionately frequent and severe, it becomes a pathological pain sensation on its own (neuropathic pain). It is not always possible to distinguish between the two if the site of possible cause of pain can neither be located nor ruled out.

Neuropathic pain is the main concern in SCI. Many pains may seem difficult to explain in the perception of normal pain reception and its pathways of conduction. However, it can be explained at least hypothetically from the perspective of the RF. The main role of RF's in pain is modulation to reduce it at various levels.

In spinal cord, there is a Gate mechanism of inhibiting pain at segmental levels. The pain, temperature and crude touch sensations are conducted through the small calibre axons (Type C and Aγ fiber). The large caliber axons (Type Aα and Aβ fibers) of the dorsal root conduct other sensations. Both have synapses with the interneurons in the Substantia Gelatinosa Zone II. The conduction time of Type Aα and Aβ fibers is shorter than that of Type C fibers. Signals from these fibers reach the zone first and close the gate to pain stimuli to second neurons which give rise to spinothalamic tract. This would produce presynaptic inhibition of the afferent input to the spinothalamic tract. The second neurons also receive inhibitory influence from the brain RF to modulate pain. Of them, the strongest probably comes from the PAG. At PAG, confluence of inputs from all regions of the CNS, including all higher centres, take place and are processed in there. It is probably the most important processing centre of the CNS.

The acupuncture and electrical stimulation of Aα and Aβ fibers to reduce pain are based on this Gate hypothesis. The point chosen for stimulation must assure that it does not cause pain. Otherwise the procedure will fail. When a special dull uncomfortable feeling is elicited, the procedure would succeed. Such feelings are conducted through thick fibers (Type Aα and Aβ). The stronger such feelings the better pain inhibiting effect.

The current definition of completeness of SCI is based on somatic systems. It does not mean complete damage to the RF. Therefore, even in so-called complete injury, non-painful stimuli below and at the level of injury can be misperceived as pain and get through via the RF to higher levels of the CNS. In incomplete injury, the picture is even more so. Pain perception is not just about peripheral or central input. It is also about central modulation. Apart from sensory inputs from thalamus and sensory cortex, the latter includes inputs as emotion, memory, endocrine and metabolic regulation from the cortex, limbic system and hypothalamus. Depending upon the severity and pattern of damage to the RF, the balance between pain perception and pain modulation can shift to either direction. In case of pain, of course, balance is shift to perception and causes or increases pain.

Sleep apnoea

Sleep apnoea is a rare but fatal condition if not reversed timely. In high cervical lesions, insufficient afferent impulses to the brain stem RF and higher centres during sleep deprive the individual's ability of waking up and restoring normal rhythm of respiration when blood oxygen becomes dangerously low during extremely shallow breathing.

Cross system changes

Due to the wide connections of the RF throughout the CNS, any stimulus from one system could affect another system. In SCI, the clear examples are that stimuli from the skin (uncomfortable temperature,

pressure sore) and the bladder (calculus, infection etc.) can trigger and increase spasm and spasticity. On the other hand, high intravesical pressure can trigger dysreflexia. There are many other examples.

Spinal cord repair and functional recovery

Spinal cord repair has come to an age of clinical trial. Some work has been done round the world. The results of the trial depend on outcome measure. Most clinicians involved in the research expected major return of somatomotor and somatosensory function as the most important criteria.

As one of the most renowned evolutionary biologists, Theodosius Dobzhansky (1973) wisely said, " Nothing in biology makes sense except in the light of Evolution." Hence, such expectations have to be judged from an evolutionary point of view. We are in the very early stage of understanding how spinal cord repair can be achieved with transplant of more or less primitive cells. Therefore, we cannot expect to achieve somatomotor and somatosensory functions to recover satisfactorily because these systems are relatively late phenomena in the ladder of phylogenetic evolution. The most ancient systems in the human CNS are olfactory system, limbic system and reticular formation. Cells from the former two systems have reparatory ability whilst the latter is easier to repair, particularly because it is rarely completely damaged.

The phylogenetic order of development of various parts of the human CNS is:

1. Reticular formation
2. Cerebellar system
3. Sensory system
4. Motor system

Hongyun Huang from China has done olfactory ensheathing cell transplantation for spinal cord injury on more than 700 patients. The pattern of recovery follows the above-mentioned order. Skin temperature, spasticity, bladder function that are closely connected to the RF improved first followed by somatosensory and somatomotor recovery in lesser extent. There is difficulty in assessing cerebellar functions in severely paralysed muscles.

Summary

1. The RF has reciprocal connections with all parts of the human CNS. This special feature has made its coordinating and modulating the entire system possible. Therefore, it can be seen as the Command Centre of the CNS.

2. A network of trillions of bilateral connections makes total destruction of RF almost impossible except in extreme cases.

3. RF offers basic support for health and life. Its severe damage leads to breakdown of coordination and modulation of various parts of the CNS and the peripheral organs. As a result, diseases and complications develop. Severe damage above high cervical level leads to death.

4. In certain circumstances, signals may choose RF as an alternative to traditional long pathways.

5. It is one of the phylogenetically most ancient structures of the CNS and hence has greater potential to regenerate or be repaired.

Further reading

Neuroscience is developing so fast that clinicians working in fields related to it needs to update their knowledge regularly. As the amount of new knowledge is unbelievably huge, it is difficult for busy clinicians to read hundreds of articles within a short space of time in order to get a clear idea. For practical reasons, instead of listing hundreds of pieces of unfamiliar biomedical literature, the authors offer only a few recently published books and articles for further reading. Through the reading, clinicians working in SCI can be familiarised with the advance of modern neuroscience to improve their knowledge and practice. In each of the first two books listed below, there is a special chapter of RF. From there, readers can extend their reading futher.

1. Patestas MA, Gardner LP. A textbook of neuroanatomy. Blackwell Publishing, 2006.
2. Siegel A, Sapru HN. Essential Neuroscience. Lippincott Williams and Wilkins. Philadelphia, London, Tokyo, Hong Kong, 2006
3. Kapit W, Macey RI, Meisami E. The physiology colouring book, 2nd Edition, San Francisco, New York, Harlow, Sydney, Amsterdam, 2000.

13. LONG-TERM MEDICAL RISKS IN SPINAL CORD INJURY

Nazirah Hasnan
Department of Rehabilitation Medicine, Faculty of Medicine, University of Malaya,
Kuala Lumpur, Malaysia

Abstract

Spinal cord injuries (SCI) occur as the result of a traumatic injury to the spine or disease affecting the spine and/or its surrounding structures. SCI is a catastrophic injury with extensive medical, physical, psychological, social and economic impact. SCI is associated with a multitude of potential medical complications from the time of injury to the individual's entire lifetime. There is still no cure for SCI and quality of life issues in individuals with SCI are highly related to their health maintenance. Health maintenance is through the understanding of the medical risks in SCI and the need for effective preventive measures.

There is now improved understanding of SCI resulting in increased survival in acute SCI worldwide through improved emergency care and the availability of specialised units providing skilled medical, surgical, nursing care and rehabilitation. Life expectancy has increased significantly for people with a SCI. However, it remained lower than in the general population (estimated to be between 70% and 90% of the normal life expectancy) and people with SCI still die at younger ages because of medical complications and secondary conditions. Pneumonia remains the leading cause of death among people with SCI. Other leading causes of death include septicaemia, heart disease related deaths, renal failure and suicide.

Some of the most common medical complications in long-term SCI patients are pressure ulcers, autonomic dysreflexia, respiratory complications, spasticity, pain, urinary complications and bowel problems. These complications are a frequent cause of morbidity and mortality and lead to increased rates of rehospitalisation and cost of care. Respiratory complications and diseases of the genitourinary and skin systems are among the most frequent reasons for rehospitalization.

Long-term SCI patients are at risk of developing these medical conditions which can dramatically impact their health, functioning and psychosocial well-being as well as having the potential to be life-threatening. These

medical risks are best managed through preventive measures, early identification and patient education to facilitate their rehabilitation, community participation, employment and improve quality of life. It is essential that medical management remain an integral part of the SCI patients' long-term follow-up.

14. CURRENT TRENDS IN SURGICAL MANAGEMENT OF THE PRIMARY SACRAL TUMOURS

Ziad Al Zoubi

Sacral tumors are rare and usually missed in diagnosis, when the treatment is only surgical like giant cell or chordoma, the operation is difficult and risky. There is no definite method for approach, avoidance of complication, prevention of recurrence, and stabilization of the spine we have experience in 8 cases over the last 8 years, treated surgically one of them is very huge. The experience build up over the years with discussion of our method of stabilising the spine will be discussed.

15. Prevention of SCI : methodology , approach and use of patient information to foster the prevention message

Mr Eric Weerts , Handicap International Vietnam
Bach Mai Rehabilitation center Hanoi Vietnam
: Handicap International , 78 Giai Phong Road , Dong Da district , Hanoi Vietnam

Background and objective:
Methods implementing prevention of SCI focus on occupational hazards, behavioral issues in the domestic sphere , recreational activities . The presentation aims to show from a simple data collection of information in spinal Cord Units in Vietnam, which messages and key ideas can be used when addressing the contend of prevention message to the public and target group.

It also casts a wider view on how , from simple methodologies , prevention knowledge collected from persons with SCI can be used effectively in shaping contend of SCI prevention and which areas of activity , mindset , culture , media can be targeted and used in order to disseminate the most appropriate and realistic message to the responsible institutions at regional , country level.

Methods:
Questionnaire survey analysis, cause and circumstance analysis of accidents , review on resources in injury prevention , collection on information on national injury prevention programs .

Results:
The injury etiology found in the survey (sample of 257 persons) resulted in 48 % of transport related accidents , 20 % of falls , 4 % of Assault , 18 % other traumatic injuries , 4 % sports and 6 % of non-traumatic spinal cord dysfunction . These findings on this small group were in line with the data collection done on patient admission records (over 500 patients in four years) .In regard to the circumstances of the accidents , high speed on vehicles , alcohol use as well as use of poor quality equipment during activities were significant factors surrounding the accident. Other traumatic injuries were mainly due to crushing from heavy objects. A problem analysis on the findings results considered the following domains of prevention: road safety , occupational accidents (building sector) , prevention of unintentional injuries in the domestic sphere. These subjects were integrated and considered in interactions between MOH injury prevention programs.

Conclusions:

Strategy for prevention of SCI do not need specific and dedicated programs focusing on SCI only . They should be included as a complement of existing programs (occupational health safety , road safety , first aid) . Implementing these strategies do not require substantial means . Further research is needed to measure the impact of these strategies.

16. Percutaneous posterior spinal fusion and fixation techniques

Ralf H. Gahr, Leipzig, Germany
Raja Rampersaud, Toronto, Canada

Introduction

Minimally invasive spinal surgery is a recent concept that is still evolving, maturing, and benefiting from technological advances. The main goal is to reduce the trauma related to the surgical approach while allowing a surgical procedure comparable to that achieved via the conventional approach. There is no proof that spinal outcomes are better with minimally invasive surgery than with conventional surgery, which remains the gold standard against which new techniques should be evaluated. Nevertheless, minimally invasive surgery has been found to improve patient comfort in the postoperative period by decreasing operative site pain and shortening the time spent in the intensive care unit and in the hospital.

Minimally invasive pedicle screw fixation using the Sextant™ system

Conventional pedicle screw fixation requires incision and retraction of the paraspinal muscles on both sides to expose the roots of the pedicles and to identify the sites of screw insertion. This gold standard technique ensures strong stabilization but only at the expense of muscle scarring. In some situations, the pedicular screws can be inserted through the skin and muscles via tubular retractors positioned opposite the pedicles. The rod that connects the screws is inserted through the muscles using a sextant system that positions the rod into the polyaxial screw heads. Posterior stabilization after anterior interbody fusion is the best indication of this technique. The patient is given general anesthesia and placed in the prone position on a radiolucent operating table. Fluoroscopic monitoring with anteroposterior and lateral views is used. Guidewires placed in contact with the roots of the pedicles serve to guide the insertion of tubes for sequential muscle dilatation. Finally, a tubular retractor is placed at the appropriate location and along the desired pathway to ensure that the screw stays within the pedicle. A starting hole is made in the pedicle and a wire is inserted to prepare the implantation of the polyaxial screw. Each screw is connected to an extender that extends above the skin. A sextant is then used to introduce the rod through the extenders. The extenders ensure that the rod travels through the muscles in the direction of the muscle fibers and connects the two pedicular screws. The rod is then tightened in place and the extenders removed. This technique is essentially an internal fixation method. Reliable and long lasting stabilization requires the addition of a graft.

Minimally invasive posterior interbody fusion

By combining percutaneous pedicle screw fixation and access to the epidural and disc spaces via tubular transmuscular retractors, circumferential fusion can be performed. Interbody cages are implanted via the double posterior epidural approach. Alternatively, a single specific interbody cage can be inserted via the unilateral transforaminal approach. We use the transforaminal approach for minimally invasive posterior fusion . The patient is in the prone position under general anesthesia. On one side, 4 cm from the midline, a large tube (2040 mm in diameter), is inserted through the muscles, as with the micro-endoscopic discectomy procedure. The foramen is opened by complete facetectomy using an electrically powered mill. The root exiting the foramen and the nearby suprajacent root are identified. The disk is approached in the foramen and removed as completely as possible via the tube. On the other side, pedicular screws are implanted using the sextant system. The rod is introduced after interbody distraction through the tubular retractor on the other side. The pedicular fixation obtained after the rod is tightened on the screws maintains the distraction. This allows insertion through the tube of a graft or interbody cage. Then, pedicular instrumentation is implanted on the side of the tube to complete the assembly.

17. Laser in transforaminal disc surgery and lateral foraminoplasty technique and my results.

SATISHCHANDRA GORE

In 1900, Sachs and Fraenkel described the diagnosis and treatment of lateral recess stenosis as an entity. The availability of computed tomography (CT) and magnetic resonance imaging has facilitated visualization of the content of the lateral recess and diagnosis of this pathological condition.

Endoscopic laser foraminoplasty addresses degenerative disc disease of the spine, lateral recess syndrome, and failed back surgery as a complex of multiple sources of pain production. Since April 1995 this endoscope assisted laser technique has been used for widening the lumbar exit route foramina and address pain generators.

Patient selection includes primarily unilateral sciatica and claudication as well as low back pain and referred buttock pain following various operative interventions.

Endoscopic laser foraminoplasty (ELF) utilises an endoscope, a uniportal posterolateral approach and a side firing holmium laser probe. Under direct vision and within the protection of saline solution, epidural scarring, extruded and sequestrated disc protrusions and/or osteophytes are removed by holmium laser ablation. The patient is responsive and aware under local anesthesia and this ensures the protection and the integrity of the nerve root.

ELF opens the lateral recess, decompresses the nerve roots, accepts the settlement and allows continued micro movements at the segmental level. This is expected to avoid the acceleration of degeneration at the adjacent levels.

Presentation will show details of technique and results in my hands of this novel and innovative technique.

18. Cardiovascular effects of sexual activity and vibrostimulation following spinal cord injury

Andrei Krassioukov
MD, PhD, FRCPC,
Associate Professor, Div. Phys. Med. & Rehab.,
Scientist, ICORD, Dep. of Medicine,
University of British Columbia, Vancouver, BC

Unstable blood pressure and cardiac dysrrhythmias occur in higher incidence in spinal cord injury (SCI) subjects compared to able bodied controls. The autonomic dysreflexia (AD) and other cardiovascular abnormalities may be underestimated during ejaculation procedures in this population and place the individuals at risk for acute cardiovascular dysfunctions.

Research specific to AD associated with sexual activity or sperm retrieval procedures is limited. Recently, in a case series we reported significant alterations in blood pressure in patients with atypical AD and referred theses prolonged and severe episodes as malignant AD. These clients experienced AD with sexual activity, and the AD continued to return each time the client voided for several weeks after the initial episode.

Frequently, clinicians found it difficult to provide accurate information to clients as to the risks of AD with sexual activity due to the lack of research. The sexual activity and ejaculation with VS procedure in SCI men is accompanied by significant cardiovascular responses that are not evident in able bodied men. These concern have to be addressed by clinicians during the sexual rehabilitation and education of individuals with SCI.

19. Strengths and Limitations of Cell Transplants for the Treatment of Spinal Disorders: The Hope and the Hype

John Steeves
John and Penny Ryan BC Leadership Professor
Director of ICORD
UBC and Vancouver Coastal Health
Vancouver, BC, Canada

Replication of a preclinical scientific discovery prior to a clinical trial is a good start:

Independent Replication (Validation) of Preclinical Finding:

- Using different types of SCI or variations of treatment (demonstrates robustness of finding)
- Using different species (demonstrates fundamental nature of the therapeutic target and/or intervention)
- Using the most clinically appropriate type of SCI injury to mimic human condition (demonstrates relevance).
- To facilitate independent replication and validation, it is important to outline methodology and results in detail.
- Inclusion of a preclinical "functional" outcome measure similar to one that could be used in a human clinical trial (i.e. anatomical outcomes alone are not sufficient).

What do we need to have answered before going forward to a human study:

- Therapeutic target
- Possible toxic side effects or adverse events
- Route of administration
- Effective time and duration for therapeutic application (window of opportunity)
- Pharmacodynamics / pharmacokinetics of drug or fate of cell transplant
- Number of subjects required for each trial phase and ethical issues associated with conduct of trial
- Primary and secondary outcome measures (clinical endpoints)
- Precise study protocol design of clinical trial
- Number of study centers required to complete trial in a reasonable time frame (1-2 years)
- How to coordinate and manage multiple study centers.

What are Stem and Progenitor Cells?

- Stem cells have the potential to self-renew indefinitely and differentiate (develop into) a number of different types of cells.
- Totipotent cells are found with the early blastocyst and can produce all differentiated cells in an organism (i.e. Totipotent cells have total potential or total plasticity).
- Pluripotent cells can give rise to most, but not all tissues.
- Multipotent cells are derived from pluripotent cells, which have undergone further developmental restriction.
- Unipotent cell can only differentiate into one cell type.
- Progenitor cells have limited capacity for self-renewal and are only multipotent or unipotent. For example, multipotent neural progenitor cells can only become different types of neurons and glial cells (*in vivo*, they often spontaneously become glial cells).

What are the limitations of Cell Transplantation after SCI?

- Cell fate There is no reliable or acceptable method for accurately tracking the fate of these cells after human transplantation, but it is known that transplanted cells can be phagocytically removed by macrophages in animal models.

- Immune reactions - The risk of stimulating the immune system in a way that reduces (e.g. removes) the transplanted cell's effectiveness is a potential risk and may also impede subsequent transplantations.

Limitations of Cell Transplantation after SCI (continued)

- Multicellular damage, such as SCI, may require several types of cells to be replaced through transplantation and as such would be especially difficult to treat effectively using the transplantation of a single stem or progenitor cell line.

- Aberrant cellular differentiation and/or synaptic connections we have little information how to direct stem cells towards a particular phenotype and maintain them in that phenotype after transplantation.

- Tumorigenicity - Chance of inducing a tumor - If the replication of the transplanted cell cannot be controlled, it could induce a tumor.

How are Cell Transplants Likely to Be Delivered to the Injured Spinal Cord?

Transplanted cells could be delivered to the spinal cord via:

- Intravenous (requires ability to cross endothelial cells of blood-brain barrier and does not restrict delivery to CNS)
- Intrathecal (restricts delivery to CNS and enables initial targeting to injured level of cord)
- Intraparenchymal (enables direct delivery to injured cord, but direct injection may cause additional mechanical damage)
- Epidural (is an unlikely route as migration of cells across dura would be limited with current techniques)

What Knowledge Is Necessary before Cell Transplants Can Be Validly Used To Treat Human SCI?

- What controls or regulates the differentiation of a stem cell towards a particular cell type *in vitro*?
- What are the preferred sources of cells for transplantation after SCI?
- Do the cells have to be collected from the host and then expanded for a sufficient number of cells for transplantation (i.e. an autologous transplant) ?
- What immune reactions are elicited from an allotransplanted cell (i.e. an allograft from a genetically non-identical member of the same species)?
- How influenced or independent of the surrounding host tissue environment is a transplanted cell in terms of its cell differentiation and survival (i.e. cell lineage and fate)?
- What factors could make a transplanted cell tumorigenic?

What is the current Hype (and currently unsubstantiated)?

- Rudimentary cell culture practice, the essential technology for growing (i.e. expanding) cells *in vitro*, can be created within a small clinic. It enables clinics and hospitals in developing countries to generate cash from treatments that are not currently validated or allowed in developed world.
- Currently, such experimental transplantation treatments are known to have been undertaken in Brasil, Russia, India, China, Mexico, Turkey, Ecuador, Azerbaijan, ???.
- To some naive people, stem cells are a miraculous way to achieve the repair of a complex tissue, such as the CNS, because they expect the transplanted cell will take instructions from the host tissue and differentiate (change into) the necessary neural cell types for functional recovery.

What is the current Hype (continued)?

- Since virtually all adult tissues have a small population of stem or progenitor cells, numerous kinds of cells have been proposed for transplantation, including:
  - Embryonic cells
  - Fetal cells
  - Umbilical cord cells
  - Adult stem cells from CNS, skin, blood, bone (stromal), etc.
- Many of these cells have not been carefully or fully characterized and are often not stem or progenitor cells. They are often poorly "tissue matched" to the recipient, or it is claimed as being unnecessary since stem cells do not trigger and immune rejection.
- Currently no valid pre-clinical or clinical evidence exists for any cell transplantation procedure improving the functional outcomes (providing clinical benefit) to an animal or human with SCI. "Stem cell biology is in its infancy and its medical application is not just around the corner." (Goldman, 2005)

Minimum Requirements for a Human Study to be referred to as Clinical Trial:
Varies with each Phase (1-4), however, by pivotal Phase 3 (confirmatory), the protocol would include the following criteria to assure objectivity :

- Appropriate (placebo) control subjects
- Blinded assessments by qualified examiners
- Suitable clinical endpoint and outcome measure

.... with no charge to the study subjects for their participation .... or payment to the investigators !

Treatments are offered by some practitioners who claim they are conducting a clinical trial, but satisfy none of the above essential criteria

Guidelines for the conduct of clinical trials

for spinal cord injury (SCI) as developed by the ICCP Panel:

- Fawcett JW, Curt A, Steeves JD, Coleman WP, Tuszynski MH, et al. *Spontaneous recovery after spinal cord injury and statistical power needed for therapeutic clinical trials*. *Spinal Cord* (in press)
- Steeves JD, Lammertse D, Curt A, Fawcett JW, Tuszynski MH, et al. *Clinical trial outcome measures*. Spinal Cord (in press)
- Tuszynski MH, Steeves JD, Fawcett JW, Lammertse D, Kalichman M, et al. *Clinical trial inclusion/exclusion criteria and ethics*. Spinal Cord (in press)
- Lammertse D, Tuszynski MH, Steeves JD, Curt A, Fawcett JW, et al. *Clinical trial design*. Spinal Cord (in press)

Selected Resources:

- Zeitlow R., et al. 2008. Human stem cells for CNS repair. Cel Tiss Res. 331:301-322.
- Cedar S.H., et al. 2007. The therapeutic potential of human embryonic stem cells. Ind. J. Med. Res. 125:17-24.
- Goldman, S.A. 2005. Neurology and the stem cell debate. Neurology 64:1675-1676.
- http://www.icord.org/iccp.html *"Experimental Treatments for Spinal Cord Injuries: What you should know if you are considering participation in a clinical trial."* (for general public and health care professionals)
- http://www.ninds.nih.gov/disorders/sci/detail_sci.htm
- http://www.ninds.nih.gov/disorders/brainandspinaltumors/detail_brainandspinaltumors.htm

http://stemcells.nih.gov/info/basics/basics4.asp

20. THE BACK & NECK PAIN AND THE MIND

Dr. V. T. Ingalhalikar, Dr. Anagha G. Vaze.
Ashwini Back Institute, Thane.

