ISSICON 2004

Indian Spinal Injuries Centre

ISICON 2004

International Spine & Spinal Injuries Conference

12th - 14th March 2004; New Delhi, India

2nd Scientific meeting on
'Spinal Cord Society'

ISCOS

Under the patronage of ISCoS
(International Spinal Cord Society)

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Souvenir

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International spine & spinal injuries conference
10th - 15th March 2004

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Indian Spinal Injuries Centre

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

Chairman
Indian Spinal Injuries Centre,
New Delhi

MESSAGE

It is an indeed a great privilege to extend a warm welcome to all the participants of ISSICON 2004. The success of ISSICON 2002 has raised the expectations of a lot of people and we hope we will be able to live up to it.

We are fortunate in having the support of 29 international esteemed faculty members from around the globe. In addition, with the distinguished people in the field of spine from around the country, the total figure of faculty members sums up to 79. Thus for the conference top brains from all over the world would not only be discussing the technical details and recent advances, but would also be putting their minds together to exchange techniques and technology that could be used not only for the affording population around the globe but also to explore the ways and means to bring this technology to the millions of needy but financially deprived sections of the society.

We are grateful to the International Spinal Cord Society (ISCoS) and International Collaboration on Repair Discoveries (Icord) for having supported our endeavour. We are also grateful to all the faculty members and the delegates who have gathered here in order to contribute to the success of the conference.

I hope that all of you have very fruitful deliberations during the conference and spread the message and awareness once you go back. Wishing you a very happy stay in our country.

With regards,

Major H.P.S. Ahluwalia
Chairman,
Indian Spinal Injuries Centre, New Delhi

Wagih El Masry

Honorary Secretary
The International Spinal Cord Society

MESSAGE

It is most encouraging to see the Indian Spine and Spinal Injuries Conference Committee continuing to be very active in the field of

teaching, training, education and research. The organisers of this Congress have put together an excellent programme which is both comprehensive and impressive. The workshops and the Congress cover many important aspects of Spinal Disorders and Spinal Injuries. Furthermore Major Ahluwalia and his team have succeeded in capturing an eminent National and International faculty.

I would like to congratulate Major Ahluwalia , Dr Mukherjee ,Air Marshall Chahal ,Dr Chhabra and all the members of the advisory and Organising Committee for their efforts into putting together such an excellent programme.

On behalf of the Executive of the International Spinal Cord Society I would like to wish the organisers, the speakers/contributors and the delegates of ISSICON 2004 our best wishes for a very successful Congress . I would also welcome a short report of your feedback for publication in our ISCOS newsletter.

With regards,

W S EL MASRY FRCS Ed
Hon Secretary, ISCOS

Prof. JJ Wyndaele MD, DSc, PHD

Honorary Secretary
The International Spinal Cord Society

MESSAGE

"As chairman of the ISCoS Education Committee I congratulate the organizers for their continuing effort in promoting the comprehensive management of spinal cord lesioned patients. Symposia and workshops are a fruitful way to bring the practical knowledge to all involved in this care. Different aspects will be enlighted during these days and attendants will learn from the experience around the world and the application to their own local circumstances.

It is a great pleasure to see such a promising programme and so many presenters from different centers and hospitals. Spinal cord lesioned patients deserve the most optimal approach. This is a process in constant evolution and new data and experience are acknowledged every day. Primary and secondary prevention are among the topics dealt with and they are very important indeed.

ISCoS and its education committee are happy to be able to help to stimulate education and assist in this congress.

Knowledge is at the true basis of proper handling.

Prof. JJ Wyndaele MD, DSci, PhD
Honorary Secretary
The International Spinal Cord Society

Air Marshal A. S. Chahal

Director General (Emeritus), ISIC
New Delhi

MESSAGE

It gives me great pleasure to welcome all of you to ISSICON-2004. The success of ISSICON-2004 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.

Ever since we had brought the concept of comprehensive management of Spinal Injuries to the country, the management of complications had been a big challenge. Even though world over the pattern of these complications is changing in the developing countries the management of complications may still be the leading complication. The deliberations during the course of the conference would be very useful since minds from the developed and the developing countries would get together to focus attention on this issue. We hope that all of you would contribute to the success of the conference through your