There is a high incidence of Psycho-Somatic back and neck Pain.

In one of the clinical research studies of chronic back pain sufferers that we carried out, up to 62 percent patients had major or minor contribution from psychological factors towards production and suffering of their back pain.

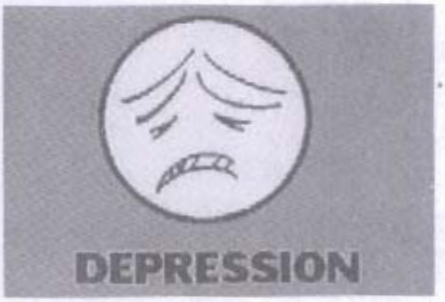
Psychological and emotional factors can Influence and even Induce back pain. There could be a genuine objective physical cause for back pain suffering. But the pain may be increased or sometimes even relieved by psychological factors. (Emotionally Influenced Back Pain). In some, there may be no underlying objective physical cause whatsoever, but pain can be felt. (Emotionally Induced Back Pain)

The focus of patient's attention is physical pain, i.e. Back & Neck Pain, therefore the patients see doctors other than the psychiatrists. When the psychosomatic contribution to the patient's spinal pain goes unrecognized the treatment given may sometimes be ineffective.

Acute pain is often associated with Anxiety.

Chronic pain usually associated with Depression.

A Combination of anxiety and Depression is very common.



Back pain is very commonly blamed for the depression in a person. It is often thought that chronic back pain suffering produces Depression and, therefore, it is claimed that if the back pain is properly treated and cured, the depression will be cured. This is not always true. The back pain itself could be a presentation of the Depression. There are incidences of people committing suicide from severe chronic depression and their chronic back pain is blamed for the person's ending his / her life.

Back Disability :

A large number of patients have chronic back pain but it does not produce any major disturbance in their own life or in the lives of those around them. Most often it is a simple back pain and whatever the suffering, is confined to the back pain sufferer alone. This can be likened to a person's taking alcohol regularly and leading perfectly normal life. If at all the alcohol is likely to produce any harm it will be to the person himself or herself. Nobody else suffers. On the other hand, a person's taking alcohol may affect not only his life but the lives of people around him. Such a person is not a simple alcohol taker, he could be appropriately termed as an Alcoholic. In a similar way, whenever the back pain in a patient significantly affects his / her life and the lives of others around him in terms of normalcy of life, we like to term this as a Back Disability.

This back disability is not necessarily a direct result of the underlying spinal disorder. It has more to do with patient's psychological and social resources available for coping with the life situations. These people often cease to live happy, fruitful and meaningful life. They often cease to exist as normal useful members of the society. In any community or country, in present times Stress is unavoidable. More and more people suffer from stress related Back & Neck pain. Stress induced chronic back pain sufferers have high tendency to become back disability persons.

Early diagnosis of psychosocial back pain is necessary since on-going back pain can produce Back Disability. Longer the duration of disabling back pain suffering, lesser are the chances of the patient resuming fruitful functioning as originally.

Psycho-Somatic Back Pain :

Presentation :

The Common associated findings are : -

- **Multiple Bizarre Symptoms** : symptoms belonging to various body systems presenting singly or in combinations in such a funny manner that it does not form any single medically rational and coherent clinical picture. E.g. ; headaches , tingling and numbness in body, chest pain, abdominal pain, difficulty in speaking swallowing, palpitations, apprehensions, Intolerance to noise, Persistent aerophagy (burping) etc.

- **Multiple Physician Contact** : Because of the symptoms indicating multiple body systems affections, many physicians of different specialties are approached for treatment. Plenty of investigations may be carried out, many of them not revealing any significant / abnormal results.

- **Verbosity of Complaints** : The patient may describe his suffering in verbose, grandiose and mega-emphasized manner.

- **Superlative Response to Clinical Examination** : Exaggerated pain response to even most gently carried out examination.

- **Most of these patients also have : -**

- **High urgency demands** : They want to be treated out of turn on priority basis. The examination very often may not reveal enough objective physical disease commensurate with the expressed suffering . They expect many years of suffering to vanish in just a few days.

- Unrealistic expectations and frustrations over residual pain.

- Over reaction and misinterpretation over residual back pain.

- **Somatic Preoccupation :** mind occupied with thoughts of body and illness all the time.

- **Phobias :** fears and apprehensions.

- Their Back and neck pain stimulation can be brought about by - loud noise, stress, fever, crowd etc.

Other important things to know about pain suffering :

- Early training of healthy pain habits is very important. A child who has during his developing years learnt incorrect attitude of looking at any body pain, is likely to grow into Pain Prone Personality as an adult.

- The Pain tolerance varies and also the resultant complaint behavior varies.

- The Pain perception changes with mood.

- Sometimes the thought that pain is likely to be produced by something later, is enough to start pain perception now. This is to be termed as the Nocebo Effect of Pain Suggestion.

- It is commonly believed that whenever a person complains of pain, the pain is actually being produced at that moment in the body (Real Time Pain Production). This is not always true. Due to neurophysiological adaptations in the brain, the back pain can be a "Learnt Phenomena". The pain experience can be stored in the memory centers of the brain and this memory of pain can be aroused by situations similar to original pain producing episode. Thus the pain can be felt in the absence of actual pain production at that moment. It is like opening a file from the hard disc of a computer. The pain suffering on this memory arousal can be as real and vivid like the original experience. Though the back pain can be felt due to psychosomatic causes, the patient's suffering is not fake or unreal. Migrainous headaches are classic examples of this suffering. Anybody who has had such headaches knows how real the suffering is ! It is unfair to say that such a person is suffering imaginary and "all in the head / mind".

Psycho-Somatic Back Pain And Surgery :

In patients with psychosomatic back pain, some investigations like MRI or CT, myelogram etc. may reveal certain positive findings which may have no direct relevance to the patient's back pain suffering. Here it is often very difficult to ascertain the exact contribution made by psycho-somatic factors. Some of these patients may not get pain relief after surgery.

It is not unlikely to see a chronic back disability sufferer insisting on undergoing surgery to end his suffering. Very often this is an attempt to have his suffering authenticated and signatured by a surgical episode, especially if investigations are not strongly indicating a physical source of suffering.

Like any new treatment modality in back care, a surgical episode may show temporary relief of pain in the immediate post-operative period for no real reasons. This is a Placebo effects of surgery.

Poor post-operative results can be predicted in certain psychological disorders like Paranoid Schizophrenia and chronic Depression. Sometimes it is better to accept some morbidity with the back problem rather than operate upon these patients, since these patients have high chance of deteriorating psychologically or they using the surgical episode as an excuse for their ongoing complaining and Back Disability Behavior.

Psychiatric Help and LBP :

During clinical evaluation most patients and their relatives strongly deny any psychosocial problems. Most would deny referral to psychiatrists or medical social counselor. A good physician always acknowledges the legitimacy of the patient's back pain. He always has a positive scientific rationale for referring the patient to the experts in psychological and social fields. Such a referral is routine and it does not necessarily indicate a transfer under psychiatrist's care. The patients and their family members must understand this and comply with the treatment instructions in order to be benefited.

Care of Psycho-somatic Back & Neck Pain :

- Psychosocial counselors and psychiatrists are often needed.
- Scientifically educating the patient about the spine, the spinal disorders, their care, their prevention and about the psychological factors involved, is very important in getting the patient out of the difficulty. Back School is the most effective modality in achieving this.
- Active participation of a well motivated patient is a key to success.
- Psychotherapy and relaxation sessions bring about relief in many patients.
- Team Approach in Back Care : The patients are treated by a group of clinicians consisting of an Orthopaedic Surgeon, Neurologist, Physical Therapist, Occupational Therapist, Psychiatrist, Clinical Psychologist, Psycho-social counselor.
  - Such a team approach : Saves time and reduces risk of side tracked treatment.
    - Prevents shunting of the patient from clinician to clinician
    - Different levels of expertise are available
    - It eliminates individual clinician's bias.
  - Contrary to the common belief, the patients do not mind team approach. They do not mind a group of clinicians discussing their case and are happy that more than one brains are working on their case.
- Many patients of chronic back and neck pain take medications for prolonged periods, sometimes even for years. All drugs must be stopped eventually
  - Pain killers and Anti-Anxiety drugs are habituating and it is preferable to give them for short courses.

    Antidepressants are often needed. Their actions take effect slowly. They need to be given for prolonged periods. Some of them have side reactions like dryness of mouth etc.
- Medical illnesses like diabetes, hypertension, heart diseases etc. reduce pain tolerance. Their drugs sometimes cause reduced energy levels, mental blurring and psycho-physical addiction.

Weaning of chronic pain killers and anti anxiety drugs is difficult, but must be done. The chemical detoxification improves mental state and gives the patient a sense of control over his back-neck pain suffering.

21. Advances in Management of Inflammatory Back Pain

Prof. Anand N. Malaviya,
MD, FRCP (Lond.), ACR '*Master*', FACP, FICP, FAMS, FNASc,
(Ex-Head of the Department of Medicine, and
Chief of Clinical Immunology and Rheumatology Services,
All-India Institute of Medical Sciences, New Delhi)
Consultant Rheumatologist, 'A&R Clinic'
and Visiting Sr. Consultant Rheumatologist
ISIC Superspeciality Hospital, New Delhi.

Introduction:

Rheumatologists classify back pain in 3 categories:

- ***"Mechanical / non-specific / idiopathic LBP"*** (> 90% of low-back pains):
  - Commonest, not life-threatening.
- ***"Inflammatory" LBP*** due to spondyloarthritis / ankylosing spondylitis group (~ 5% of cases but SHOULD NOT BE MISSED, *fantastic new therapies in early stage of the disease*):
  - Less common, *non-rheumatologist confuse* it with 'mechanical' category, they miss it in early stage. In a study from Germany, 41% of patients being operated for so-called 'disk prolapse' surgery, were actually cases of early stages of ankylosing spondylitis (with positive HLA B27 genes) where the diagnosis was missed by the surgeons [Bingham WF. The role of HLA B27 in the diagnosis and management of low-back pain and sciatica. J Neurosurg 1977; 47:561-566].
  - For rheumatologists: *easy early clinical diagnosis*, fantastic new treatments at early stages.
- **"Sinister" LBP"** due to tuberculosis (other infections) / neoplasm / severe trauma-mechanical derangement with increasing or persistent severe neurological deficit: Least common (<1-2 % of back pains), a medical emergency, clinical features usually typical, diagnosis NOT difficult.

There have been 5 major recent advances in the management of Inflammatory-LBP as follows:

1. In making a clinical diagnosis for early cases (preventing misdiagnosis)
2. In the understanding of responsiveness to drug therapy
3. In the development of instruments for objective assessment disease to assess drug response.
4. Drug therapy
5. Identifying those who are candidates for biological therapy.

Making a Clinical Diagnosis:

- Morning stiffness of >30 minutes' duration
- Improvement in back pain with exercise but not with rest
- Awakening because of back pain during the second half of the night only
- Alternating buttock pain

Sensitivity of 70.3% and a specificity of 81.2% if at least 2 of these 4 parameters were fulfilled (positive likelihood ratio 3.7). If at least 3 of the 4 parameters were fulfilled, the positive likelihood ratio increased to 12.4 [Rudwaleit M, Metter A, Listing J, Sieper J, Braun J. Inflammatory back pain in ankylosing spondylitis: A reassessment of the clinical history for application as classification and diagnostic criteria. Arthritis Rheum 2006; 54:569-578]

We recently presented our paper on AS at the American College of Rheumatology meeting at Boston (November 2007). In that paper we emphasised the problem of misdiagnosis leading to delay in initiating proper treatment by a mean of 8.9 years. (Aggarwal R and Malaviya AN. Abstract ACR Nov 2007, Boston, USA)

Understanding of responsiveness to drug therapy:

~ 50-66% AS patients are not very severe and do well with physical therapy, exercises, and NSAIDs/Coxibs. They usually do not have eye involvement (uveitis, iritis, iridocyclitis and hip involvement. Only ~ 1/3rd patients are severe with poor out come.

Development of instruments for objective assessment disease to assess drug response:

With the availability of potent drugs to control the disease it is not considered essential to have instruments to objectively measure 'disease activity' levels at every patient follow-up visit. The ASAS assessment instruments including BASDAI, BASFI, BASMI and BASRI have come a long way in objectivising the assessment of disease activity in AS. This has revolutionised the way the patients are treated now-a-days in day-to-day clinical practice.

Drug therapy:

The approach to drug therapy has seen dramatic changes in recent years. First has been the realisation that 50-66% of AS patients do not need more than NSAIDs/coxibs to control and halt the progression of their disease. But, the main advancement has been in the realisation that 'on-demand' NSAIDs/coxibs do not achieve; for achieving complete disease control, continuous use of these drugs irrespective of the fact that patient does not have nay residual symptoms is absolutely mandatory. [Wanders A, Heijde D, Landewe R, Behier JM, Calin A, Olivieri I et al. Nonsteroidal antiinflammatory drugs reduce radiographic progression in patients with ankylosing spondylitis: a randomized clinical trial. Arthritis Rheum 2005; 52:1756-1765; Ward MM. (Editorial on the above article). Prospects for disease modification in ankylosing spondylitis: do nonsteroidal antiinflammatory drugs do more than treat symptoms? Arthritis Rheum 2005; 52:1634-1636; Maksymowych WP. Therapeutics and Clinical Risk Management, 01/29/08. A recent trial suggests that continuous as opposed to on-demand use may be superior in preventing progression of structural damage. One particular NSAID, which is a highly selective cyclo-oxygenase 2 inhibitor, etoricoxib, may be superior to standard NSAIDs for AS]. In the rest of ~ 33% of patients do not respond to this treatment biologicals are required to control the progression of the disease (below).

Identifying those who are candidates for biological therapy:

In 1/3rd of the unresponsive AS patients it becomes necessary to use biologicals. The risk of flare of latent TB must be carefully assessed before initiating this therapy. The main problems with biologicals is their high cost but, their response is truly dramatic. It is to be understood that if structural damage is too advanced the expectations from these drugs should not be unreasonable; they do not 'repair' structural damage!

What to do in those who cannot afford ant-TNF?

Pamidronate infusions (synchronised with 'pulses' of methylprednisolone) once every month for 6 mo. Are reported to be effective. Thalidomide is the other alternative that has been reported to be effective.

Conclusion: Recent years have seen rapid advances in the knowledge of AS and its management. Several highly effective drugs have become available that control the symptoms as well as halt the progression of the disease. These facts makes it mandatory that the diagnosis of the disease is made early, the disease is regularly assessed objectively and the treatment is tailored to the type and severity of the disease the patient has.

22. Minimally Access Surgical Management for Tubercular Spondylitis".

Arvind Jayaswal
Professor ; Department. of Orthopaedics & Chief of Spine Services ,
All India Institute of Medical Sciences, New Delhi , INDIA

Tubercular spondylitis is a major cause of deformity of the spine and neurological deficit affecting all ages. Though majority of patients are managed with antitubercular chemotherapy alone, surgery is required for spinal instability and deteriorating neurology. Anterior and Antero-lateral decompression of the cord are two popular surgical procedures with good time tested results. However, the morbidity associated with open thoracotomy makes surgical anterior decompression to be undertaken with caution. Posterior and posterolateral decompressions which avoid thoracotomy, have gained popularity with advent of good posterior spinal instrumentation. The Minimally Invasive Surgeries aim to further decrease the morbidity associated with each of the open procedures without compromising on the surgical goals. Video Assisted Thoracoscopic Surgery (VATS) has changed this clinical scenario in thoracic spine with decreased morbidity associated with anterior decompressions. Various procedures can be done using VATS to address specific clinical scenario, starting from simple drainage of abscess not responding to chemotherapy, debridement and decompression with grafting for deteriorating neurology and anterior instrumentation using VATS to address spinal instability. VATS decompression can also be combined with Percutaneous pedicle screw Stabilization to address spinal instability. In the Lumbar spine, percutaneous pedicle screw instrumentation can be combined with Transforaminal decompression using Minimally Invasive tubular rectractors with Interbody fusion or MINI ALIF with anterior debridement and anterior column support.

A prospective study at our centre to evaluate the short term results in terms of the surgical goals like deformity correction and neurological improvement with VATS decompression and stabilization using conventional spinal instrumentation along with associated morbidity was done.

AIIMS study : A total of 23 patients were included in the study. All the patients had thoracic spinal tuberculosis (T4-T11) limited to a single level. The average age was 38.2years. The primary goal of the surgery was adequate decompression. Various procedures were done and accordingly four study groups were recognized, GroupI : Debridement + drainage of pre & para vertebral abscess in 4cases, GroupII : Debridement + decompression + reconstruction with rib graft in 8 cases, GroupIII : Debridement + decompression + Anterior vertical titanium mesh cage + open posterior pedicle screw-rod fixation in 5 cases and, Group IV : Debridement + decompression with anterior screw rod fixation in 6 cases. All the patients were put on anti tuberculous chemotherapy regimen for a minimum of 12 months. The surgical outcome was assessed in terms of pre and postoperative neurological status, operative time and blood loss, average hospital stay, deformity correction and maintenance, Fusion status and complications. The average follow-up period was 22 months (range 12 32 months).

The average operative time was 228 minutes (102 to 324 min). The average blood loss was 780ml (330 to 1180ml) and increased with the operative time and addition of anterior instrumentation. The average postoperative stay was 6 days (range 3 - 12 days). Overall fusion rate was 95.64%.There was no significant loss of correction at final follow up (avg. 3°). No patient had neurological deterioration and 17 of the 18 patients regained ambulatory power (94% above FrankleD). 2 had prolonged ICD tube in situ and conversion to open thoracotomy was undertaken in 3 cases.

Conclusion: Minimally Access Surgeries viz. VATS etc. are valuable addition to the armamentarium of the

spine surgeon, considering its benefits of decreased blood loss and postoperative morbidity & achieving similar outcomes as open surgeries in terms of fusion & neurological recovery. However, there is a steep learning curve before all the surgical goals of the open method can be attained.

23. Overview of Assistive Technology for People with Spinal Cord Injuries

Rosemarie Cooper

Technology plays a critical role in promoting well-being, activity and participation for individuals with spinal cord injury (SCI). It is one of the few things that can be provided to people with SCI where one can see an immediate and profound benefit. As technology has improved, so has the realm of possibilities open to people with SCI. The range of activities in which people with SCI participate is impressive and yet still growing. School, work, travel and leisure activities are all facilitated by technology. Advances in materials have made wheelchairs lighter, and developments in design have made wheelchairs that fit individual needs. Software has made computer interfaces adaptive and in some case intelligent, through learning the user's behavior and optimizing its structure. The trend is certainly taking us in two exciting directions: (1) personalized design where the technology matches and adapts to the user's needs; (2) and aware systems that learn from the user's behavior, the context and the environment to support the end-user. As participatory action design and aware systems take greater hold, transformational change is likely to take place in the technology available to people with SCI.

24. PHYSICAL THERAPIES FOR SCI: A SYSTEMATIC REVIEW

Harvey L, Lin C, Glinsky J and De Wolf A
Rehabilitation Studies Unit, Northern Clinical School,
Faculty of Medicine, University of Sydney, Australia

The purpose of this systematic review was to collate the evidence supporting the effectiveness of physical therapies for people with spinal cord injuries. Databases were searched for randomized controlled trials involving physical therapies typically provided by physiotherapists, occupational therapists, exercise physiologists and similar health-care professionals. Each trial was rated for susceptibility to bias and the key findings extracted. 4,500 abstracts were identified of which 29 met the inclusion criteria. These 29 trials examined the effectiveness of different fitness and strength training regimes (n = 7), hand and upper limb therapy (N = 7), gait training (n = 5), stretch (N = 4), pain-relieving therapies (n = 3) and other related interventions (n = 3). The 29 trials together included 700 subjects. Most trials did not use blinded assessors or concealed allocation; design features important for minimising bias. Twelve trials reported a statistical between-group difference on at least one outcome measure although the 95% confidence intervals of between-group differences in all but 3 trials were large and spanned minimally worthwhile treatment effects. Nonetheless these trials support the use of different fitness, strength and gait-training interventions. The results of this systematic review indicate the pressing need for high-quality research to determine the effectiveness of physical therapies commonly administered to people with spinal cord injuries. This systematic review also highlights the importance of minimizing bias in clinical trials and interpreting results not just with respect to statistical significance but with respect to what is clinically meaningful.

25. Overview of Assistive Technology for People with Spinal Cord Injuries

Rosemarie Cooper, MPT, ATP-University of Pittsburgh

Co-Authors: Rory A. Cooper, PhD-University of Pittsburgh

Introduction

Assistive devices provide crucial support for community participation, vocation, recreation and to perform activities of daily living. An end user with a severe disability will likely rely on a variety of assistive devices in order to maximize function. The proper fitting of the technology to the individual and the training in the usage of the devices are both critical to success. Access to transportation, either personal or public, accessible housing, personal assistance services, and assistive technology are among the most critical factors to be addressed once the acute rehabilitation phase has been completed.

A team approach is most effective when assessing an individual for assistive technology. Ideally, the clinical team would include a physiatrist, therapist (physical, occupational, speech), rehabilitation engineer, vocational rehabilitation counselor and a rehabilitation technology supplier. The end user and her/his family should be at the center of the team, and ultimately make the decisions as to the most appropriate technology. Often this will require some patient education, but eventually many people with disabilities gain considerable knowledge about their AT needs.

The goal with the provision of assistive technology is to allow the individual with the disability to perform activities as independently as possible in a variety of situation and environments. A thorough AT assessment includes evaluating the individual's physical abilities (e.g., strength, endurance, flexibility), cognitive abilities (e.g., decision making, processing multiple sources of information, comprehension), sensory function (e.g., vision, hearing, sensation), living environment (e.g., home, work, school), and support systems (e.g., family assistance, paid assistance) and affect (e.g., acceptance of disability, participation in process).

When making recommendations for AT consideration must be given to the home environment and fixed and movable features. Ramps, stair lifts, widen-doorways all may be needed to allow effective use of some devices within the home. Moveable features such as furniture can be rearranged to allow access pathways through the home and in some cases may need to be replaced. For example, it is more difficult to get in and out of a soft low couch than a higher recliner with armrests. Community activities need to be included in a thorough evaluation. Community based tasks such as shopping, using an automated teller machine, or eating in a restaurant all provide important insight into AT needs and the associated training. It is also important to provide people exposure to integrated activities. Integrated recreational activities are important for building self confidence and adjusting to a new self image. These can include activities like skiing, hand-cycling, swimming or playing billiards. It is easy to forget that travel is also an important community activity.

Travel may be for leisure or business, therefore people should be taken to events during their rehabilitation that requiring an overnight stay in a hotel to learn to perform tasks outside the structure of their home.

Wheelchairs

Mobility devices, in particular wheelchairs and scooters, make up a significant portion of assistive devices in use today. Manual wheelchairs are mainly used by individuals that have the necessary upper body strength, function, and stamina for everyday propulsion. Co-morbid conditions such as, excessive body weight, overuse of the upper limbs, long time living with a disability and poor health and nutrition can impair the ability to independently propel a manual wheelchair and for these individuals it may be more functional to use an electric power wheelchair. For individuals who cannot use a power wheelchair because, for example, they are unsafe or are physically unable to, a manual wheelchair is prescribed and mobility is facilitated by an attendant or caregiver.

Manual Wheelchairs

Design is a critical factor in the mobility of manual wheelchair users, since individuals need the upper body strength to bear the load of the wheelchair in addition to the weight of their body. Standard manual wheelchairs, typically used in hospitals and nursing homes, tend to be bulky, heavy, and of a one size fit all nature. Due to the weight and comfort restraints, these wheelchairs are not intended for long term use, but rather temporary use of less than a few hours a day. For individuals requiring long term use, high strength, ultralight wheelchairs have been designed. These wheelchairs can be customized to fit the user allowing for better comfort and mobility. They are typically made of materials such as aluminum and titanium rather than the heavy steel used in standard wheelchairs.

The basic features of an ultralight wheelchair include seat height, width, and depth, backrest height, armrest height, seat and back angles, rear wheel camber and rear axle position. Manual wheelchair frames are made of aluminum, high-strength steel alloy tubing, titanium, and lightweight composite materials. The frame structure affects durability, transportability and storage. For example, rigid frame chairs are one piece with removable wheels and foldable back supports for transport and storage, while cross-brace frames allow for the wheelchair to collapse in the middle for storage. Some frames have suspension elements to decrease shock and vibration and make for a smoother overall ride.

Electric Powered Wheelchairs

Electric powered wheelchairs (EPW) are indicated for a wide range of individuals with disabilities. For some individuals with severe sensory-motor impairments, EPW are the only functional mode of mobility. Examples of this are individuals who have high-level tetraplegia, advanced multiple sclerosis, or severe cerebral palsy. Sensory-motor impairments due to these diseases can limit functional motor control to individual parts of the user's body. In these cases, EPW input devices into the controller must be customized to take advantage of the intact motor function of the individual. Micro switching mechanisms that can be actuated with the mouth (sip-and-puff) or other parts of the body (feet, head, etc.) must be used as controller input. For all users, the goal of the EPW is to provide greater independence and quality of life for the individual user The technological advances of controller programmability, special seating systems, integrated control units (with augmentative communication devices, environmental control units, etc.) have allowed a wider population of people with disabilities to become independent.

Power-Assisted Wheelchairs

Power assist devices include stand-alone powered units that are external to the wheelchair and the wheelchair user holds onto it, power-add on devices that attach to the wheelchair and have a steering mechanism or input device for controlling the wheelchair, or a pushrim-activated system (PAS) with motors in the wheelchair hubs .PAS offer an alternative between manual wheelchair mobility and electric-powered wheelchair driving. A PAS operates much like a manual wheelchair but with less effort. This may make PAS suitable for people with or at risk for upper extremity joint degeneration, reduced exercise capacity, and low upper-extremity strength or endurance.

Seating systems

For people with disabilities who are unable to walk and require the use of wheeled mobility and seating devices, sitting is necessary and identifying the most effective seating system for a specific individual's needs can be challenging. Prior to the provision of a seating system, a physical-motor assessment including muscle strength, joint range of motion, coordination, balance, posture, tone, endurance, sitting posture, and assessment of cognition and perception are necessary to obtain a basic understanding of the capacity and needs of the person. These assessments should be performed by a qualified professional with specialty training and certification as well as knowledge of wheelchair seating and mobility applications. A proper assessment will begin with listening to their needs, concerns, and goals for a device. Realistic goal setting fosters discussion related to what the technology is and is not capable of.

Every person should be given a seating system designed and provided specific to the user's medical, functional, and personal preference needs. Medically a system should address issues of soft tissue management, comfort, reducing the potential for or accommodation of orthopedic deformities, and maintain vital organ capacity. Functionally, the system should address the movements and supports the user needs to perform such as the ability to reach or access objects, transfer, get under tables, and do activities of daily living. This requires careful matching of critical chair dimensions to body dimensions, user ability, and intended use. The user's goals and priorities need to be primary considerations. For example a user may forgo pressure relief and comfort for a firmer system that provides greater stability and allows them to slide off the seat for transfers.

Seating systems are comprised of several components including at least a seat and back support. Other components also often include supports for the arms, legs, and head. Adjustable features may include reclining backrest, tilt-in-space, seat elevators, and standing.

Augmentative and Alternative Communication

Augmentative and alternative communication (AAC) is a field of endeavor with a goal to optimize the communication of individuals with significant communication disorders (ASHA, 2004). The basic elements of a comprehensive AAC assessment and the role of rehabilitation engineers in making decisions about AAC technology are critical to achieving successful outcomes. The significance of language issues and AAC language representation methods must be understand prior to evaluating solutions, emphasizing the need for AAC technology to support the spontaneous generation of language in order to optimize communication function and participation. Only by understanding the language issues can rehabilitation engineering professionals appreciate the technology, device features, and human factors issues associated with AAC interventions.

AAC refers to any communication approach that supplements or replaces natural speech and/or writing. Effective communication is desired to be able to participate at work and school or for leisure and entertainment. Although a range of AAC interventions are possible to engineer solutions for improved function and participation, the demands of communication should be analyzed in terms of the language requirements for the best outcomes to be achieved.

Computer access

Client side assistive technologies aid users with disabilities to access the computer. It is impossible to imagine a modern computer without a mouse. The operating systems and applications of today co-evolved with the mouse, and some software literally can't be used without a mouse. The mouse is used for pointing, clicking, double-clicking, and clicking and dragging. The operations that are most troublesome for individuals with physical disabilities are often those that involve button presses. Fortunately, the mouse is but one example of a much larger class of pointing devices, all of which can perform the operations listed above. Each pointing device requires a different set of skills, which the clinician can match to a client's abilities.

Pointing devices come in a variety of shapes and sizes. The most familiar pointing devices are the mouse and the track pad (most often seen on laptop computers). Other frequently seen pointing devices include the trackball and the track point. Pointing devices that are more commonly associated with individuals with disabilities include touch screens, head-mounted mouse emulators, and mouse keys

Driving Controls

Adaptive driving controls for the individual's vehicle is prescribed after completion of a comprehensive driving evaluation, education and training program provided by Certified Driving Rehabilitation Specialist (CDRS) .The programs include a pre-driver's evaluation to assess the basic skills necessary for driving, such as vision, perception, cognition, physical functioning and knowledge of driving, and an on-road assessment, to evaluate actual driving skills. Only after the completion of the program the CDRS together with the individual will be able to determine if the person is able to developed competency to drive with the recommended equipment.

Examples of adaptive driving controls may include adapted steering devices, accelerators, and a variety of secondary vehicle controls. A steering device, such as a spinner knob attached to the steering wheel allows steering with one hand. A left-sided accelerator can be used if access with right foot to operate the gas or brake pedal is not possible. A turn signal crossover that relocates the turn signal indicator from the left side of the steering wheel to the right side can be used to allow a person without the use of their left hand to access the turn signal using only their right hand. Other secondary vehicle controls such as windshield wipers, lights and horn can be relocated to provide timely and accurate access with the functional and/or dominant hand.

Positioning straps, like a chest harness, used in combination with the seat belt, will provide additional trunk control, if sitting balance is compromised and interferes with functional operation of the vehicle. A strap or other modifications for seatbelt retrieval is helpful if grasp or reach is limited. A parking brake extension allows access to floor-mounted parking or emergency brake pedal. Strategically placed mirrors may assist in compensation of partial loss of visual fields or the presence of scotomas. As with all adaptive equipment, specialized education and training is required to assure correct placement and proper use of the additional mirrors.

Vehicle Access Technology

A variety of adaptive equipment and vehicle modifications can be used for vehicle ingress and egress. Automatic car door openers, also known as keyless entry, built-up key holders or key turners are recommended if hand function is impaired. To ease the transfer for driver or passenger from their wheelchair into the vehicle seat, a power base seat has the option to swivel out, glide out of the vehicle and then lower to a desired level for ease in transfers. Portable wheelchair ramps are available to load and unload unoccupied mobility equipment, such as manual or power wheelchairs or scooters, into the vehicle without significant vehicle modifications. Car toppers are another type of lift that attach to the top of a sedan type vehicle and can lift and store a manual wheelchair on top of the vehicle. Wheelchair or scooter users may require a vehicle ramp or lift to either get into their vehicle or to lift their mobility device into the vehicle. It is critical that prior to the recommendation and installation of any adaptive equipment in the vehicle, compatibility between the individual, the mechanical device and the vehicle is appropriately assessed and verified.

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26. Lower urinary tract dysfunction: from pathophysiology to treatment

JJ Wyndaele MD, DSci, PhD
Professor of Urology and Chairman,
Department of Urology, University Antwerpen Belgium.
Fellow ESU, Fellow ISCoS

Neurophysiology

The innervation of the lower urinary tract combines activity of autonomic and somatic nerves. Its central control makes a "voluntary" working of a mostly "autonomic" system possible, adapted to daily living..

Overview of actual knowledge of the normal neurology of the lower urinary tract LUT

The innervation of the lower urinary tract is manyfold.
Sympathetic, parasympathetic and somatic nerves are involved.
Neuropharmacological studies and studies on receptors and transmittors have given an imcomplete but easy to use scheme for daily practice.
The innervation of the LUT counts sensory and motor nerves.
The sensory system is related mainly to free nerve endings in the bladder wall and to receptors which are linked to at least two types of nerve fibres: Adelta and several types of C, some of which are becoming active only when there is neuropathy.
Elbadawi and others have shown that a special distribution exists of neuroreceptors in the LUT.

receptor	location	neurotransmittor	function	function
alpha	Bladder neck	noradrenaline	Closing bladder neck	continence
beta	Bladder wall	noradrenaline	Relaxing bladder	Bladder filling low pressure
muscarinic	Bladder wall	acetylcholine	Contraction bladder	voiding

The higher neurologic system has several pathways in the spinal cord , the brainstem and the brain. There is increasing interest in the nonadrenergic-non cholinergic system and its transmitters as Substance P, CGRP, VIP, about the function of NO and about other receptor types as X2P or vanilloid receptors.

A dysfunction can occur on different levels and with different consequences.

Causes can be:
Anatomical as from outflow obstruction or decrease of urethral resistance
Neurological in many diseases as diabetes, spinal cord lesion, cerebral pathology
Behavioural when the voluntary control is ill used such as in non relaxing sphincter
Iatrogenic due to drugs
The key to proper treatment is a proper diagnosis

Diagnosis of lower urinary tract dysfunction

The clinical history is an essential part in patients with LUT disease. In most patients this history is obvious : an accident has happened and lesions have been noted. Some medication is used. There is a history of multiple or complicated childbirth. Symptoms can however be unreliable as the patient has to translate his observations into a message to the doctor. Direct quality questioning may help.

It is without saying that a complete history taking is needed.

The clinical examination has a general (weight, general impression, behaviour, skin lesions and scars) and a specific part (sexual organs, lower abdomen, prostate). The clinical neurologic examination has also an important role for the early approach of the urinary system.

The specific clinical neurological examination related to the pelvic region is valuable if neuro-anatomical pathology in this region is suspected
Urine analysis is mandatory. Some blood tests may be needed.

Urodynamic testing is useful in capable hands. It is strongly advocated in neurologic patients and before more invasive treatment is applied. The evaluation of upper tract should be part of the management. Activity of the bladder neck has to be evaluated. Sensation can be present or absent and this information can be important for the treatment (Spinal Cord 2004; 42: 110-6). Clinical observation during hospitalization is important: incontinence, smelly urine, evacuation of calculi, fever et al need to be reported. Bedside icewatertest has been moved towards urodynamic ice water test in patients with very long bladder areflexia.

The period of spinal shock has to dealt with with great attention: a proper bladder drainage has to installed and this will most probably be indwelling to cover the period of cardiovascular instability, changes in diuresis and bladder areflexia. Intermittent catheterization is best started as soon as possible. If longer indwelling catheter is needed a suprapubic tube would lower the risk of urthral problems especially in men. Two main goals during this period: AVOID OVERDISTENTION AND AVOID INFECTION OF THE URINARY TRACT.

Postshock treatment

Goals are to safeguard the kidneys and keep the patient alive plus to restore bladder function to permit a good quality life

- To empty the bladder regularly and completely
- To keep the intravesical pressure low during filling and micturition
- To avoid infection of the lower urinary tract
- To avoid other complications as lithiasis, reflux, kidney problems
- To keep the patient continent
- To achieve a state of "balanced" bladder which permits a good quality of life

To keep the pressure in the bladder low at all time has been shown to be one of the most important things to do.

The therapy can consist of several things

1 Reeducation
2 Physiotherapy
3 Drugs
4 Catheterization
5 External appliances
6 Surgery

Depending on the combined disorders of detrusor and sphincter the following very general guidelines can be put forward. One must however bear in mind that treatment of a SCL patient with a neurologic bladder dysfunction is and has to be very individual thus adapted to the patient's possibilities and needs.

Recent evaluation have shown that triggering and Valsalva voiding are often dangerous and that intermittent self catheterization should be preferred. Indwelling catheters to be used if no other way possible.

Electrical stimulation in bladder and on involved nerves is under further development.

Medication is mostly bladder relaxing. Newer approaches are intravesical injection of Botuline which needs some more experience in spinal cord injuried patients.

Surgery aims at restoring low pressure bladder: bladder augmentation or detrusor myomectomy. Sacral neuromodulation anterior rooth stimulation(Brindley) have indications.

For low pressure in the urethra sling or artificial sphincter can be used.

Conclusion

Treatment of patients with SCL and neurologic bladder has seen evolution through better knowledge and better understanding. Treatment must always be individual and aims at getting patient dry , with complete emptying of a low pressure bladder in a way that permits to avoid complications and allows a good prognosis.

Postscriptum:

The most recent literature shows the first results of restoring LUT function by nerve transplantation. This needs much more study but has in theory a possible real role in future treatment and recovery.

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o 1819.

27. GARBAGE IN, GARBAGE OUT - REFLECTIONS ON A NOVEL ASSESSMENT AND PLANNING MODEL FOR SCI REHABILITATION IN SOUTH AFRICA

Authors: Dr. Rob Campbell (Medical Director Aurora Hospital).

Spinal cord injury is a devastating and costly injury. The physical rehabilitation of individuals with spinal cord injury is a time-consuming, complex and expensive process, which if conducted appropriately and efficiently results in a substantial reduction in morbidity and mortality in this group of patients and sets the stage for a return to significant quality of life. The extent to which morbidity and mortality are reduced and individuals with SCI are able to return to their lives is dependent as much on contextual factors as on the individuals themselves.

The team at Aurora Hospital in Port Elizabeth developed and implemented a management system in an attempt to ensure that the process of rehabilitation and care is managed smoothly, effectively and efficiently for each individual patient, within his or her unique context.

The system was developed to accommodate a patient centred clinical method, the Outcome-Based Rehabilitation model (ILO, WHO, UNESCO), the framework of the International Classification of Function, Disability and Handicap (WHO) and enhance interdisciplinary team function.

A computer system was designed to integrate with these models by means of prompted inputs and structured processes to ensure that complete data is entered into the database and that this data is constantly available to all team members. The system assures appropriate reporting of these processes for internal discussion and review within the rehabilitation unit and also for ensuring that funder reporting requirements are complied with.

This paper briefly outlines the pillars on which the system was constructed, provides a snap shot of the system itself and then reflects on our experience of the system.

This experience has raised several questions, which in our minds demand careful consideration from groups involved in rehabilitation care and research:

- Have we neglected the whole person and the importance developing better ways of working with relationships in favour of pursuing excellence through better technology and better management structures through interdisciplinary teams?
- Have we found the right balance between the use of empirical research and development of a theory of rehabilitation and care?
- How can we balance the search for universal benchmarks and standards against the need to meet each individual's needs is it more important to classify and count or to understand?

27. Advances in Fertility Management in Spinal Cord Injury

Mr. Sanjeev Sharma,
Specialist in Reproductive Gynaecology and Infertility,
Head, Post Graduate School of Obstetrics and Gynaecology,
Liverpool, UK

There are approximately one thousand new cases of spinal cord pathology in the UK every year, of which two thirds are due to injury to the spinal cord. After an initial period of settlement a large proportion of these cases need management of their reproductive and sexual functions. Since the average age at the time of injury is 33years and 82 percent of these patients are men, discussion in this paper will be centred around men with spinal cord injury. Even though only a third of patients with spinal cord injury will eventually marry, men who are already married or in a relationship, at the time of the injury, 80 percent will still be with their partners 5 years later.

Reproductive consequences of spinal cord injury include failure of erection and ejaculation and poor sperm quality. Fertility treatment and its success has evolved and improved considerably over the last 15 years. Treatment started with crude insemination techniques and moved to simple assisted conception treatments with time. In the last 5years, outcome in spinal cord injury patients has become comparable to that in able bodied men. This improvement has largely been achieved because of improved sperm collection techniques. Assisted ejaculatory techniques (electro ejaculation and vibro ejaculation) had always been successful in achieving semen specimen, however the sperm quality was invariably compromised. Retrograde ejaculation and white cells in the semen were two main reasons for the poor quality of sperm and low pregnancy rates.

Introduction of surgical sperm retrieval techniques (testicular sperm aspiration and extraction) and use of intra cytoplasmic sperm injection (ICSI), have significantly improved outcome. Sperm obtained directly from the testes are comparable to the specimens obtained from able bodied men in their fertilizing capacity. Subsequent use of ICSI has improved fertilization rate and embryo quality. Freezing rates of both the sperm and embryos, are also significantly better.

All this is reflected in the pregnancy rate spinal cord injury patients which is now similar to that in able bodied men.

28. Role of intraoperative Iso-C based navigation in challenging spine trauma

Dr. S. Rajasekaran,
Department of Spine Surgery,
Ganga Hospital, Coimbatore, India

Abstract

Background: Pedicle screw fixation is the most preferred method of stabilizing unstable spinal fractures. Pedicle screw placement may be difficult in presence of fractured posterior elements, deformed spine, gross instability and spinal pathology. Challenging spine-fracture fixation is defined as the presence of one or more of the following: 1) obscured topographical landmarks as in ankylosing spondylitis, 2) fractures in occipitocervical or cervicothoracic regions and 3) preexisting altered spinal alignment. We report a series of pedicle screw insertion with guidance of navigation in difficult fixation problems.

Materials and Methods: Fourteen patients [hangman's fracture (n=3), odontoid fracture (n=4), C1C2 fracture (n=1) and spinal fracture with coexistent ankylosing spondylitis (n=6)] underwent posterior stabilization. Intraoperatively after surgical exposure, images were acquired by Iso-C 3D C-arm and transferred to navigation system. Instrumentation was performed with navigational assistance. Postoperatively, placements of pedicle screws were evaluated with radiographs and CT scan.

Results: Sixty-seven pedicle screws (cervical, n=33; thoracic, n=6; lumbar, n=26; sacral n=2) and 15 lateral mass screws were inserted with navigation guidance. The average time of image data acquisition by Iso-C 3D C-arm and its transfer to workstation was 4 minutes (range, 2-6 minutes). Postoperative CT scan revealed ideal placement of screws in 63 pedicles (94%), grade 1 cortical breaches (<2 mm) in 3 pedicles (4.5%) and grade 2 cortical breach (2-4 mm) in one pedicle (1.5%). There were no neurovascular complications. Deep infection was encountered in one case, which settled with debridement.

Conclusions: Intraoperative Iso-C 3D C-arm based navigation is a useful adjunct while stabilizing challenging spinal trauma, rendering feasibility, accuracy and safety of pedicle screw placement even in difficult situations.

Keywords: Computer-assisted surgery, neuronavigation , pedicle screw, spine fracture, challenging spinal trauma.

Although majority of spine fractures can be treated conservatively, surgical stabilization is warranted in grossly unstable fractures and in presence of concomitant neurological deficits. [1,2] Pedicle screw has emerged as the most preferred modality of posterior spinal stabilization because of its superior biomechanical characteristics, feasibility in presence of disrupted posterior elements and possibility of concomitant decompression. [3] Safety concerns do persist, as any misplacement can injure the adjacent visceral and neurovascular structures. Despite progressive improvement in technique of pedicle screw placement, locating pedicle screw entry points and trajectory, especially in case of fractured posterior elements and post-traumatic deformity, can be difficult. [4] The inaccuracies in pedicle screw insertion can place the adjacent neurovascular structures at risk because of variable spinal morphology in different individuals, [5] difficult regions (occipitocervical [4,15] and cervicothoracic [11,17]), preexisting deformity and spinal pathology like ankylosing spondylitis obscuring the anatomical landmarks. [6,13]

Computer-assisted surgery, after its introduction as frameless stereotaxy in neurosurgery in late 1980s, has found various applications in spine surgeries.[10] Its superiority over conventional techniques in various spine disorders has been demonstrated,[11][12] but still its application in spine fractures is restricted to few case reports.[13][14][15] Widely prevalent preoperative CT-based navigation is limited by registration errors due to positional intersegmental changes during surgery, as CT is acquired in supine position while surgery is performed in prone position.[10] This factor can be furthermore limiting in unstable spine fractures because of additional instability at fracture site.[12] Intraoperative Iso-C 3D C-arm based navigation overcomes the problem of positional error as the images are acquired intraoperatively after completion of surgical exposure.[11][16]

The purpose of the present study is to evaluate the role of intraoperative Iso-C 3D C-arm based navigation in challenging spine trauma where otherwise pedicle screw placement would have been considered dangerous or impossible.

Materials and Methods

Challenging spine fracture fixation was defined as presence of one or more of the following: 1) obscured topographical landmarks as in ankylosing spondylitis, 2) fractures in occipitocervical or cervicothoracic regions and 3) preexisting altered spinal alignment. From February 2005 through January 2007, fourteen patients [Table - 1] with challenging spine fracture were operated using intraoperative Iso-C 3D C-arm based navigation. Ethics committee approval and informed consent from all the patients were obtained.

The study group [Table - 1] consisted of hangman's fracture (n=3), odontoid fracture nonunion (n= 4), C1C2 fracture (n=1). Six patients of ankylosing spondylitis had subluxation of C_{2-3} and C_{6-7} in one case each, chance fracture of C_3 in one patient and fracture distraction lumbar spine L_{3-4} in two cases and L_{4-5} in one case. The mean age of patients was 48 years (range, 17-70 years), and 12 of them were male.

Preoperative workup included thorough clinical assessment, radiographs, multislice CT scans and magnetic resonance imaging. Five patients had neurological deficits (odontoid fracture nonunion - 2; coexistent ankylosing spondylitis - 3), and remaining nine were neurologically intact [Table - 1].

Preoperative planning was done based on radiological characteristics of fractures [Table - 1]. C1-C2 fixation was scheduled for a case of C1-C2 fracture (case 1) and three cases of odontoid nonunion (cases 2, 3, 7) [Figure - 1]; and in one odontoid nonunion with concomitant Atlas [More Details] fracture, occipitocervical fixation was planned (case 4). Osteosynthesis was provisionally planned for two of hangman's fractures (cases 5, 14); while in the third one, communition of fracture warranted segmental fixation (case 13). Long-segment fixation was scheduled for fracture fixation in all patients of ankylosing spondylitis (cases 6, 8, 9, 10, 11, 12, [Figure - 2]).

Surgical technique

All the patients were operated in prone position on a carbon fiber radiolucent operating tabletop under general anesthesia. Patients were positioned in such a manner that relevant anatomy was in isocenter (i.e., at midpoint of arc of rotation) of Iso-C C-arm (Siremobil Iso-C ^{3D} ; Siemens Medical Solutions, Erlangen, Germany) in both anteroposterior and lateral views. The region to be instrumented was exposed by conventional midline posterior approach. MIRA (minimally invasive reference array) was firmly affixed to the spinous process of vertebrae next to the caudal-most vertebra to be instrumented. The computer workstation

(Vector vision compact, BrainLAB-AG, Germany) with its electro-optic camera was stationed at the foot end of operating table to allow simultaneous tracking of both MIRA and calibration target attached to Iso-C. Images were acquired by Iso-C 3D C-arm with automated orbital rotation of 190°. The images were reconstructed in processor unit of Iso-C and transferred automatically to computer workstation, which obviated the need for separate manual registration. Good quality sagittal, axial and coronal reformatted images were produced on a virtual basis whenever the marker tool was brought into the field of data acquisition. Registration of spinal anatomy was verified by placing navigator tool over exposed topographical landmarks, and its correspondence with images displayed in monitor was ensured. The C-arm was then moved away from the operating field with no need for any further fluoroscopic exposures during the entire procedure.

Instruments like burr, pedicle awl and drill were calibrated to navigation system by Instrument Calibration Matrix -4, so that their position relative to patient's anatomy could be tracked during surgical procedure. Pedicle screw entry points were localized by navigator tool and developed with precalibrated 2.5 mm high-speed burr under navigational assistance. Pedicle tracts were made with navigation, ensuring proper trajectory, using precalibrated drill in cervical spine and awl in thoracolumbar spine. Additionally, integrity of pedicle tract was verified manually by tactile feedback with ball probe intermittently before incremental advancement. The length and diameter of pedicle screws were ascertained with navigational assistance. Decompressive laminectomy if needed was done after instrumentation.

Intraoperative blood loss and duration of surgery were documented. Postoperatively, periodic clinical and neurological assessment of patients was done. All the patients were mobilized with region-specific brace after the removal of drain. Postoperative CT scans were performed briefly after the surgery or in followup to assess the placement of pedicle screws. The pedicle screw placement was graded on CT as follows: Grade 0, no pedicle perforation; Grade 1, only the threads outside the pedicle (less than 2 mm); Grade 2, core screw diameter outside the pedicle (2-4 mm); Grade 3, core screw diameter outside the pedicle (more than 4 mm); and Grade 4, screw entirely outside the pedicle.[11]

Results

Intraoperatively, clear visualization of pedicles was obtained with navigation in all the cases. Sixty-seven pedicle screws (cervical, n=33; thoracic, n=6; lumbar, n=26; sacral, n=2) and 15 lateral mass screws were inserted with navigational guidance. Fifteen of the 48 cervical pedicles planned for instrumentation were considered not suitable for screw placement and were aborted owing to extremely small dimensions (n=9), fractured pedicle (n=2) or absent medullary canal (n=4). Here, fixation was achieved by placing lateral mass screws. Eleven of these aborted pedicle screws were in patients with ankylosing spondylitis. The average number of instrumented segments was 2.5 (range, 0-5). In two cases of hangman's fracture, it was possible to do osteosynthesis of fractured C2 pedicles, obviating the need for segmental fixation.

Instrumentation was done in occipitocervical spine in two patients, cervical in eight, cervicothoracic in one, lumbar in two and lumbosacral in one patient. Posterior decompressive laminectomy was done in five patients (cervical, n=4; lumbar, n=1) with post-injury neurological deficits [Table - 1]. None had concomitant anterior fixation. The average time of image data acquisition by Iso-C 3D C-arm and its transfer to workstation was 4 minutes (range, 2-6 minutes). The mean duration of surgery was 130 minutes (range, 100-240 minutes), and average blood loss was 550 ml (range, 200-1100 ml).

Postoperative CT scan revealed good placement of screws in all except grade 1 cortical breaches (<2 mm) in

three pedicles (4.5%) and grade 2 breach in one (1.5%). Of these pedicle breaches, three occurred in cervical spine (two grade 1 - right C1, left C5; one grade 2 - right C3) and one grade 1 breach in lumbar spine (right L2, ankylosing spondylitis). There were no neurovascular or procedure-related complications. No pedicle screws required revision for malpositioning. Deep infection was encountered in one case of ankylosing spondylitis in early postoperative period, which settled with debridement and intravenous antibiotics. Neurological recovery of at least one grade was noted in all the cases with preoperative neurological deficits.

Discussion

Pedicle screw placement is a technically demanding procedure because of complex three-dimensional morphology of vertebrae and closely located critical neurovascular structures. [5][17] Various technical modifications have been suggested to improve the accuracy of pedicle screw placement. [3][10][19] The identification of the correct anatomic landmarks, tactile feedback by probe and the use of intraoperative radiography or fluoroscopy are common methods for safe and accurate insertion of the pedicle screw. [4] Although thoracic and lumbar spine pedicle screw freehand placement with fluoroscopic guidance has attained acceptable accuracy, its use in cervical pedicles is still considered challenging for even experienced surgeons. [4][5][10][15] In the presence of ankylosing spondylitis, the topographical landmarks for pedicle entry are difficult to identify in widely ossified spine [8][9] ; moreover, spine is usually kyphotic, thus leading to inaccuracy of pedicle screw placement even in thoracolumbar spine.

Computer-assisted surgery, since its inception as frameless stereotaxy in neurosurgery, has demonstrated improved precision in various spinal applications. Improved accuracy has been reported in pedicular screw placements with navigational assistance in stabilizing spine in various spinal disorders. [11][12] Navigation provides real-time, precise, multiplanar virtual visualization of pedicle and thus gives the surgeon intraoperative guidance while placing pedicle screws. In a recent meta-analysis [20] of 130 published studies, the median placement accuracy for the *in vivo* assisted navigation subgroup (95.2%) was higher than that of the subgroup without the use of navigation (90.3%).

Preoperative CT-based navigation is the most commonly employed system. With time, limitations of preoperatively acquired image based navigation have been realized like cumbersome surgeon-driven point-to-point registration, prerequisite of CT scan according to specific protocol and simulation error due to difference in position of scan acquisition and surgery. [10] With availability of intraoperative Iso-C 3D C-arm based navigation, these limitations have been largely overcome. [11][16] Some investigators have used intraoperative fluoroscope-based navigation, [21] but absence of three-dimensional images limits its usefulness, particularly in complex cervical pedicles or in cervicothoracic junction.

The published literature regarding the use of navigation in spinal fractures is restricted to few case reports. [13][14][15] Our study provides valuable information on role of Iso-C 3D C-arm based navigation in unstable spinal fractures, especially in challenging situations. Intraoperative acquisition of images after positioning and reduction of fracture solves the problem of simulation error due to change of patient position during surgery and changes due to instability at fracture site, to some extent. Still it is recommended to observe caution, not to move the spine extraordinarily while instrumentation. Use of drills can minimize the pressure needed to develop the pedicle tract, decreasing the associated movement. The rate of misplaced cervical pedicle screws in the present study, three out of 67 (4.5%), must be considered quite low, especially considering the spine fractures in patients included were relatively challenging. Despite four pedicular violations, none of these cases has clinical manifestations. This correlates with findings of other authors that majority of pedicular violations are assymtomatic. [4] Optimal placement of pedicle screw is important for improved biomechanical purchase, besides safety concerns.

Cervicothoracic junctional region fractures pose unique problems of poor radiographic visualization and approach-related difficulty because of the anteriorly located vital structures.[6,7] Posterior pedicle screw offers an easier and biomechanically apt modality to stabilize fractures in this region. Standard fluoroscopic guidance suffers in this region due to overlap of shoulders, and thence navigation becomes furthermore important. We instrumented successfully one case of fracture in cervicothoracic region in spite of coexistent ankylosing spondylitis.

Judet direct pedicular osteosynthesis is considered optimal treatment in Hangman's fracture, being a "physiological operation."[22] This surgery is rarely performed because of the high risk of spinal cord damage or vertebral artery tear. Direct transpedicular osteosynthesis was safely performed in two Hangman's fractures in our series, thus avoiding the instrumentation and fusion of uninjured motion segments. Arand *et al.* reported safe transpedicular screw fixation of one Hangman's fracture with preoperative CT-based spinal navigation; but they cautioned against the possibility of simulation error, especially in highly unstable fracture due to change in intervertebral anatomy after patient positioning for surgery.[13] Taller *et al.* have described intraoperative CT-guided direct transpedicular screw fixation of 10 Hangman's fractures with excellent outcome.[23] But it has limited applicability owing to high costs, ergonomic issues, increased radiation exposure and need of special operation suite.

Cervical spine pedicle screw placement infrequently needs to be aborted due to extremely small dimensions and obliterated medullary canal.[4,15,20] Here, alternative modalities like lateral mass screws and wire cables may be employed. Careful selection of pedicle is important to improve accuracy of screw placement. In 15 cervical pedicles in our series, screw placement was aborted and lateral mass screw fixation was used at respective levels. In our series only one complication was noted in the form of deep infection in case of ankylosing spondylitis, but it settled with timely debridement and parenteral antibiotics. Surgery in fractures in cases with ankylosing spondylitis are known to be plagued with complications like higher blood loss, formation of epidural hematoma, surgical wound infection and pulmonary complications.[9]

In Iso-C navigation assisted surgeries, radiation to surgical team is significantly reduced as they can stay at a distance during 3D image acquisition; moreover, during actual procedure C-arm is moved out of surgical field.[11] Although resolution in Iso-C based navigation is slightly inferior to CT-based navigation, yet it is sufficient for most of the clinical applications. Iso-C navigation does have limitations - in cases of morbid obesity, where centralization of relevant anatomy can become difficult; and in cases of severe osteopenia, where resolution is not adequate.[11,22]

Conclusions

Intraoperative Iso-C 3D C-arm based navigation is a useful adjunct while stabilizing challenging spinal trauma, rendering feasibility, accuracy and safety of pedicle screw placement even in difficult situations. However, the risk of injuring the adjacent neurovascular structures cannot be completely eliminated. Iso-C based navigation is unique in its ability to acquire multiplanar three-dimensional images of intraoperative anatomy, automated registration, simplified workflow and real-time feedback during instrumentation.

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29. Respiratory Management of the Acute Quadriplegic Patient

By A/Professor Douglas J. Brown

Accident Scene

History and examination give clues to underlying quadriplegia. The patient needs to be managed semi prone with the head supported to prevent inhalation of gastric contents. If the injury is in the upper cervical spinal cord, the patient may not be breathing and will require CPR. Patients with lower cervical injuries will have the diaphragm as well as the accessory muscles and will be able to breathe thenselves. They are likely to have paradoxical breathing as an expression of 'spinal shock'. A number of patients with injuries at the C5-6 level will have oedema ascending to C4 and above and they may also develop respiratory failure at or soon after the accident and require intubation at the accident scene or in the nearest emergency department.

Emergency Department

A history of the accident and of associated past medical conditions such as asthma and smoking needs to be taken as well as a neurological assessment of sensation and motor power. Examination should note paradoxical breathing, which is a sign of spinal shock, the presence or absence of bowel sounds, general physical findings, especially with regard to trauma and the neurologic findings. If blood gases are poor and vital capacity is low (<1000ml), intubation and ventilation should be considered. Patients who were apnoeic at the scene should continue with intubation and ventilation. Patients who are incomplete or whose respiratory function is satisfactory may be managed with non-invasive techniques physiotherapy, BiPAP, CPAP, insufflation-exsufflation, plus or minus antibiotics. Patients with associated injuries may need intubation and ventilation for the treatment of those injuries, particularly injuries affecting the respiratory system - fractured ribs, particularly for flail chest, lung contusion, haemothorax, pneumothorax.

Loss of abdominal muscle power abolishes or weakens coughing and predisposes the patient to pneumonia. In the spinal shock phase, paralytic ileus leads to an accumulation of gastric contents. A naso-gastric tube must be inserted as soon as possible to prevent regurgitation of gastric contents into the lungs and to prevent acute gastric dilatation caused by the build up of gas in the stomach. The latter can impede diaphragmatic excursion and hasten respiratory failure.

ICU

Vigilance is needed 24 hours a day to prevent respiratory complications. Patients are thus often best managed in ICU from admission. This is a pro-active approach which enables the early detection of developing respiratory complications. These can then be managed at a very early stage and this may prevent the development of respiratory failure.

Surgery stabilises the cervical spine and allows movement of the patient to maximise physiotherapy opportunities such as repositioning e.g. rolling side to side, sitting up. However, surgery, particularly from an anterior approach, adds to soft tissue trauma, may increase cord oedema and may increase the disruption of the swallowing mechanism.

If the intubated quadriplegic patient cannot be weaned in ten days, we proceed to a tracheostomy. This may speed weaning, improves sputum clearance, prevents vocal cord trauma, aids communication and allows the

patient to be transferred to the ward more quickly.

Extubation can take place at a leisurely pace in the wards. Published literature on this topic is sparse and of poor quality. We have therefore developed a hospital based approach using an expanded respiratory team Tracheostomy Review and Management Service. The guiding policies for this are available from the hospital via the website www.tracheostomyteam.org - click Resources or Education.

Scientific Presentation

1. A new laboratory test for diagnosis of Ankylosing Spondylitis with Estimation of Serum Sialic Acid & Glycosaminoglycans

Bidre Upendra[1], Arvind Jayaswal[1], Taposh K. Das[1], Abrar Ahmed[1]
Dept. of Orthopaedics, AIIMS, New Delhi

Introduction:

Laboratory markers of Ankylosing spondylitis, like HLA-B27, ESR and CRP lack specificity. The present study was undertaken to evaluate the serum concentrations of SA and GAG and their diagnostic value in patients with ankylosing spondylitis.

Methods:

Total of 110 patients were included in the study. STUDY GROUP included 70 patients with Ankylosing spondylitis: Patients were diagnosed as having ankylosing spondylitis with the modified new york criteria and were further grouped into Active and Quiscent stages using the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI). GROUP I - Ankylosing Spondylitis active stage (58pts) & GROUP II (12pts) Ankylosing Spondylitis quiescent stage. The CONTROL GROUP had 40pts which included : GROUP III - Tuberculosis of spine (6pts), Group IV - Low backache (LBA -26pts), Group V - Other Rheumatic disorders (8pts). The study of Sialic acids (WINZLER METHOD) and Glycosaminoglycans (WHITEMAN METHOD) levels in serum were estimated for all these patients.

Results:

Statistical analysis of serum concentrations of SA & GAG was done using multiple comparisons Bonferroni. Serum sialic acid concentration > 870.4mg/l, Serum Glycosaminoglycans concentration < 179.8mg/l and Serum SA :GAG ratios > 4.99 were found to fall within 95% confidence limits for diagnosing a case as Ankylosing spondylitis in ACTIVE STAGE. ($p<0.001$). Further, Serum SA :GAG ratios > 4.17 was found to fall within 95% confidence limits for diagnosing a case as ANKYLOSING SPONDYLITIS in ACTIVE or QUISCENT STAGE. ($P < 0.01$). SA:GAG value of > 4.17 had diagnostic significance for AS ($p<0.01$) with a Sensitivity of 97.14% and Specificity of 92.5%. Further, a SA:GAG ratio of > 4.99 signifies that the patient is having AS in active stage ($p<0.001$) with a Specificity of 98.07%.

Conclusion:

Serum SA:GAG ratio is a test with significant diagnostic value in ankylosing spondylitis and can also be used as a prognostic indicator in patients with AS.

2. Correlation Of Prehospital Care and Functional Outcome in Thoracolumbar Spinal Trauma Patients

Pankaj Kandwal, Upendra B.N, Mahesh.B.H, Lalit Sharma, Abrar Ahmed, Buddhadev Chowdhury, Arvind Jayaswal,
Department of Orthopaedics, AIIMS, New Delhi.

Introduction:

Unlike western literature, the epidemiological data of a given population in India is lacking. This study is aimed at evaluating the profile of patients that come to a busy tertiary care hospital in an urban set up. Importantly, besides evaluating the different epidemiological factors, the study aims to correlate the outcome of spinal cord injury with various epidemiological factors.

Methods:

Four hundred forty patients with unstable thoracolumbar spinal injuries admitted from January 1990 to May 2000 were studied. Epidemiological factors like age, sex, and mode of injury, mode of transport, time of reporting and number of transfers before admission were recorded. Frankel's grading was used to assess neurological status. Effect of the above factors on neurological recovery and first year incidence of complications were evaluated. Outcomes were measured in terms of neurological recovery, level of rehabilitation at two years and incidence of complications at two years were assessed.

Results:

Females comprised 34.1% of study group while 65.9% were males. 40.9% (180) of them were in third decade, 18.18% (80) were aged between 11-20 years, 11.36% (50) belonged to fourth decade and 15.9% (70) were between 41-50 years. Two hundred sixty (59.1 %) of patients reported within 24 hours, Forty patients (9.1%) between 24 hours to 96hours, 50 patients (11.4%) between 5-10 days while 90 (20.4%) patients came 10 days after the injury. Fall from height remained the most common cause with 230 (52.3%) of patients sustaining injury by fall. Road traffic accidents and violence related activities like fire arms accounted for 150(34.1 %) and 20 (4.5%) of injuries respectively. Two hundred ten (47.7%) patients were transported by ambulance while rest were brought by other means. Only 30(6.8%) of patients had less than 2 transfers before admission. Three hundred twenty (72.7%) patients were transferred 2-4 times and the mean transfer rate was 3.4 per person. 53.3% of patients who reported within 48 hours recovered either completely or functionally, while 37.5% showed any recovery in these who reported after 5 days. All 30 (100%) patients with single transfer showed complete neurological recovery while 190 (59.4%) patients who were transported between 2-4 times recovered either completely or functionally. Ambulance transfer showed 140 (66.7%) patients recovering functionally or completely while 39.2% of those transported by other means had functional recovery. 33.3% of patients transported by ambulance developed bed sores while 52.2% transported by other means developed bed sores.

Conclusion:

More than two thirds (72.7%) of patients are transferred 2-4 times after injury and less than half (47.7%) of transfers are done in an ambulance, reflecting the lack of adequate facilities and knowledge among health workers about safe and early transfer of spinal cord injury patients. It is imperative that India requires spinal cord injury care systems with facilities ranging from rescue and retrieval of spinal cord injury patients to referral hospitals with comprehensive spinal trauma care.

3. Outcome based study of Anterior Column Reconstruction and instrumentation in Burst Fractures of thoraco-lumbar region

Lalit Sharma, Prasoon Shamshery, , B.H.Mahesh, Upendra.B.N., , Dr.B.D.Chowdhury, Prof. Arvind Jayaswal
All India Institute of Medical Sciences, New Delhi.

Introduction :

Burst fractures typically occur in young population and account for 64%-81% of thoracolumbar fractures. Spinal fixation without anterior column fixation in 1990s resulted in hardware failure (up to 10-15%) and loss of correction. Load sharing classification recognized the need for anterior column reconstruction in these fractures.

Study :

Ours was a prospective study, carried out from Jan 1999 to June 2003. In this fractures were assessed by load sharing classification and patients with score >6 were treated by anterior column reconstruction with vertical titanium mesh cage & instrumentation. Twenty four patients (two column involvement in 17, three in 7) with an average age of 30-35 years were operated. These patient were followed up clinically, functionally (Donald J. Prolo's scale) & radiologically by CT&MRI. Fusion was assessed using criteria of Kevin et al.

Results:

The deformity correction on average was 70% and there was only loss of 4 correction on 2 year follow up. 92.4% achieved fusion and 46% improved neurologically to frankel's Grade D-E. On Prolo's scale, the ratings were fair. 54% achieved complete & modified rehabilitation. There was one implant failure in an osteoporotic individual which needed revision.

Conclusion :

Anterior column reconstruction in Burst fractures with significant communition as shown by load sharing classification, results in maintenance of correction, decrease in hardware failure, earlier rehabilitation & good fusion rates. Vertical titanium mesh cages as a method of anterior column reconstruction in these fractures provide stiff constrict, high fusion rates with minimal complications, and also is a good access for anterior decompression of the canal.

4. Outcome study of MISS vs Open surgery in low grade spondylolisthesis

Ram Kinkar, Bidre Upendra,
Abrar Ahmed, Buddhadev Chowdhury, Arvind Jayaswal
Dept. of Orthopaedics, AIIMS, New Delhi

Introduction:

Literature shows biochemical evidence of lesser muscle injury in minimally invasive surgery. To evaluate the clinical benefits of minimally invasive surgery, a comparative study between open and minimally invasive surgery was undertaken.

Methods:

A total of 28 patients with spondylolisthesis were included for the study. 15 patients underwent TLIF with minimally invasive spine surgery (MISS) techniques. 13 patients had grade-I listhesis and 2 had Grade-II listhesis. The rest 13 patients underwent open TLIF procedure for Grade-I listhesis in 9 patients and Grade-II Listhesis in 4. Average age in the MISS group was 39.2y (16-61y) and that in the open group was 41.1y (17-69y). Outcome measures included Hospital stay, blood loss, surgical time, VAS pain scores, Oswestry scores, Fusion status and clinical complications. The average follow-up was 15m (11-30m).

Results:

The average blood loss in the MISS group was 485ml(190-820ml) and that in open group was 1075ml (310-1450ml), average surgical time was 238min(186-332m) in the MISS group and 249min (206-286min) in the open group; the average hospital stay in the Miss group was 9.8 days (6-14) and 14.2 days (11-18) in open group. The average pre-op Oswestry scores in MISS and open groups were 41.9(33-46) and 47.1(39-52) respectively which decreased to 18.6 and 20.4 respectively at 12m post-op, the average pain VAS scores preoperatively in MISS and open groups were 3.4 and 3.35 respectively which on Day-1 post-op was 4.2 and 5.5 and on day-7 was 2.8 and 3.6 respectively. Only the Differences in the blood loss and the pain VAS scores between the two groups were found to be statistically significant ($p<0.05$). 91.2% had Grade I/II Fusion (CT scan) in MISS group and 92.8% showed Grade I/II fusion in the open group.

Conclusion:

The present study shows that MISS gives clinical results almost identical to the open procedure and significant reduction in postoperative pain which translates into decreased postoperative narcotic usage, earlier mobilization, shorter hospital stay, and a faster return to work.

5. Bladder Management Outcome after Spinal Cord Injury: A Prospective Study

Abhishek Srivastava1, Navnendra Mathur2

1. Dept. of Psychiatric & Neurological Rehabilitation, National Institute of Mental Health & Neurosciences (NIMHANS), Bangalore, India.

2. Dept. of Physical Medicine & Rehabilitation, SMS Medical College, Jaipur, India.

Abstract

Objectives: To assess the mode of bladder management, reasons for stopping intermittent catheterization and complications encountered in bladder management after spinal cord injury

Design: Prospective study

Setting: Spinal injury unit of a tertiary center

Methods: Persons with spinal cord injury underwent inpatient rehabilitation with at least one-year follow up duration (Total - 479), of which 124 (25.9%) were followed up; duration 12-48 months (23.3 m), of which 48 (38.7%) regained bladder control and excluded; remaining (n=76), tetraplegics - 29 and paraplegics 47 were assessed by single evaluator on a pre-designed questionnaire.

Results: At initial admission in spinal unit, seventy-one patients (total n=76) were discharged on clean intermittent catheterization. At follow up, 47 (66.1%) stopped intermittent catheterization; ability to pass urine was primary reason for stopping it in 33 (63.4%) patients. Reflex emptying was most favored mode of bladder management in 25 (32.9%) along with intermittent catheterization in 24 (31.5%) patients. Bladder autonomy and catheter free status was achieved by 54 (71%) and 39 (51.3%) patients respectively. Sixty-nine (90.7%) patients experienced urinary incontinence and 36 (34.2%) had urinary tract infection. Antibiotics and anti-cholinergics were commonly prescribed adjunctive medications in 26 (34.2%) and 16 (20.1%) patients respectively.

Conclusion: Most of the patients stopped doing intermittent catheterization and shifted to other modes of bladder management as per their convenience due to poor follow up.

6. Surgical Management of Pressure Ulcers in Spinal Cord Disease at Neurological Rehabilitation Set up

Abhishek Srivastava1, Anupam Gupta1, AB Taly2, T Murali1
1. Dept. of Psychiatric & Neurological Rehabilitation, 2. Neurology
National Institute of Mental Health & Neurosciences (NIMHANS),
Bangalore, India.

Abstract

Objective: To study efficacy of surgery and simultaneous comprehensive rehabilitation in the management of pressure ulcers.

Design: Prospective study.

Setting: Neurological rehabilitation unit.

Sample: Patients of spinal cord diseases with grade III/IV pressure ulcers, underwent surgical reconstruction and inpatient rehabilitation in year 2005 with a minimum one year follow up.

Outcome measures: Ulcer healing rate, postoperative complications, ulcers recurrence rate, neurological (ASIA Grade), and functional recovery (Barthel Index).

Statistical analysis: Frequency analysis and Paired t-test on SPSS 13.0

Results: Surgical intervention was carried out in 25 subjects (M-19, F-6), total 39 ulcers (stage III -16, IV 23). Surgeries performed: debridement - 3, split skin grafting -13 and flap mobilization and closure - 23. Four subjects (16.6%) had initial complications: wound dehiscence - 2 and delayed graft healing -2. Follow up rate was 92.0% (23/25), duration of 12-21 months (15.4+/- 7.45m) and four subjects (17.3%) had ulcer recurrence. Most subjects - 13 (56.5%) improved neurologically on ASIA Grade and functional evaluation on Barthel Index suggests statistically significant improvement ($p<0.005$).

Discussion: All outcome variables showed significant improvement at follow up with good ulcer healing rate (87.0%), low initial complication (16.6%) and recurrence rate (17.3%), and good neurological (56.5%) and functional ($p<0.005$) recovery.

Conclusion: Timely surgical interventions are necessary for grade III-IV pressure ulcers and simultaneous inpatient rehabilitation significantly improves outcome of patients with spinal cord disease.

7. PAEDIATRIC CERVICAL TRAUMA PATTERNS OF INJURY AND MANAGEMENT

Dr Arvind G Kulkarni, Bombay Hospital, Mumbai
Dr Andrew Cree, Royal Alexandria Hospital,
Westmead, Sydney, Australia

INTRODUCTION:

Paediatric cervical trauma is relatively rare and few reports exist regarding the injury profile , especially the use and efficacy of modern instrumentation in children. The aim of this study was to review the management of paediatric cervical trauma at a major teaching hospital.

METHODS:

The clinical charts and imaging studies of children with cervical spine injuries managed between January 2000 and July 2006 at a tertiary children's hospital were retrospectively analysed for patient demographics, mode of injury, neurological status and management. Complications and the use of implants was evaluated.

RESULTS:

33 cases had structural injury needing bracing or surgical intervention, the ages of the patients ranging from 1year 15 years (average 8.7 years). There were 21 males and 12 females. Motor vehicle accidents (15), sports injury (12) and domestic injury (6) were the causes of injury. . A total of 12 patients (36.4 %) were managed operatively, 5 patients (15 %) died as a result of trauma and the rest (16 cases, 48.5 %)) were treated conservatively. There were 14 (42.5 %) upper cervical injuries (C0-C3), 14 (42.5 %) lower cervical injuries (C4-T2), 4 cases (12 %) involving both upper and lower cervical levels and one case of anterior spinal cord infarct (3 %). A total of 9 patients were victims of polytrauma. Modern spinal titanium instrumentation utilising locking screws, cables was employed in patients needing operative stabilization. There were no complications and no cases of implant failure. Spinal cord monitoring was utilized wherever possible, but the safety of motor evoked potentials has not been validated in children less than four years of age, and they were frequently unreliable in the multi-trauma situation, especially in the presence of a concomitant head injury.

DISCUSSION:

Cervical trauma although rare, is the commonest region involved in paediatric spinal injuries. Motor vehicle accidents form the commonest cause of cervical injuries. Pre-operative CT scans and MRI are critical for accurate diagnosis and meticulous planning. Proximal cervical trauma, especially atlanto-occipital dissociation can be a challenging diagnosis, but modern instrumentation can be utilized successfully. Although the cases are limited, preliminary experience shows that rigid internal fixation with modern instrumentation is safe and effective in paediatric cervical trauma for all age-groups. Customisation of routine inventory as well as adaptation of miniature instrumentation systems utilized in other fields of orthopaedics (eg. phalangeal plates) is necessary for successful instrumentation in the paediatric cervical spine. Development of specialized paediatric cervical instrumentation is a prospective area of further research.

8. Total lumbar Disc Replacement

Arvind G Kulkarni, Ashish Diwan

Introduction:

Chronic low backpain can be disabling needing definitive surgical treatment. The aim of this paper is to present the results of TDR for chronic low back pain secondary to degenerative disc disease.

Material & Method:

Prospective study of patients undergoing TDR for chronic low back pain secondary to degenerative disc disease between 2002 and 2004. The frequency of back pain, quality of life and pain intensity (VAS) were used as measurement tools.

Results:

Seventeen males and 16 females with a mean age of 44 years (range, 29 to 65 years) underwent surgery. A total of 37 discs were replaced. Significant improvements in patients' symptoms of pain, quality of life and frequency of back pain were noted. One patient developed psoas hematoma as a complication which underwent natural resolution.

Conclusions:

TDR is an option in the treatment for patients with chronic discogenic low back pain.

9. Long Follow-up in Spinal Cord Injury

Dr. Navnendra Mathur, Dr. Navin Kumar

Spinal Cord Injury (SCI) is one of the difficult challenges for Physiatrists. The patients of SCI are poorly compliant & poorly motivated and pose several problems for the treating physiatrists. 1820 cases of acute SCI (960 Cervical & 860 Dorsolumbar) were admitted in Department of Physical Medicine & Rehabilitation, S.M.S. Medical College & Hospital, Jaipur from years 2000 to 2006. 217 (12%) cases came in follow-up of more than 12 months until 28th December 2007. 103 cases (11%) were in cervical & 114 cases (13%) were in Dorsolumbar group. The follow-up period ranges from 12 to 78 months with an average of 26 months. In cervical cases, the maximum follow-up period is 65 months (mean -26), while in dorsolumbar, it is 78 months (mean -27). These cases were evaluated for their neurological status initially and in their last follow-up and graded as per American Spinal Injury Association (ASIA) guidelines. In initial evaluation, 145 cases (67%) 50 (49%): cervical & 95 (83%): dorsolumbar were in ASIA grade A. In follow-up, out of total 217 cases, 62 cases moved 1 or 2 grades up; 35 cases moved 3 or 4 grades up and one case deteriorated 3 grades. Majority of the cases were community ambulators in cervical and functional ambulators in dorsolumbar group, performing clean intermittent catheterization (CIC) or reflex emptying for bladder management and managing bowel by manual evacuation, psychologically depressed and unemployed. Neuropathic pain and spasticity were common complications.

10. Effect of Pharmacological agents on Neuropathic pain following Spinal cord injury

Dr. Nitin Pandey, Dr. Navnendra Mathur

Neuropathic pain following spinal cord injury (SCI) is still an unsolved mystery for the doctors treating SCI patients and a very troublesome condition for the patients. This problem when studied at Deptt. of P.M & R, S.M.S medical college, Jaipur (Rajasthan), revealed that out of total 494 SCI cases studied, 68 developed neuropathic pain and incidence was found to be 13.76%. After selection of cases Patients were randomized in 5 groups according to the last digit of their registration number.

A placebo controlled concurrent drug trial was performed in a flexible dose schedule , pain was measured using visual analog scale. Drugs studied are Amitriptyline, Oxcarbamazepine, Gabapentin & Pregabalin. After analyzing statistically it was found that Amitriptyline reduced pain score significantly after 28 days & highly significant pain reduction was observed after 3 months. Where as Pregabalin showed highly significant pain reduction after 7 days, Oxcarbamazepine showed significant pain reduction after 28 days and Gabapentin showed significant pain reduction after 3 months. These study groups when studied against placebo the difference was found to be statistically insignificant.

So this can be concluded that these agents reduce pain score at some point of time, but this can merely be a chance variation, as statistically insignificant difference was seen on comparison with placebo.

Keywords Spinal cord injury, Neuropathic pain.

11. Rehabilitation outcome in patients with compressive spinal cord diseases

RAJESH.V.L

Abstract

Background: Spinal cord diseases are among the primary causes for admission in rehabilitation units. Not much data is available regarding outcome of patients with compressive etiologies, other than cord injury.
Objective: To study efficacy of inpatient rehabilitation in patients with compressive spinal cord etiologies.
Design: Prospective study.
Setting: Neurological rehabilitation unit of a tertiary center.
Sample: Patients of spinal cord diseases underwent inpatient rehabilitation during year 2003 - 2007.
Outcome measure: Functional recovery on Barthel Index.
Statistical analysis: Frequency analysis and Paired t-test on SPSS 13.0
Results: During the study period 109 patients were admitted for rehabilitative care - Men: Women: 76:33, mean age 32.20 ± 12.72 (range - 65), mean length of stay 49.03±40.62 (range 4-205). The primary diagnosis was: traumatic - 51, tumors - 24, Pott's spine - 18, prolapsed disc - 10, spinal arachnoiditis - 3, spina bifida - 2, spondylytic myelopathy - 1. 4-205 days. Functional outcome assessed on Barthel Index improved to statistically significant level ($p<0.001$) from mean admission score of 36.38±17.21 (range 5-95) to discharge 50.50±19.14 (range 0-100).
Discussion: Most of the subjects were young adult males, suffering from either spinal cord injury or tumors, reached maximal functional independence with in a period of two months of rehabilitative care.
Conclusion: Timely rehabilitation interventions significantly improves outcome for patients with spinal cord diseases

12. Dilutional Hyponatraemia (DH) during skull traction: Diagnosis and management.

Dr. Sayeed

Dilutional Hyponatraemia (DH) is not an uncommon condition for the patient during skull traction; unfortunately awareness regarding the condition appears limited in some medical areas. There have been cases of it being unrecognized, leading to misdiagnosis. In DH, patient has no major disturbance of body sodium content and is clinically euvolaemic. The development of this type of hyponatraemia stimuli are linked to abnormally high intake of fluid, increased Arginine Vesopressin (AVP) secretion, sustained severe pain and stress and nausea. After giving skull traction patients may develop (1) severe headache due to penetrating injury to skull, rotatory movement of body to avoid pressure sore and (2) neck-shoulder pain due to neck muscle spasm and continuous muscle pulling. In addition, patients may undergo stress due to severe pain and thoughts about their future. These stimulate the posterior pituitary causing increased AVP secretion resulting in impaired water excretion and development of concentrated urine. Intake of fluid is also required since high level of AVP alone is usually insufficient to produce hyponatraemia. Clinical features include anorexia, nausea, vomiting, confusion, lethargy and coma but no edema. Urine osmolality is typically higher than plasma osmolality. The treatment critically depends on the rate of development the electrolyte abnormality and its severity. Fluid should be restricted in the range 600-1000 ml/day. When Na conc. is <120mmol/l with rapid onset of neurological sings 3% NaCl should be started with caution. The rate of correction of the plasma Na conc. should not exceed 10mmol/day (0.4 mmol/l) as there is a chance of development of Myelinolysis and a slower rate would generally be safer. To reduce pain and stress, strong analgesics with muscle relaxant are to be considered. If necessary, withdrawal of traction should be considered, replaced by a cervical collar.

13. Md.Iqbal Hossain

Abstract

A previous study by Madhab Shriti Vocational Training Centre at CRP showed that 95% of participants who had received electronics training had returned to work in this field successfully. Our study hoped to expand on this information and aimed to find out the factors which influenced outcome's of electronics training for the people with paraplegia, once they had returned to their community. In depth information was collected via convenience and purposive sampling. Analysis of the data showed that various factors directly influenced return to work outcome. After return to their community, all participants reported facing similar difficulties associated with their: new environment, financial situation, physical environment accessibility, physical illness, lack of enough practical knowledge in electronics, and not enough family members were available to support their shop. Those patients who were independent with their earning had a future plan to expand their business, set up own repairing shop and wanted to use their skills to train others. The unsuccessful cases, who had not returned to work, had no future plan to work in electronics or any other job. All participants reported they had a good impression of the services they had received at the Vocational Training Centre. However they offered suggestions regarding ways in which the service could be developed or improved such as: arrange placement at different settings, include modern machineries to repair, extend course duration and provide regular follow-up once patients had returned to community. Following spinal cord injury, successful return to work in the community is effected by a number of factors. Accessible environment, community and local government support is essential to the process, and needs to be considered by any facility offering vocational retraining.

14. Prospective analysis of 129 patients operated for cervical spondylotic myelopathy (CSM)

Dr. Vishal Kundanani

Paucity of prospective data on surgical management of cervical spondylotic myelopathy (CSM), especially multilevel CSM, makes surgical decision making difficult.

OBJECTIVE

1. To identify radiological patterns of cord compression (POC)
2. To propose a surgical protocol based on POC and determine its efficacy

METHODS:

Average follow-up period was 2.8 years. Following patterns of compressions were identified:
POC I - one or two level anterior cord compression
POC II one or two levels of anterior and posterior compression
POC III three levels of anterior compression
POC III variant similar to POC III, associated with significant medical morbidity
POC IV three or more levels of anterior compression in a developmentally narrow canal or with multiple posterior compressions
POC IV variant similar to POC IV with one or two levels, being more significant than the others.
POC V three or more levels of compression in a kyphotic spine
Anterior decompression and reconstruction was chosen for POC I, II and III and posterior decompression for POC IV and III variant. For POC IV variant a targeted anterior decompression was considered after posterior decompression.

RESULTS

The difference in the mJOA score before and after surgery for patients in each POC group was statistically significant. Anterior surgery in multilevel cervical myelopathy had better result (mJOA = 15.9) versus posterior surgery (mJOA = 14.96), the difference being statistically significant. No major graft related complications occurred in multilevel groups.

CONCLUSION

The better surgical outcome of anterior surgery in multilevel CSM may make a significant difference in surgical outcome in younger and fitter patients like those of POC III whose expectations out of surgery are more. Judicious choice of anterior or posterior approach should be made after individualizing each case.

15. "CT- GUIDED" PERCUTANEOUS VERTEBROPLASTY :- A SUPERIOR TECHNIQUE

Enhanced precision at lower cost

Dr. Vishal Kundanani

BACKGROUND

CT guidance for vertebral biopsies has been a very successful technique, and this formed the background for using CT for performing vertebroplasty in this first Indian report on this technique. CT helped precisely localize needle track, optimize cement insertion and avoid complications of conventional vertebroplasty

OBJECTIVE

To determine the advantages of CT-guided percutaneous vertebroplasty as a reasonable upgrade to the conventional vertebroplasty technique in the management of vertebral insufficiency fractures.

METHODOLOGY

CT-guided percutaneous vertebroplasty was carried out under local anesthesia in 52 vertebrae of 43 patients with varied indications (mean age - 71 years). Precise localization of the needle tip into the lesion and optimum cement insertion at the desired site was achieved with axial CT slices. Pain, cement leakage and procedural complications were recorded. Patients were mobilized on the same day of the procedure.VAS scores were noted in immediate post op period and at three months postoperatively. The mean follow-up time was 12months (range 3-24 months).

RESULTS

Axial CT slices assisted precise needle placement at the desired site of pathology in every single case. CT guidance helped achieve optimum cement insertion. Intraprocedure complications like embolism, symptomatic cement leakage and neurological deficit were not seen in any case. Asymptomatic epidural cement leakage was seen in 6 vertebrae (11%), much less than that stated in literature for fluoroscopy guided vertebroplasty (26%-44%).

Pain relief on VAS scores was comparable to that achieved by conventional vertebroplasty in literature, while net cost to the patient and the institution was significantly lower.

CONCLUSION

CT-guided vertebroplasty is a secure, proficient and reasonable improvement in the technique of vertebroplasty to achieve desired goals with better accuracy and lower costs and complications than the conventional procedure.

16. Efficacy of anterior approaches in managing tubercular spine -72 cases long term follow up

Dr. Vishal Kundanani

Study Design

Prospective study

Background Data

Prognostication of outcome in tuberculous paraplegia continues to be an enigma. This is due to lack of consensus in selection of a surgical approach based on clinical and radiological criteria. Debate continues regarding superiority of anterior versus posterior approaches.

Objective

To identify patterns of cord compression in dorsal and lumbar Pott's spine
To select approach based on clinical and radiological criteria
To evaluate recovery in paraplegia

Methods

72 out of 79 surgically treated patients were evaluated prospectively for period of 2 years(2 to 6 years). Anatomical distribution of lesion was mid-thoracic(42), thoraco-lumbar(27), and lumbar(3). The dural compression was designated as anterior(52), posterior(5), circumferential(6), hemispherical(1), extensile(8) and skip(10). Anterior and posterior osseous lesions were graded (Grade 1 to 3) according to the severity of destruction. Clinical parameters considered were the age and co-morbidities (ASA grade). The surgical approach (anterior versus posterior) was based on type of dural compression and clinical parameters. The instrumentation (anterior, posterior, global) was decided by the anatomical location and the severity of destruction. Based on this approach following surgeries were performed: Anterior approach(60), posterior approach(6), global decompression (6). Reconstruction included anterior bone grafting(22), anterior bone graft with instrumentation(35), posterior instrumentation(6) and global instrumentation(9).

Results.

Average delay before surgery was 6.18 weeks. Average pre and post operative JOA were 9.36 and 16.36 ($P<0.05$). Average time required for complete recovery was 8.2 weeks. Duration and severity of myelopathy had no correlation with neurological outcome. Age correlated negatively($P<0.05$). Average pre and post operative kyphosis was 18.5° and 1.6° ($P=0.0015$). Commonest complication was uninstrumented graft failure(8). Other notable complications were recurrence(2), pulmonary(7), intercostalgia(27), wound dehiscence(4), implant failure(1) and death(1). No neurological deterioration was noted.

Conclusions.

Significant neurological recovery is expected after optimal decompression irrespective of the duration and severity of myelopathy and destruction.

17. Dr. Deepti Aggarwal

Integrated Medicine takes into account the modern approach plus the complementary therapies to treat the ailments. Homoeopathy works by stimulating both the health-maintaining and the repair mechanisms holistically taking into account the physical & mental make-up along with the personality traits of the patient. Modern Medicine fraternity has also started acknowledging the holistic approach towards the diseases.

Integrated Medicine lacks proper documented research to establish itself as an evidence based medicine. The controlled research study trials have proven its efficacy in the risk factors of the spinal diseases. The controlled clinical study with patients of Delayed wound healing (peripheral vascular disturbances) and post-operative Pain Management have given us promissory results with homoeopathic intervention. The ongoing research for the tertiary post-operative spinal patients with paraplegic spasticity & autonomic dysreflexia is also giving positive results towards the clinical efficacy of Integrated Medicine.

18. Biological Plating for Unstable Sacral Fracture (A Case Report)

Presenting author: Dr. Anil Kumar***
Co-authors: Dr. G. K. Aggarwal*, Dr. Arvind Aggarwal**,
Dr. V. K. Sahni**, Dr. Manoj Garg****,
Department of Orthopedics, Maharaja Agrasen Hospital, New Delhi (India)

Abstract:

Complex unstable fractures of the sacrum present specific surgical challenge and to make the patient move around pain-free is a good achievement.

A 39yr old lady reported into the casualty department, following suicidal jump from 30 ft height. She was in shock and had to be given multiple blood-transfusions. After gaining consciousness, she was unable to sit upright in bed and nursing care was difficult. She had got unstable fracture of sacrum and right-sided radiculopathy at L5, S1 and S2 levels with foot-drop on right-side and bladder/bowel involved.

Biological dual plating was done with reconstruction plates into posterior ilium on both sides by sliding the plates across the fracture without opening it. Reconstruction of pubic symphysis was done by another reconstruction plate.

Nursing care became easy and patient was able to sit upright on the 2nd post-operative day. She started full weight-bearing at 3 month, though foot drop is still persisting at 9 month; and she is still catheterized.

By proper stabilization, such patients can be made move around pain-free. Major complications like bed sore, systemic infection and gross disability could be prevented, along with benefit of getting easy nursing care.

Correspondence:

Dr. Anil Kumar, Flat No.-103, Block No.-2, Punjabi Bagh Enclave, DDA MIG Flat, Madipur, New Delhi-110063 (India). Ph/Fax: +91 11 25211681; Mob: +91 9891723710
E-mail: orthonil@hotmail.com

INTRODUCTION

Complex unstable fractures of the sacrum (such as Tile C fractures, which are unstable both rotationally and vertically) present specific surgical challenge and it is really difficult to make the patient move around pain-free. Stability to the posterior sacro-iliac complex is provided by the posterior ligamentous complex only; the sacro-iliac joint itself has no inherent bony stability. So such fractures require posterior fixation to regain vertical stability.

In our case, sacral fixation was done through posterior approach by inserting two reconstruction plates across the sacrum without touching the fracture site; along with anterior fixation of the pubic symphysis for rotational stability. Computed tomography is an essential part of the evaluation of any significant pelvic injury, allowing evaluation of the posterior portion of the pelvic ring that may be poorly seen on standard roentgenograms.

CASE REPORT

A 39yr old lady reported into the casualty department in stage of shock following suicidal jump from 30 foot height. She had to be given multiple blood-transfusions. She had got unstable fracture of sacrum and right-sided radiculopathy at L5, S1 and S2 levels with foot-drop on right-side and bladder/bowel involved. Turning in bed was very painful and nursing care was difficult. There was no other bony injury over other part of the body.

*MBBS, MS (Ortho), HOD; ** MBBS, MS (Ortho), Sr. Consultant; *** MBBS, D.Ortho., DNB-Candidate.
Department of Orthopedic Surgery, Maharaja Agrasen Hospital, Punjabi Bagh, New Delhi (India)

Figure: 1
(Radiograph showing Sacral fractures Denis type II on right side and type I on left side with sacroiliac joint dislocation and, widening of pubic symphysis)

Figure: 2
3-D reconstruction CT scan confirms the comminuted fractures of the sacrum and sacroiliac joint dislocation, Tile C3.

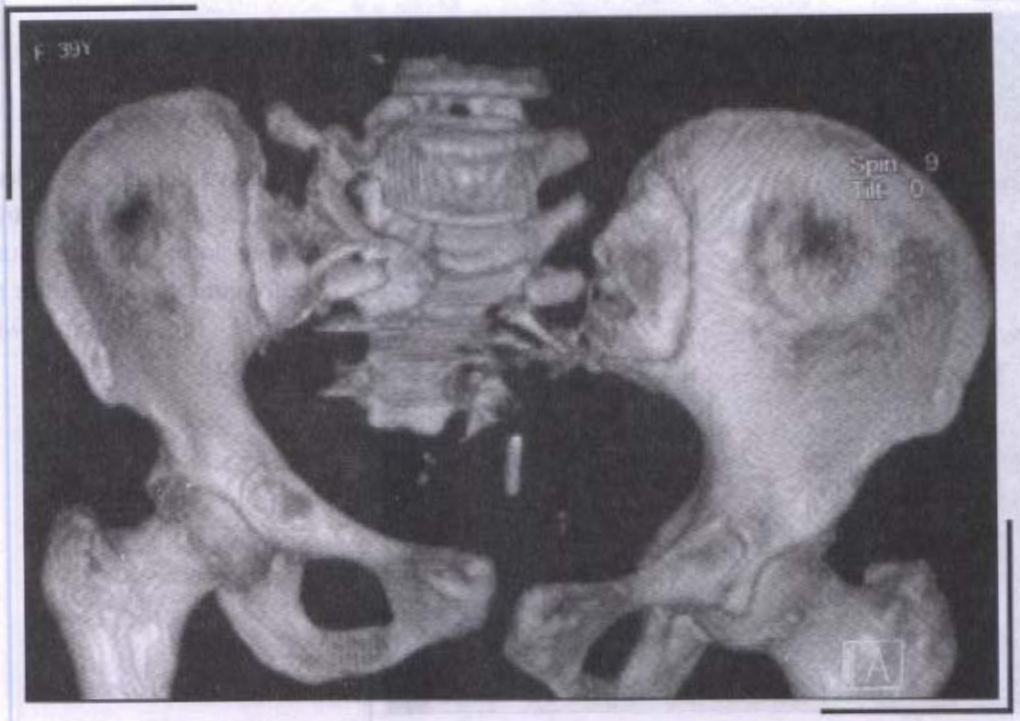


Figure: 3
Right hemipelvis has migrated upward, in respect to the left one. The fracture-line on right side involves some of the central part of the sacrum (Denis type III injury).

Figure: 5
(3 D CT showing coccygeal fracture)

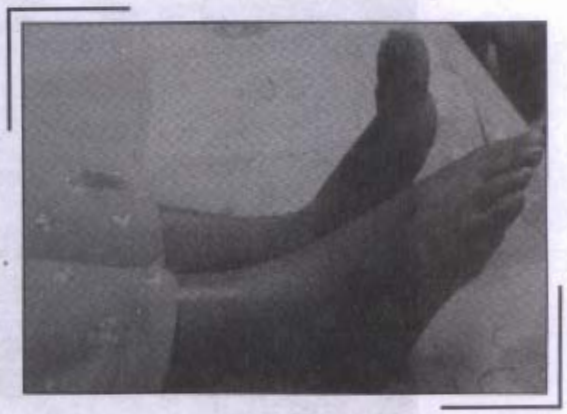
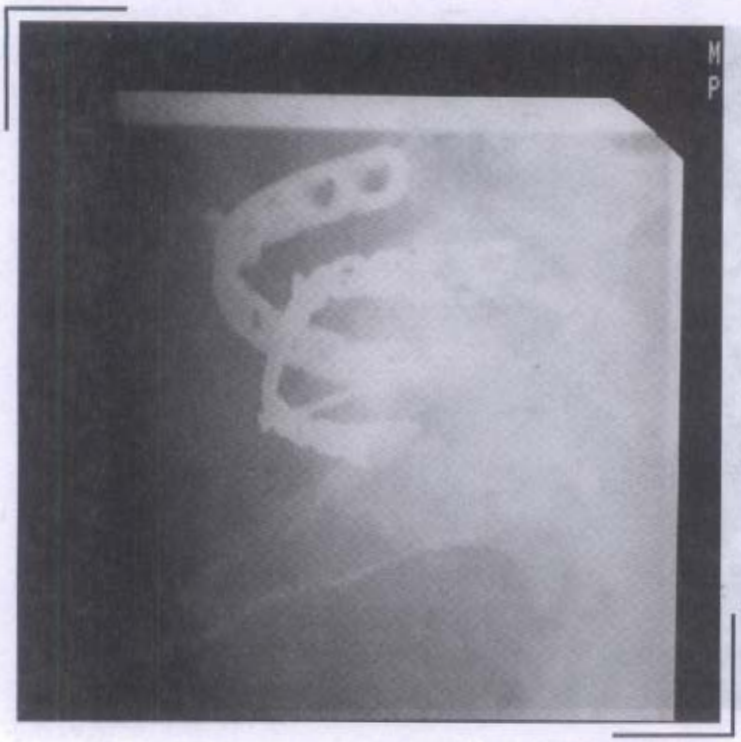


Figure: 4
(Foot drop on the right side)



Biological fixation was done by dual plating with reconstruction plates into posterior ilium on both sides by sliding the plates across the fracture without opening it.

Figure: 6

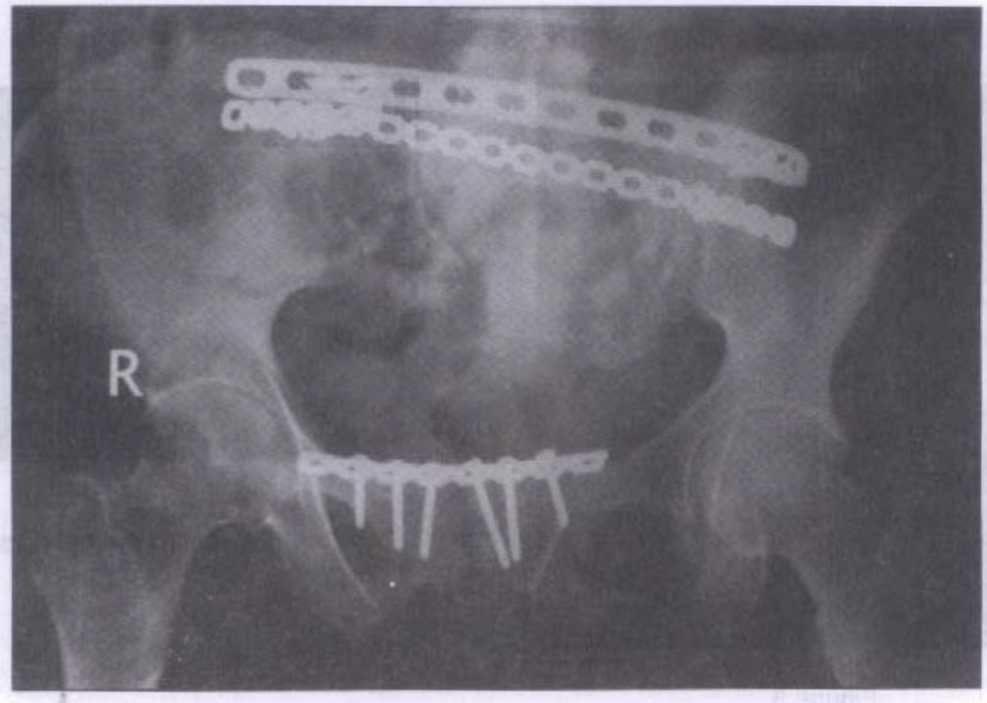


Figure: 7
2 reconstruction plates across the sacrum (posterior approach)
1 reconstruction plate across the pubis symphysis (anterior approach)

Reconstruction of Pubic symphysis was done by another reconstruction plate through anterior approach. Suction drain was removed on the 2nd post-operative day.

Figure: 8
(Full weight-bearing with stick)

Figure: 9
(Full weight-bearing without stick)

Nursing care became easy and patient was able to sit upright on the 2nd post-operative day. Non weight-bearing walking was allowed in 3 weeks but could bear partial weight only after 6 weeks. She started full weight-bearing at 3 month, though foot drop is still persisting at 9 month; and she is still catheterized.

DISCUSSION

Sacral fractures are better treated with closed reduction and percutaneous iliosacral screw fixation which offers adequate stability with a lower risk of wound complication when compared with open reduction and internal fixation. But it is difficult, requiring multiple assistants, continuous traction, and control of the ilium to reduce the fracture. But it is difficult, requiring multiple assistants, continuous traction and control of the ilium to reduce the fracture.

Watson-Jones (1940) described "an unusual and instructive case" of lumbo-sacral dislocation with a cauda equina lesion, in which the patient eventually died from ascending urinary tract infection. **Evans (1959) described another** case associated with a fractured femur. The dislocation was missed at first and intractable bed-sores drew attention to the cauda equina lesion.

CONCLUSION

By proper stabilization, such patients can be made move around pain-free. Major complications like bed sore, systemic infection and gross disability could be prevented, along with benefit of getting easy nursing care.

REVIEW OF LITERATURES

Simpson et al. reported excellent results with the use of the anterior retroperitoneal approach for anterior plating of the sacroiliac joint because it allowed direct observation of the joint.

J Trauma 27:1332, 1987

Kellam recommends anatomical reduction of the posterior injury and internal fixation with fusion of the sacroiliac joint.

Clin Orthop-241: 66, 1989; OCNA-18:25, 1987

Denis, Davis and Comfort classified sacral fractures in three types: type I fractures occur lateral to the neural foramina through the sacral ala, type II are transformational, and type III occur medial/central to neural foramina, it includes transverse fractures of the sacrum.

Clin Orthop: 227: 67, 1988.

Tile has compared the relationship of the posterior pelvic ligamentous and bony structures to a suspension bridge with the sacrum suspended between the two posterior superior iliac spines.

JBJS-70B: 1, 1988; JAAOS-4: 143, 1996; JAAOS-4: 152, 1996

Tornetta and Matta used iliosacral screws for posterior fixation and reported that two thirds of patients returned to their preinjury occupations.

Clin Orthop 329:186, 1996

Cole, Blum, and Ansel reported good results with percutaneous iliosacral screw fixation of Tile C fractures.

Clin Orthop 329:160, 1996

Routt et al. described difficulty in obtaining closed reduction of pure sacroiliac joint dislocations; open reduction of the sacroiliac joint often was necessary before percutaneous screw placement. They emphasized that the surgeon must be familiar with the variations of upper sacral anatomy and that fluoroscopic imaging, including the lateral sacral view, must be excellent. They also emphasized the fact that the normal sacral ala has an inclined anterosuperior surface, the sacral alar slope, which extends from proximal-posterior to distal-anterior.

J Orthop Trauma 11:584, 1997

"Use of the endoscope enables us to apply the concept of minimal invasive plate osteosynthesis to the pelvis."

Roger et al; Journal of Orthopedic Trauma: 16(7):515-519, 2002.

Sommer and Christoph fixed a low transverse fracture of the sacrum (S3-S4) in a 15-year-old girl, with Locking Compression Plate.

Journal of Orthopedic Trauma: 19(7):487-490, 2005.

19. Revision discectomy without fusion: Analysis of 72 cases

Dr. Raj Kumar

Abstract

Object: A retrospective analysis of the outcome of the revision discectomy without fusion for recurrent lumbar disc herniation, to explore the risk factors for recurrent disc herniation and to determine the factors that influence the outcome of repeat discectomy.

Methods: The sample included 72 patients who underwent revision discectomy without fusion was performed between 1992 and 2006. There were 45 male and 27 female, whose mean age 45 years (range 17-80 years). Clinical symptoms were assessed based on the Japanese Orthopedic Association Back Scores. All medical and surgical records were examined and analyzed, including pain-free interval, level and degree of herniation, length of surgery, post surgery complication and hospital stay.

The mean follow up period was 51.3±25.4 (12-120) months. The mean pain free interval was 25.7±18.5 (9-96) months. The degrees of herniations in revision were protrusion in 7 (9.7%) cases, subligamentous extrusion in 13 (18.1%) cases, transligamentous extrusion in 20(27.8%) cases, sequestration in 32(44.4%) cases and the common site of recurrence was L4-5 (60%) level. Clinical outcome was excellent or good in 77.8 % cases at last follow-up. The length of surgery was significantly different between the revision discectomy and previous surgery (96.9±13.7mins *vs.* 68±15.8 mins).

Conclusions:

Revision open discectomy without fusion for recurrent disc herniation showed satisfactory results comparable with those primary discectomy. The most common site of recurrence was L4-5 level. Based on these study repeat discectomy without fusion can be recommended for the management of recurrent disc herniation.

20. "POTTS SPINE: THE ROLE OF *INTERFERON* γ IN DIAGNOSIS OF POTTS SPINE: A PROSPECTIVE STUDY"

By: RUPANT KUMAR DAS, MS, Senior Resident
Work carried out at Department of Neurosurgery,
Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow - 226014, UP, India
Phone No. 0522-2668700, 2668800 Ext. 2157 (C), 2158 (R), 2107 (OT), 2741 (O)
Fax No.: 91(522) 2668129 & 2668017

"POTTS SPINE: THE ROLE OF INTERFERON Γ IN DIAGNOSIS OF POTTS SPINE:
A PROSPECTIVE STUDY"

Abstract:

Introduction: Potts spine is primarily a disease entity of the developing world. It has varied morbid consequences and has been an area of concern for neurosurgeons and orthopaedicians alike. The successful management depends upon the correct diagnosis; and there are various serological, biochemical and radiological methods available. Presently interferon assays have been reported to have improved the

detection rate with high sensitivity and specificity for diagnosis. The present study was designed to assess the utility of INF-γ levels in serum, for the diagnosis of Potts spine and compare these results with conventional methods of diagnosis; done prospectively.

Material & Methods: Forty consecutive patients (mean age 35.9± 14.1 yrs; M21, F9) over a period of one year were included and analyzed. All patients underwent conventional diagnostic tests along with serum Interferon γ assay and diagnosis was established and confirmed histopathologically. For Interferon γ, quantiferon assay was used. Statistically SPSS 13 was used. Chi square test was employed using cross tabs.

Results: All patients had clinico-radiological evidence of tuberculosis Of the 30 patients studied all had a clinical and radiological profile suggestive of spinal tuberculosis. All patients underwent evaluation by Routine cell counts, ESR, ELISA for IgG/IgM, bone scan, biopsy and (INF-γ) assay. INF-γ was found positive in a very high number of cases and the statistical correlation was highly significant.

Conclusions: The INF-γ assay is a very sensitive test for diagnosis of Potts spine; which has a significant correlation with other methods as well. Being easy to do and relatively cheap, it has far reaching implications in yielding the diagnosis of spinal tuberculosis.

21. Recent advances in Pediatric Congenital Atlantoaxial Dislocation: some new concepts.

Author 1: Samir Kumar Kalra, Clinical Fellow, Neurosurgery, SGPGI, Lucknow

Author 2: Rajkumar, Professor and Head, Neurosurgery, SGPGI, Lucknow.

Author 3: Ashok Kumar Mahapatra, Director and Professor of Neurosurgery, SGPGI, Lucknow

Work carried out at Department of Neurosurgery, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, 226014, India
Phone No. 0522-2668700, 2668800 Ext. 2901 (R), 2107 (OT)
Fax No.: 91(522) 2668129 & 2668017

Running head
Pediatric Congenital atlanto axial dislocation.

Key words

Craniovertebral junction, atlantoaxial dislocation, cervicomedullary compression.

Address for correspondence:
Dr Samir Kalra,
MRA A 103, SGPGI Campus, Raibareilly Road,
Lucknow, UP, 226014.

Introduction:

The management of congenital atlantoaxial dislocation (AAD) in children is difficult due to poor understanding of underlying biomechanics, inadequate categorization and lack of outcome assessment grading system. The disease continues to be an enigma over the years and satisfactory results depend upon comprehensive understanding of these nuances. The present study is a compilation of few new tenets; understanding the importance of new bony landmarks, categorization based on trauma and designing a grading system for status and outcome assessment.

Material and methods:

Out of the 157 consecutive cases of pediatric congenital AAD (age≤ 16 years) who underwent surgical management between January 1997 and 2006, 97 cases (mean age: 7.3 ± 3.5 years; range 2-16 years; male: female ratio=56:41) were included. The radiological investigations included plain dynamic radiographs of the cranio-vertebral junction (in neutral, flexion and extension), a cranio-spinal magnetic resonance imaging (MRI) and intrathecal contrast computed tomographic scan (ITCT). The general and clinicoradiological profiles, preoperative grades as well as outcomes of patients who presented following trauma were done with those who presented without it. The comparisons were also done in relation to the atlantodental interval (ADI) and posterior foramen magnum diameter (PFMD) and a grading system was evolved using the clinical parameters and its applicability tested. The statistical analysis was carried out using SPSS 10 software (SPSS Chicago, IL, USA) and the chi square tests and logistic regression analysis was used.

Results:

Most patients presented with long tract signs (n=85) and occipitalization of atlas (n=43); with an even distribution between the two types of AAD. The patients who presented following trauma (n=55) presented early, in better grades and had better outcomes in comparison to those who presented without with statistically highly significant associations. The clinical symptoms, functional status and outcome showed statistically significant correlation with the PFMD in comparison to the ADI. The grading system based on clinical parameters was more reflective of neurological status, sensitive to change, good positive predictive value (82%) and had excellent interobserver and intraobserver reproducibility and reliability.

Conclusions:

The posterior diameter of foramen magnum correlates better with the clinical profile, preoperative functional grades as well as with the outcome in comparison to the ADI. The categorization of these patients based on the history of antecedent trauma is appropriate and justified. A grading system based on clinical parameters is well suited for this condition and has excellent applicability

22. Craniovertebral Tuberculosis Treated Conservatively

MANISH CHADHA[1]

[1]*UNIVERSITY COLLEGE OF MEDICAL SCIENCES*

Introduction

Craniovertebral tuberculosis is a rare entity even in endemic countries, and there is no consensus in the literature regarding conservative or surgical management for the same. Reports range from radical surgery to totally conservative approach. We report our experience in treating 13 such patients conservatively.

Materials & Methods

A retrospective review of 13 patients diagnosed with craniovertebral tuberculosis was performed. All patients were treated conservatively with cervical traction for initial 3 months followed by a brace along with multidrug antitubercular drugs for 18 months

Results

All patients responded favorably to conservative treatment. Follow-up averaged 43 months (range,1665 months). No patient deteriorated neurologically. All patients had symptomatic improvement. Failure to reduce atlantoaxial dislocation/lateral subluxation of the dens completely was seen in 2 cases.

Conclusion

We think that all patients with Craniovertebral junction tuberculosis can be managed adequately using conservative means regardless of the extent of bony destruction with a good patient outcome. Surgery should be reserved for only a selective few where diagnosis is in doubt and there is initial severe or progressive neural deficit with/without respiratory distress in presence of documented mechanical compression and documented dynamic instability following conservative treatment.

23. RECOVERY AND SUBSTITUTION OF FUNCTIONS AFTER A SEVERE SPINAL INJURY

Nina G. Konovalova,MD, Mark A. Leontiev*, MD, Yuliya Solonchuk, MD

Federal Spinal Centre, Novokuznetsk

International Charitable Foundation "SM. charity", Krasnoyarsk

The rehabilitation methods of the spinal cord injury patients can pursue substitution or recovery of functions. The substitution treatment is carried out by technical means and aimed at enhancement of motor abilities in the segments above the injury level. The rehabilitation based on the substitution concept allows achieving results within rather short terms but doesn't contribute to the function recovery. However the restoration of vertical position is necessary for somatic health maintenance, prolongation of the lifetime and for psycho-emotional well-being of the spinal cord injury individuals. Up to 70% of patients with lower paraplegia of type A or B are able to walk with an auxiliary steady support. Generally the treatment outcomes depend on the preservation grade of osseous-articular apparatus of the lower extremities. But the recovery concept is less applied because of very strong and complicated efforts to be demanded both from a rehabilitation professional and a patient. The rehabilitation specialists more often reveal the trend to appeal to the recovery

concept. It is possible due to FES and some robot-based techniques of walking recovery as a treadmill with weight support, the ERIGO and the Locomat. The natural laws have been "discovered" once again to promote functional outcomes even with a severe morphological deficit. This can inspire in us the hope for further development of rehabilitation methods based on the recovery concept.

24. Md.Iqbal Hossain

Abstract

A previous study by Madhab Shriti Vocational Training Centre at CRP showed that 95% of participants who had received electronics training had returned to work in this field successfully. Our study hoped to expand on this information and aimed to find out the factors which influenced outcome's of electronics training for the people with paraplegia, once they had returned to their community. In depth information was collected via convenience and purposive sampling. Analysis of the data showed that various factors directly influenced return to work outcome. After return to their community, all participants reported facing similar difficulties associated with their: new environment, financial situation, physical environment accessibility, physical illness, lack of enough practical knowledge in electronics, and not enough family members were available to support their shop. Those patients who were independent with their earning had a future plan to expand their business, set up own repairing shop and wanted to use their skills to train others. The unsuccessful cases, who had not returned to work, had no future plan to work in electronics or any other job. All participants reported they had a good impression of the services they had received at the Vocational Training Centre. However they offered suggestions regarding ways in which the service could be developed or improved such as: arrange placement at different settings, include modern machineries to repair, extend course duration and provide regular follow-up once patients had returned to community. Following spinal cord injury, successful return to work in the community is effected by a number of factors. Accessible environment, community and local government support is essential to the process, and needs to be considered by any facility offering vocational retraining.

25. Clinical significance of Electro diagnosis in Lumbar disc herniation.

Authors: **Narkeesh .A**[1],Multani.N.K[2],Verma.S.K[3]
1-Reader,2-Prof&Head,3-Prof&DeanResearch&Medicine
Department of Physiotherapy&Sports Science,
PUNJBAI UNIVERSITY,Patiala(PB)

KEY WORDS: MNCV, H-Reflex, Electro diagnosis.

PURPOSE OF THE STUDY: To find out the influence of disc herniation at L5-S1 level on motor nerve conduction velocity, H-reflex and to correlate values of affected and unaffected limb.

MATERIAL USED: Electro diagnosis machine, Plinth, Measuring tape, ECGgel, MRI Report.

METHODOLOGY: It is experimental and correlation study of same subject design. The study was conducted with 18 patients with disc herniation presented with unilateral radiating pain having positive SLR between age group of 20-50 yrs and MRI Report shows L5-S1 Disc Herniation.

PROCEDURE: MNCV,H-reflex recording was performed on subjects
After positioning of the patient and electrodes recording was done. A supra maximal stimulus was given for MNCV and sub maximal stimulus was given for H-reflex to posterior tibial nerve of affected and unaffected leg respectively Record MNCV, H latency And H/M Ratio

RESULT: Paired t test and Karl Pearson correlation test was used for data analysis, which showed significant changes in MNCV($p<.05$),H -latency($p<.05$) and H/M ratio($p<.05$) and non significant latency difference($p>.10$) on affected side. Correlation between MNCV and latency difference was negative.Correlation between H-latency and H/M ratio also carried negative.

CONCLUSION: This study concluded that there are significant changes in MNCV,H latency and H/M ratio on affected side. Correlation between MNCV and latency difference was negative. Correlation between H-latency and H/M ratio also carried negative.

Hence this conclude that MNCV, H -latency and H/M ratio can be used as diagnostic tool in L5-S1 level disc herniation.

26. SPINAL INTRADURAL LESIONS AND MANAGEMENT- 359 CASES,12 YEARS

DR,Suresh,M,Dugani

INTRODUCTION

Spinal intra dural lesions are diverse in nature,neurofibromas,schwannomas, meningiomas, dermoids,epidrmoids,arachnoid cysts Astrocytomas,Ependymomas,Haemangioblastomas,lipomas etc.They present with pain and neurological deficits.modern neuroimaging and microsurgical techniques have contributed for excellent out come.

METHODS

Over last 12 years we have treated 359 patients with these lesions,they presented with varied neurological manifestations.These lesions were treated with microsurgical techniques.Various approaches and procedures,depending on location,plane and pathology were utilized.

RESULTS

All lesions were attempted for complete excision.Follow up period was 6months-12 years .128 nervesheath tumors,62 meningiomas,16 arachnoid cysts,19 lipomas,15 dermoids,15 epidermoids ,4 neurenteric cysts,5 haemangioblastomas,9 metastasis, 2 tuberculomas,5 vascular malformations,28 astrocytomas, 39 ependymomas,were treated.All except malignant astrocytomas,metastasis,vascular malformations had Excellent results,with good functional out come.

CONCLUSIONS

Majority of intra dural lesions are benign inspite of diverse pathologies.
Microsurgical techniques are extremely important for better treat ment out come.
Treatment out come is highly rewarding,achieving cure ,excellent functional recovery

In majority of cases.,except in malignant Gliomas,metastasis,vascular malformations, Haemangioblastomas.
Poor pre op neurological status did not matter for good post op recovery in majority of cases
Various approaches ,procedures,are planned depending on situation ,plane ,pathology, of the leision

27. ACTIVE REHABILITATION FOR YOUNG SPINAL CORD INJURED IN INDIAN CITIES

Prof. Ms. Ketna L Mehta

Introduction:

There are over 15,00,000 paraplegics, people with spinal cord injury, in India. Each year we add 1000 to this figure; Majority of them are male (82%) and age group is 16-30 years (Youth category). The trend has been on an increase of such people with this specific medical due to increasing motor accidents, participation in adventure sports and urbanization issues. This paper explores the condition of SCIs in India in the past and present. The opportunities for rehabilitation then and the need or a holistic approach of rehab for Indian SCIs for active fulfilling life.

Spinal cord injury (SCI) is damage to the spinal cord that results in a loss of function such as mobility or sensation. The spinal cord does not have to be severed in order for a loss of function to occur. In most SCI cases, the spinal cord is intact, but the damage to it results in loss of function. A case in point is the Hollywood actor Christopher Reeve who met with a horse-riding accident and became a quadriplegic, paralyzed neck down from C1, C2 vertebrae level.

SCI symptoms usually appear immediately after the injury. However, symptoms can develop slowly, if an infection or tumor is gradually increasing pressure on the spinal cord. General symptoms are as follows:

- Weakness, Poor coordination or Paralysis, particularly below the level of the injury
- **Numbness**, Tingling, or Loss of sensation
- Loss of bowel or bladder control
- **Pain**

Rehabilitation Services means a sequence of services built around the issues of a person with disability and designed to restore optimum physical, psychological, social, and vocational levels of function.

Rehabilitation techniques can greatly improve patients' health and quality of life by aiding them learn to use their remaining abilities. They start by setting functional goals. Functional goals are a realistic expectation of activities that a person with SCI eventually should be able to do with a particular level of injury. These goals are set during rehabilitation with the medical team. They help the patient with SCI learn new ways to manage his/her daily activities and stay healthy. The SCI units include kitchens and laundry facilities and other equipment so that patients can learn independent living skills, such as cooking meals or ironing clothes. A spinal cord injury can also affect the nerves and muscles and can cause bowel and bladder problems and skin problems. Patients are prepared for these changes during rehabilitation and are taught the self-care skills needed to deal with these problems.

Rehabilitation for SCI: requires close collaboration between the patient and the rehabilitation team. The team focuses on restoring the individual's capabilities through improving physical health and psychological well-

being, as well as enhancing social support. The patient and the team work together to develop realistic goals. Family and friends are trained to assist in the recovery process. The ultimate goal is to encourage individuals to develop realistic goals and to assist them in achieving their maximum potential. It is vital to have a high quality rehabilitation program with skilled professionals to help a newly injured person develop the skills needed to maintain physical and emotional health throughout his/her lifetime.

The person with Spinal Cord Injury after rehabilitation is in a position to live life with dignity and become an economic contributor to the country. Physically, emotionally and financially by being independent, they are rehabilitated completely, and is an active tax payer.

In the context of rehabilitation of SCIs currently in India. It is of relevance to understand what it was like in the past; trace the changes to the present and plot a road map for the future.

Rehabilitation of SCI in the past:

It was a pitiable condition for those afflicted with SCI in the 1950's and 1960's. The life span was maximum 3 to 6 years and the main causes of death were infection and hypoprotienemia. Infection was caused due to UTI (Urinary Tract Infection) chest and pressure. The role of physiotherapists was to give passive movements to the limbs, UUR sores and splinting. There were no specialized SCI centres and multi disciplinary approach was unknown. After the hospitalization or surgery there were left to fend for themselves and invariably they succumbed to infections.

Concept of Rehabilitation :

It is a Multi disciplinary approach. Rehabilitation by Multidisciplinary Approach requires; wards, Cots with foam mattresses, wheelchairs with foam cushions, Gymnasium, Parallel Bars, Tilt Beds, Walkers, Exercises Mats Beds, Orthotic appliances, Exercises Therapy Equipments

Rehabilitation of SCI in the Present:

There have been tremendous strides made. Due to kind of people getting SCI moved up, from socially backward citizens to more aware and educated people their exposure to information and specialized rehab centres in the world they indulged in active rehabilitation. There have been advances in therapy when greater number of nerve fibres are preserved in acute care. The surgeons and doctors are also exposed through international seminars about the holistic approach for rehabilitation. It is more of team work with Neuro or Spine or Ortho Surgeon, Physiotherapists, Orthotician and Occupational Therapists working jointly for the SCI patient. There are rehab centres in Delhi, Vellore, Bangalore, Orissa, Bhopal, Mumbai and Baroda.

Challenges to Rehabilitation In India

1. Ignorance Awareness and information required during different stages of rehab is not available. Once they go back home, access to doctors, physiotherapists for doubts may not be there.
2. Economical The average expense of an SCI in India P.A is Rs. 60,000 to 1,00,000.
3. Lack of Institution For revisits, every few years for new exercises etc also group therapy helps a lot.
4. Lack of relevance of models to home and community

5. Limitations of rehabilitation

6. Access Indian cities, tours and villages woefully lack access and several barriers exists preventing outdoor mobility.

7. Vocational avenues Limited to new skill training lacking.

8. Recreation Nil

9. Social support Slowly dwindles as advances in life takes place.

In a developing country like India a lot still needs to be achieved in order to have a satisfactory quality of life for the Spinal Injured- (Dr. Harvinder Chhabra, ISIC, New Delhi)

Rehabilitation in the Past:

A study conducted by Paraplegia in 1986 threw us these facts:

- 218 patients in rural India were analysed.
- 125 had neurological deficit.
- The commonest cause for spinal injury was falling from trees (55.2%).
- Rescue and retrieval systems for these patients were inadequate.
- Knowledge regarding precautions to be taken when transporting the patient was lacking.
- The frequency of decubitus ulceration and of urinary tract infections was unacceptably high.
- A high percentage of patients with cervical spine injury expired.

Why the Slow Progress in Rehab:

i) According to Shanta Memorial Rehabilitation Centre, Bhuvaneshwar:
   - Majority of persons with SCI are rural based, living below the poverty line, and unable to afford the cost of rehabilitation.
   - Hence, the mortality rates in this group are high at 75% within 2 to 5 years of occurrence of the injury.

ii) A research conducted by Dr. Chhabra, ISIC, New Delhi from a 34-page and responses received from 53 centers, shows:
   - In 37.5% of the institutions less then 50% of the patients got an adequate rehabilitation during the hospitalization,
   - At 58% of the institutions 0-25% of the patients got sexual or fertility counseling during hospitalization
   - 81.82% of the institutions had no facilities for a pre-discharge home visit by the staff to suggest home modifications.
   - 73.9% institutions had no facilities for follow up home care services.
   - Only 17.2% of the patients were satisfied, 13.73% moderately satisfied, 8.87% very satisfied with their life at one year follow up.

The survey also showed the main factors hindering integration of the spinal injured in the mainstream of the society:

- Inadequate rehabilitation,
- Problem of access in work place
- Environment and financial barriers

Rehabilitation Models in India:

i) Institution based rehabilitation includes;
   - Acute care rehabilitation
   - Day care services
   - Social services
   - Vocational services
   - Family and care giver counseling
   - Person with disability

ii) Community based rehabilitation includes;
   - Use of simple technology
   - Community involvement
   - Teaching persons with disability and their families.
   - CBR does not rule out the need for institutional care, but requires a continuum of services that are accessible and appropriate for the individual.

The Future:

Paraplegics today are more optimistic than before. The life span has considerably increased. The internet and mobility of paraplegics traveling the world over have exposed them to a whole new life. Publications specifically dedicated to SCIs like Nina Foundation's ONE WWORD Voice of Paraplegics and yahoo groups like www.sci-india@yahoogroups.com have mentioned solutions easier to find.

Today the Rehabilitation team consists of:

1. Physiotherapist
2. Occupational Therapists
3. Social Workers
4. Urologists
5. Andrologists
6. Psychiatrists
7. Vocational Counselors and
8. Nurses

This can be better explained by the role of the different team:

Role of Social Workers
- Direct Link with Paraplegics
- Spouses / Family
- Employer / Donors
- All the members of Rehabilitation team
- Emotional Support

Role of Surgeon
- Initial Diagnosis Management
- Surgical / Medical Conditions with Paraplegia
- Periodical Follow up

Role of Special Surgeon

- Conservative
- Surgical Management
- Decompression
- Stabilization
- Plastic Surgery

Role of Urologists

- Management of Retention
- Management of Incontinence
- Management of Infection
- Management of Catheterisation
- Management of Bladder
- Management of Kidney / Bladder Stones

Role of Orthotist

Manufacture of orthotic appliances, shoes, calipers, spinal braces, walking aids, Walkers, crutches, stick, etc.

Role of Occupational Therapists

- Activities of Daily Life
- Prevocational assessment & training
- Therapeutic Exercises through occupation
- Tackle emotional problems through occupational activities

Role of Physiotherapists:

- **Preventive**
  - **Prevention of complications**
- **Restorative**
  - **Restoration of Function**
  - **Ambulation, Transfers**
  - **Use Of Appliances Etc**

The Aims of the Rehabilitation Team

- Study problems
- Predict outcome
- Set a goal
- Achieve

The primary complications faced by an SCI are: Physical, Psychological, Social and **The secondary complications** faced by and SCI are: Chest Infection, Pneumonia, Restrictive Lung Disease, DVT, UTI, Pressure Sores, Osteoporosis, Ectopic bone formation, Autonomic Dysreflexia, Neuropathic pain in SCI, Sign of recovery?Sharp electric shock, Phantom limb pain, Treatment medications, Nerve block

Spasticity

Flexion withdrawal, Bladder infection can increase, Baclofen, Valium, Dantrium, Botox, Surgery (Rhizotomy)

Osteopososis and SCI

HYPER CALCIURUIA starts in 10days and it is Peak in 1-6 months. It gets worse in bed ridden SCI. Metabolic is imbalance between bone formation & resorption.

Osteporosis

Maximum affected in Femur & Tibia Fractures common, especially in higher level increases with age.

Autonomic Dysreflexia

D6 and above lesion, Controlling mechanism of BP and heart function affected, Triggered by Dystended Bladder, UTI, Constipation, Pressure Sores.

The symptoms of the same are:

- Pounding Headache
- Blurred vision
- Sweating
- Can cause a stroke

The Treatment given is:

- Remove the stimulation
- Sit up
- Monitor urine output
- Bowel control

The **Psychological Problems faced are**

- Anxiety-Fear
- Depression
- Suicidal tendency

Psycho Social Problems Management

- Group therapy
- Counseling
- Sports
- Vocational training

Counselling

All team members including Andrologist, Psychiatrist and Rehabilitated Paraplegics play a major role in counseling SCIs

The Management Team of **Pressure Sores includes:**

Physiotherapists Nurses / Attendants / Patients relatives / Plastic surgeon.

The Management **Pressure Sores includes:**

- Positioning
- Dressing
- Hygiene
- UVR
- Laser

Improvement in Ambulation:

- Orthotics
- W/C- better
- Tricycle
- Scooters 2 additional wheels
- Hand operated cars

Active Rehab Includes:

i) Physical Exercises:

Exercise can be difficult for many individuals with high levels of injury. The types of exercises that you can do may be limited by your lack of mobility, but you do have options. There are exercises that you may be able to do by yourself, and there are some exercises others can help you do.

Breathing exercises can offer great health benefits for some individuals with injuries between levels C1 and C4. You can start by doing a set of 4 breathing exercises twice in the morning and twice at night. As a result, you can help keep your respiratory system strong. You can increase your lung capacity and lung expansion, which makes it easier to take deep breaths. Plus, you can decrease your risk for respiratory complications such as pneumonia.

1 Take a deep breath and hold it for a 5 seconds before slowly breathing out
2 Take a deep breath as fast as you can bringing in as much air as you can before pushing the air out as fast as you can
3 Take a deep breath and hold it...take another breath and hold it...take one more breath before slowly breathing out
4 Take a deep breath in then breath out counting out loud as long and as fast as you can

Neck and shoulder exercises can improve your strength and endurance. You can start by doing 10 shoulder shrugs in the morning and 10 at night. If you have someone to help, you can ask them to hold your head and shoulders to provide some light resistance to your movements. Your assistant might also help with range of motion (ROM) exercises. When doing ROM, it helps if your arms and legs are lifted higher than your heart. This increases your heart rate because it is harder to push blood flow against gravity. Thus, you benefit more from the activity.

C4 - C5

In addition to breathing and shoulder exercises, individuals with injuries below C4 can exercise other areas. Although you may need help to set you up to exercise, you can do a lot on your own. For example, you can use elastic bands - easily found at many local retailers - to exercise your biceps. You can exercise your scapular (shoulder blades) muscles while you are sitting in your wheelchair.

C6 - C8

Individuals with injuries below C5 may find it better to exercise at the gym. Using modified gloves, you can probably exercise your shoulders, biceps and triceps on some exercise equipment. If you have finger or thumb movement, you may be able to use the equipment without the use of modified gloves. This use can improve strength in the fingers and thumbs. If you do not have access to a gym, you can do similar exercises at home or participate in other forms of physical activities. Individuals with Paraplegia

People with paraplegia, can probably exercise and do most forms of strengthening, stretching and ROM exercises without the assistance of others. Whether one uses exercise equipment or participate in other forms of physical activities, the focus should be keeping your body strong and flexible.

II) Transfers:

- Cot to Floor
- Floor to Cot
- Wheel Chair to Cot
- Wheel Chair to Car

i) **Independent Living:**
Activities of daily living; bathing, wearing clothes, bowel and bladder control, cooking, cleaning, swabbing.

ii) **Travelling:**
Within the city, by different modes of transport

iii) **Recreation Games:**
Table Tennis, throw ball, cricket, basket ball, lawn tennis, badminton, swimming, javelin and disc throw. Sense of achievement and thrill of a workout

Conclusion:

There has been a great improvement in the rehab regime for SCI in India. The techniques and equipments need to further upgrade to allow SCIs to lead a healthy full life.

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26. Core Training for Neck Stabilization:

Raejndra Thapa

Objectives:

Core training to increase the stability and strengthening of the neck as well as to reduce the further chances of injury:

Abstract:

This paper will outline the general anatomy, core stabilization and strengthening of the neck muscle. Generally, core is the lumbopelvic-hip complex, where a person's center of gravity is located and all movement begins. The whole spine is also considered as the core. The core connects the upper and lower body and serves as important link between two. The main concept of core strengthening programs involves using many muscles in coordinated movement.

Most people have developed the functional strength, power, neuromuscular control, and muscular endurance in specific extremity muscles to enable them to perform functional activities. However, few people have developed the muscles required for spinal stabilization. The body's stabilization system has to be functioning optimally to effectively use the strength, power, neuromuscular control, and muscular endurance of those extremity muscles. If the extremity muscles are strong and the core is weak, not enough force will be created to produce efficient movements; inefficient movements lead to injury.

Spinal cord injury is one of the devastating conditions. This brings the tremendous changes of the person life style. The person who will get admission in rehabilitation centre has needs a lot of focusing on physical rehabilitation. Generally, people after having spinal cord injury always focus on the Upper limb and lower limb strengthening but not to the spine. The core training aims for stabilization of the spine and strengthening of the back. The traditional method of the back strengthening has less advantages then the newer one.

We have selected 10 people including male and female having the incomplete injury and10 male and female having the complete injury . We measured the force of cervical region by putting the sphygmomanometer under the neck. Force exerted by the patient during the extension, flexion and side flexion was measured in mm of Hg. Then the patient has been taught the core training of the neck for 10 days, 3 setting, 10 times in each setting. Again we measured the force of the cervical spine during all movement as like the 1st day then we found the changes in strength dramatically.

27. Title: Patterns of morbidity in spinal cord injured earthquake victims and its implications in Activities of Daily Living

Sarah Milton M.O.T, Mathanraj David B.O.T, Milton George M.P.T

Aim To demonstrate the patterns of morbidity and its association with the demographic characteristics and activities of daily living status in paraplegic patients in the earth quake victims

Method: Samples were collected and analyzed from their medical records from year 2001 till 2005. Who were followed and treated by the rehabilitation professionals in the Gujarat earth quake victims. Morbidity patterns and its association with activities of daily living status were analyzed

Results: From the analysis we found that 77 % were dependent in activities of daily living, 58 % are using intermittent catheterization, 22% with pressure ulcers, 13 % with urinary incontinence and 13 % with depression. In this study there was no significant association between the morbidity and demographic characteristics were noted and also there was no significant association between the morbidities was found. But there was significant association between ADL and co morbidities, like catheter, depression, pressure ulcer and pain were found.

Conclusion: Reducing the complications will have a significant impact on their quality of life and improve ADL. ADL independence is also play a vital role in reducing the complications. Innovative approaches are needed to reduce the complications in these individuals who live in remote villages where modern and standard treatment approaches are out of reach.

28. VERTICAL ATLANTO-AXIAL INDEX: A NEW CRANIOVERTEBRAL RADIOLOGICAL INDEX

Arvind G Kulkarni

TITLE:

Introduction: Deduction and application of vertical atlantoaxial index (VAAI) for quantifying the vertical atlantoaxial relationship of atlas and axis and classifying basilar invagination based on the VAAI. A theory for pathogenesis of basilar invagination is proposed.

Method: Mid-sagittal CT (Computerized Tomography) scan films of ninety cases of basilar invagination treated by us between October 1999 and May 2005 with distraction and lateral mass plate and screw fixation were analysed before and after surgery. The age of the patients ranged from 8 to 55 years and the male: female ratio was 2.5:1. Additionally, mid-sagittal CT scan films of hundred normal subjects in the same age group were analysed as a control group. The vertical atlantoaxial index was measured in all cases. The images were compiled and two copies of the compilation were made. Two observers independently performed the measurements and inter-observer agreement was assessed using the ICC (intra-class co-relation) test (SigmaStat). The morphology of the facet joints was critically analyzed in all cases.

Results: The post-operative mean and mode values of VAAI are 0.78 (range, 0.60 0.89) and 0.80 respectively. The mean and mode values of VAAI in general population were 0.80 (range, 0.76 0.85) and 0.80 respectively. The results showed excellent inter-observer co-relation (ICC = 0.97). Several dysplastic features supporting possible developmental origin of basilar invagination were noted in the facet joint morphology.

Conclusions: Vertical atlantoaxial index can be an excellent measurement tool for the assessment of relationship of atlas and axis. Non-rheumatoid basilar invagination is probably developmental in origin and can be graded and classified depending on the pre-operative vertical atlanto-axial index.

29. Congenital butterfly sixth cervical vertebra with kyphotic deformity: diagnosis and management

Dr. Dharmendra Singh,
Dr Tariq A Halim, Dr. Vishal Nigam, Dr AK Srivastava Dr. H S Chhabra
Indian spinal injuries centre, Vasant Kunj, New Delhi

For poster presentation

Congenital butterfly sixth cervical vertebra is a rare disorder. In this report we describe a 15 year old patient presented with difficulty in walking and bladder dysfunction without any history of trauma or constitutional symptoms. On examination, kyphotic deformity in cervical spine was present. There were no other congenital anomalies except mild flexion in left elbow. Plain X-Ray showed butterfly sixth cervical vertebra. Magnetic resonance imaging revealed congenital anomaly of sixth cervical vertebra with kyphotic deformity and myelomalasia of the cord in form of atrophy and signal intensity changes. There was no evidence of tonsillar herniation, aqueductal stenosis, syringomyelia and diastometamyelia. Patient was operated with staged surgery- Stage 1- Anterior Decompression and Stage 2- Posterior decompression, correction and

stabilization and Stage 3- Anterior bone grafting. Post operative period was uneventful. The patient was put on rehabilitation. Patient was followed up. He has shown substantial motor and urological recovery.

Case report

A 15 year male patients presented with complaints of difficulty in walking since July 2005 though the problem started in Jan 2005 and progressed severely since July 2005. Patient also developed bladder dysfunction in form of difficulty in passing and control urine with same duration. There was no history of trauma and no history of constitutional symptoms .he has o other congenital anomaly. Patient intelligence was normal. On neurological examination muscle power in upper limbs was 4/5 in elbow and wrist the muscle in finger was2/5.the muscle power in both lower limbs was 3/5.sensation was intact. Patients was thoroughly evaluated by team of orthopedic surgeon. Investigated

X-rays

Mri report

Surgery

Stage-1 anterior decompression

Stage 2 posterior decompression and stabilization

Stage 3anterior bone grafting

Post op

Put on rehab and urodyamic assessment done.

Follow up

Power

Hip rt	3/5	2/5	lt
knee	4/5	4/5,2/5	
ankle	4/5	3/5	

30. Primary spinal epidural non-Hodgkin lymphoma:

Dr Dharmendra Singh,

Dr. Vishal Nigam, Dr Tariq, Dr Vikas Tandon, Dr. H S Chhabra

Indian spinal injuries centre, Vasant Kunj, New Delhi

For poster presentation

Spinal epidural non-Hodgkin lymphoma is an uncommon lesion. In this report, we describe a patient with a clinical picture of low back pain radiating to both lower limbs as the first presentation of malignant lymphoma. The diagnosis was not suspected preoperatively, and plain radiograph were nonspecific. Magnetic resonance imaging showed evidence of extradural soft tissue mass crossing multiple vertebral levels. Preoperatively it was suspected Potts spine. Posterior decompression was done and tissue material was sent for histopathology which revealed non-Hodgkin lymphoma. Immunohistochemistry characterization was positive for non Hodgkin lymphoma. Patient was put on chemotherapy and responded well. In these clinical and radiological findings, non-Hodgkin lymphoma should be a diagnostic consideration in older patients without prior history of malignancy.

Address for correspondence

Dr. Dharmendra Singh

Indian spinal injuries centre

Vasant Kunj, New Delhi

Phone no: 0-9891607098

31. Transpedicular drainage of presacral abscess after failure of antitubercular treatment

Dr Dharmendra Singh,
Dr Tariq, Dr Vishal Nigam, Dr Vikas Tandon, Dr H.S. Chhabrra
Indian spinal injuries centre, Vasant Kunj, New Delhi 110070

Abstract for poster presentation

Lumbosacral tuberculosis can lead to the formation of a presacral abscess. Drainage of the abscess is indicated if it is causing pressure symptoms or if it is not regressing on antitubercular treatment. Presacral region is one of the difficult regions for drainage of abscess as the approaches described for this carry a lot of morbidities. Transpeducular approach is described for the drainage of the presacral abscess. The transpedicular drainage of presacral abscess is a safer option to prevent development of neurological deficit.

32. Giant Cell Tumor (GCT) of the Spine :

Dr Vishal Kundnani, Dr Abhay Nene
SPINE CLINIC ,MUMBAI

Introduction:

Giant cell tumor (GCT) of the spine remains an intriguing and unpredictable entity. It is the most aggressive of the benign primary tumor of the spine, with a high predilection for recurrences. Most available literature reports small series', clearly indicating that it is not a common occurrence.Spinal GCTs however, often present with the unique problem of spinal cord compression due to extension into the spinal canal. Also, as it is often situated on either side of the neural tissues, complete resection becomes surgically challenging, and most often, marginal or intra lesional excision with back up therapy has to be resorted to. As with other sites, various treatment options have been described, ranging from surgical excision to adjuvant modalities like cement injection, phenol ablation, cryotherapy and radio therapy. We report our experience with 9 surgical interventions for 6 patients, over 13 years.

Materials and Methods:

We retrospectively analyzed cases of spinal GCT that had been operated at our clinic between 1993 to date. From the approximately 200 surgeries done for spinal tumors at our clinic during this period, 9 were for GCTs, and formed our study group. All data was extracted from hospital records, including pre operative and sequential post operative clinical findings, radiological details and pictures, and details of the status at last follow up. Neurology was assessed by Frankel grading. Quality of life questionnaires were not used. X rays and CT scans were studied for the presence or recurrence of tumor, instability, and the status of the fusion and spinal implants.

Results:

There were 3 males and 3 females in our group of 6 patients age ranged from 22 to 39 years. Four of our 6 patients had GCTs in the thoracic spine, 1 in the cervical spine (C2) and one in the lumbar spine. There were

no sacral GCTs, despite that being the commonest reported location in the axial skeleton. All patients, presented with cord compression and neurological deficit. All had clinical as well as radiological evidence of spinal instability.

This delayed presentation made emergent surgical intervention mandatory in all our cases. Five surgeries (in 4 patients) were done for recurrent tumors. Two of these patients had had primary surgery with us. One of these had a 2nd recurrence, which also needed intervention, making it 3 surgeries in a single patient. Another of the recurrent tumors presented with superadded infection. One 30 year old lady was being treated as spinal TB, and had already undergone 2 surgeries at another institute, presented with residual tumor, with persistent instability and cord compression.

On X ray, all cases had lytic, expansile lesions, with a 'soap bubble' appearance. Three of the recurrent tumors had implants from the previous surgery. One of these presented with post operative recurrence and instability and showed fractured anterior implants and kyphosis. The other had intact posterior implants with an anterior recurrence of tumor, and neurological deficit without instability. In terms of neurology at presentation, 3 cases graded Frankel C at presentation, and all others were Frankel D.

Though pre operative tissue diagnosis by means of a biopsy is the standard of care today, a positive pretreatment biopsy was not possible / conclusive in any of our cases. Five cases being recurrent tumors, had a histopathology report from the old surgery (though one was interpreted as tuberculosis). Two of the other 4 had an FNAC pre op, which was inconclusive. These were done between 1997 and 1999, when our experience (and that of our radiologists), with core biopsies was limited. However, today, we would definitely recommend a pre op CT guided core biopsy in all patients with suspected spinal GCT.

Surgical details:

In all, of the 9 surgical interventions, 4 were done by the anterior approach, 2 by the posterior approach and 3 had a combined posterior and anterior surgery. For all cases done posteriorly, we used the trans pedicular route for tumor resection and reconstruction with posterior fixation by pedicle screws or sub laminar wires. We found decompression to be adequate by this approach, and it also gave enough access for reconstruction.

Our earlier 4 cases had reconstruction with tricortical iliac strut grafts, while we used cages and bone cement in the 3 later cases. Two cases did not need reconstruction.

Pre operative tumor embolization:

GCT being a highly vascular tumor, digital subtraction angiography (DSA) aided tumor embolization within 24 hours before surgery is recommended. This not only minimizes blood loss, but also permits the surgeon a dry field to carry out optimum tumor excision. In some cases however, DSA shows that a common vascular feeder supplies the spinal cord as well as the tumor. In such cases, embolization cannot be carried out due to the risk of vascular infarct to the spinal cord. All our cases could have a DSA embolization could be procedure before surgery.

Results:

All our 8 interventions achieved the short term goals of neurological spinal decompression and stabilization. All 8 cases returned to Frankel grade E, in the early post operative period. Those that had worse neurology

(Frankel C) to begin with, naturally took longer (3months on an average) to come back to normal neurology. We had no major complications, though 2 of the recurrent cases had superficial wound problems that healed uneventfully.

In the long term, however 2 of our cases had recurrence of the GCT. One 23 year old female with a back and front surgery done in 1997 came back with a recurrence in 2002, with signs of cord compression, and needed and anterior surgical decompression and reconstruction with a cement spacer. The other was a 35 year old male engineer was operated for a Giant cell tumor of the C5 vertebral body, by anterior corpectomy and bone grafting by the senior author (SYB) 13 years ago. He did not receive post op radiation therapy, and the tumor recurred after a year. This time, he had a complex back and front reconstruction with back up radiotherapy, which ensured a long tumor free period. The 'aggressive' Giant cell tumor, however, recurred at 8 years post op, and a redo anterior reconstruction with fibular graft and plating had to be performed in 1999. Further radiation could not be given post op due to potential danger of radiation myelopathy, as maximum possible doses had been previously received. Both of these patients have remained asymptomatic till date, and follow up regularly.

Discussion:

Giant cell tumors in the spine, especially above the sacrum, is a relatively rare entity. According to the report from the Istituto Ortopedico Rizzoli, the incidence is 2.9% in the vertebrae above the sacrum and 2.5% in the sacrum in all giant cell tumors of the bone. We report 9 interventions surgical in 6 patients for GCT of the spine, from the 200 spinal tumors operated at our clinic in the 13 years between 1993 and 2006. Interestingly, though this incidence is similar to published data, there were no sacral GCTs in our series.

Spinal GCTs most commonly present with pain due to the expansile lesion causing periosteal stretch with or without vertebral collapse and spinal instability. This often gets compounded by neurological deficit due to encroachment onto the spinal canal. Asymptomatic, incidental radiological occurrence is uncommon in spinal GCTs. All our patients presented with spinal instability and varying grades of cord compression.

Radiologically, GCTs of the spine present as cystic, expansile lesions on plain roentgenograms. 'Soap bubble' appearance has been described. As against an ABC, a GCT usually affects the vertebral body. Soft tissue outside the cyst is often seen on CT/ MR scans, and seems to suggest local aggression. This soft tissue could be misinterpreted as infection, and is usually not seen in ABCs. All the 5 'new' cases in our series had an MRI as well as a CT scan pre operatively. The 4 recurrent GCTs had CT scans only, as they all had MRI non compatible metallic implants from the primary surgery.

Differential diagnosis of spinal GCTs, on clinico radiological evidence remains Aneurysmal Bone Cyst (ABC) and Tuberculosis (TB). Radiological diagnosis, though resorted to in some situations, has fooled clinicians often enough for us to recommend a definitive diagnostic biopsy before treatment. Though for the previously cited reasons, none of our cases had a positive pre surgical histology, a trans pedicular, CT guided core needle biopsy is definitely recommended in all cases, and is the best method of obtaining a pre treatment diagnosis. As against FNAC, this method can bring out the histopathology of the tumor in 80-85% of cases in our experience. Procedure site bleeding is not uncommon, and the interventional radiologist should be aware of this.

If biopsy is non conclusive, an intra operative frozen section becomes mandatory. Pathologists can usually comment on the aggressiveness of the GCT, which helps planning treatment. Complete, extra lesional surgical resection would be the ideal treatment for spinal GCTs.

However, as the tumor is extremely close to important neuro vascular structures, and has usually broken through the cortex by the time it is diagnosed, extra lesional / en bloc resection is generally not possible. Thus marginal or intra lesional resection followed by local radiotherapy is the treatment that is usually resorted to. Thorough intralesional curettage, and meticulous excision of as much tumor as possible, is important. The tumor wall, rather than the tumor 'substance' has the diagnostic features on histology / frozen section.

Usually, some seeders are expected to stay behind, however thorough the surgical excision is, and hence post op radiotherapy is recommended. Though earlier literature seemed to suggest that irradiation converts benign GCTs to malignant ones, this is no longer true with modern radiotherapy techniques. Recommended method of reconstruction is by cement or metallic cages. Bone graft is avoided because the tumor is known to recur in the grafted bone. Also post operative irradiation is frequently used, hampering graft fusion. Local recurrence in the spine is reported to be lower compared with other locations. A study of the natural history of giant cell tumors of the spine showed that patients with spinal lesions have a better prognosis non spine GCTs.

Weinstein, Boriani et al, in their study of incidence to tumor recurrence in spinal GCTs, state that recurrence rates were substantially higher among patients treated with attempted surgical excision before referral to a tertiary care center, for tumors that involved the vertebral body and posterior elements compared to those limited to the vertebral body only and tumors that had extra-osseous extension into the canal and into the paraspinous musculature. Their system of classifying primary spine tumors is followed by many.

In our group, 4 of the 9 cases were operated for tumor recurrence. Keeping that in mind, we routinely perform a one yearly CT scan to monitor the tumor status, and recommend post operative irradiation to minimize recurrence rates. Thus, in summary, spinal Giant Cell Tumors are challenging clinical entities. Surgical intervention is mandatory and demanding, and close follow up is important to spot recurrences early.

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Legends:

Figure 1: Intra operative picture of a recurrent GCT in the thoracic spine, approached anteriorly

Figure 2(a) : MRI appearance of a GCT in the thoracic spine. Note the lesion extending through the pedicle, affecting all 3 columns.

Figure 2(b) : Post operative x ray after combined posterior and anterior resection and reconstruction

33. Rare complication of Spinal cord injury

Dr Pradeep Singh, Dr Vishal Nigam, Dr Vikas Tandon, Dr HS Chhabra

Indian Spinal Injuries Centre, New Delhi

Presenting complaints (60/F)

- Pain in low back region with left LL radiation
- Weakness in left LL and difficulty in micturition and defecation for past two months

HOPI

Asymptomatic till about 11/2 yrs back with gradual onset back pain which gradually started radiating to left LL. This was followed by progressive weakness in both lower limbs and loss of control over bladder and bowel. Since last 1 day she has developed acute retention of urine.

Examination

- Motor: hip and knee B/L 3/5
- Ankle Left EHL EDL 1/5; rightt 3/5
- Plantars B/L up going
- B/L KJ and AJ exaggerated
- Tone B/L increased.
- Sensations decreased below D6
- PAS, VAC present

Diagnosis

- OPLL DORSAL SPINE D 3 / D 6

Treatment

On 14.06.2007 posterolateral decompression D3-D6 with posterior stabilization was done Post op

Complete loss of motor power and sensations till date

But she was again readmitted on 7 / 11/ 07 . She was again readmitted with following complaints . Swelling and puffiness over face with Loose motions and perianal excoriation of skin was present.

- For last 3 days There was history of hot water fomentation for prolonged periods at perianal region

Diagnosis at readmission

- She was diagnosed as a follow up case of OPLL dorsal spine d3/ 6 with bowel and bladder with asia a with complete paraplegia with forniers gangrene
- She was operated in emergency and emergency loop colostomy was done and debriedement of forniers gangrene was done

Conclusion: Fournier,s gangrene is a rare complication of spinal cord injured patients, and should be kept in mind

34. Correction of deformity in Ankylosing spondylitis with traumatic paraplegia

POSTER

Dr Pradeep Singh, Dr Vishal Nigam, Dr Vikas Tandon, Dr HS Chhabra
Indian Spinal Injuries Centre, New Delhi

40 yr / M with Ankylosing spondylitis presented after 8 weeks of injury following fall from height with complaints of Loss of power and sensations in both lower limbs. He was operated else where about 8 weeks earlier for traumatic fracture D10 and laminectomy with pedicle screw fixation and stabilization with moss miami instrumentation was done .

At the time of admission his neurological status was

Power -0 / 5 in lower limbs bilaterally

Sensations impaired from D11 TO L3 bilaterally

PAS / VAC - absent

In view of deformity, primary correction of kyphotic deformity with fixation of the fracture was done by pedicle screw fixation. This not only ensured fixation of unstable fracture, but correction of deformity also ensured proper sitting posture in a wheel chiar.

This greatly facilitated his rehabilitation. Also since the patient had paraplegia, further neural deterioration was avoided.

CONCLUSION: K yphotic correction can be done with fracture fixation in traumatic paraplegia with ankylosing spondylitis.

35. Favorably out come in late decompression in incomplete thoracolumbar burst fractures

PRESENTED BY -

Dr Pradeep Singh, Dr Vishal Nigam, Dr Vikas Tandon, Dr HS Chhabra
Indian Spinal Injuries Centre, New Delhi

Case 1: (18yr / M)

Presents with complain of loss of bowel and bladder sensations and control since 18 weeks following an RTA

He was diagnosed as a case of burst fracture L 1 with bowel and bladder involvement with intact neurology with loss of controll over bladder

He was operated after 18 weeks of injury through anterior approach and and anterior decompression with corpectomy L1 with cage and anterior instrumentation with rods and screw system with staples and bone grafting was done. Post operatively patient regains bladder sensations after the very first postoperative day

Case 2: (42 yr /M)

Presents with complaint of loss of power in both lower limbs and loss of sensations and control over bowel and bladder following an RTA. He was diagnosed as a case of burst fracture L1 (UNSTABLE DENIS) with paraplegia with ASIA B with neurological level D 12.

HE WAS OPERATED after 8 weeks of injury and posterior pedicle screw fixation with anterior decompression with strut bone grafting was done. Post operatively patient started regaining muscle power and sensations from day 1 and now he has grade 4 power in lower limbs and sensations are intact in L1,2,3,4,5,AND S1,2,3,4,5 , his VAC is weak and is doing CIC 4 th hourly and he is walking with help of walker

CONCLUSION

These two cases prove that decompression has favaravably out come even in late presentation of incomplete neurological injuries

36. Reduction of adult isthemic spondylolisthesis : our experience

Presenting author: Dr. Vikas Tandon , Dr. H.S. Chhabra

Spondylolisthesis is a condition in which there is forward slippage of one vertebra over the immediate caudal vertebrae. Reduction is technically demanding and is associated with complications. The study highlights 10 cases of spondylolisthesis in which reduction was achieved after proper decompression, then trans foraminal lumbar interbody fusion was done . The reduction was achieved by using conventional reduction screws and by using K fixator (Krypton fixator) and the differences are highlighted.

37. Patterns of spine involvement in Tuberculosis

Presenting author: Dr. Vikas Tandon

Tuberculosis of spine is a common disease in developing countries. A prospective study was done of 88 patients, M.R.I. screening was done, they were treated as per middle path regimen. The results highlight the involvement of spine with respect to skip lesion, involvement at different levels and correlation with the patients condition. The result of middle path regimen was also highlighted.

38. Dorsal myelopathy - Interesting case

Presenting author: Dr. Vikas Tandon, Dr. Vishal Nigam, Dr. H.S.Chhabra

It was complete study of a case of dorsal myelopathy, highlights clinical feature, neurological involvement , and treatment outcome.

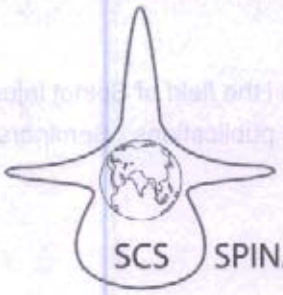
39. Technique of pedicle screw insertion in deformed spine : A concept

Poster

Presenting author: Dr. Vikas Tandon, Dr. Vishal Nigam, Dr. K. Das, Dr. H.S. Chhabra

Pedicle screw fixation in a deformed spine is always a challenge specially when we are dealing with scoliosis. Scoliosis per se is a three dimensional deformity and rotation is a major component, which makes pedicle screw placement very difficult .It is known that body rotates in the convexity of the curve and morphometry changes occur in the pedicle screw.

An in house instrument has been created to ease the insertion of pedicle screw in deformed spine with scoliosis , it can be used peroperatively after preoperative C.T. planning. The initial result of usage of this instrument over deformed spine models have been highlighted.



SPINAL CORD SOCIETY

Dr. H.S. Chhabra
Secretary - Spinal Cord Society
Chief of Spine Service & Medical Director
Indian Spinal Injuries Centre
Sector - C, Vasant Kunj, New Delhi - 110070 India
Ph: +91-11 - 4225 5356/5243/5201
Mobile: +91-98100 54854; Fax: +91-11 - 2689 8810
Email: issicon@isiconline.org/w ww.scs-isic.com
Website: www.isiconline.org

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Online payment not acceptable.

Mail/Email/Fax the Registration form to the address given above.

Spinal Cord Society has been registered to serve as a national co-ordinating, corelating and advisory non profit making body for the study of all problems concerning the causation and prevention of traumatic and non traumatic lesions of spine and spinal cord. For further details write to the Secretary at the address mentioned above.

SPINAL CORD SOCIETY

Aims & Objective

- Serve as a national body for promoting Academics, Education & Research i the field of Spinal Injury.
- Provide an exchange amongst the members and other individuals through publications. Seminars, Conferences, Workshops and other activities.

Membership

- Full Members: Doctors involved in the treatment of Spinal Cord Lesions.
- Associate Members: Para-medical personnel and medical student.

Membership Fee

- **Full Member**
  - Life Membership — Rs. 1000/-
  - One Year Membership — Rs. 200/- per annum.
- **Associate Member**
  - Life Membership — Rs. 600/-
  - One Year Membership — Rs. 150/- per annum.

LIST OF NEW GOVERNING BODY MEMBERS OF SPINAL CORD SOCIETY

S.No.	Name	Designation
1	**Dr. A.K. Mukherjee**	President
2	**Vacant**	Sr. Vice President
3	**Dr. Arvind Jayaswal**	Vice Presidents
4	**Dr. H.N. Bajaj**	Secretary
5	**Dr. H.S. Chhabra**	Jt. Secretary
6	**Vacant**	Treasurer
7	**Dr. Sunil Katoch**	Member
8	**Dr. Patrick Kluger**	Member
9	**Dr. Fazlul Hoque**	Member
10	**Capt. Dilip Sinha**	Member
11	**Dr. D.K. Taneja**	Member
12	**Dr. K.V.P. Singh**	Member
13	**Dr. Navnendra Mathur**	Member
14	**Dr. N.K. Agarwal**	Member

SPINAL CORD SOCIETY
(Indian Chapter)

Fellowship / Observership Form

To

The President

Spinal Cord Society

Sir,

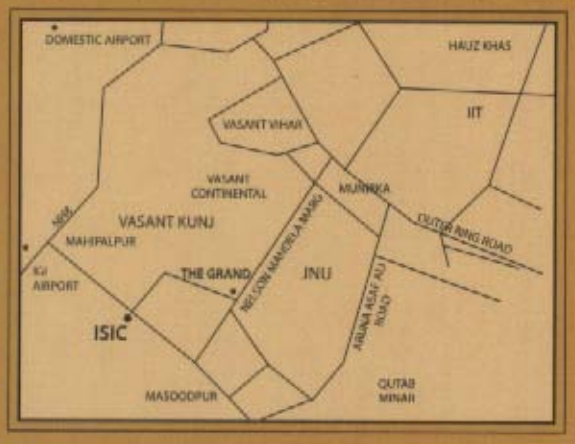
I Dr. ..... would like to apply for a fellowship / observership in spine surgery at the Indian Spinal Injuries Centre for a period of six / twelve weeks from ..... to ..... My special areas of interest are ..... I am enclosing my CV for your kind consideration. I am a member of the spinal cord society and my registration number is .....

Thanking you,

With regards,

Name & Mailing address

Situated at Vasant Kunj, Delhi, virtually next to the airport, spread over an area of 15 acres, surrounded by lush greens - is Indian Spinal Injuries Centre (ISIC) - notable for providing best medical attention to Spinal, Orthopaedic and Neurological problems.



Built with Italian collaboration, established in 1997, this 140 bed hospital has emerged as one of the most reliable institutions of medical care and is a leading hospital in India, for spinal disorders and related specialities.

Indian Spinal Injuries Centre
Sector - C, Vasant Kunj
New Delhi -110070, India
Ph:+91-11-4225 5356/4225 5201
Fax: +91-11-2689 8810
www.isiconline.org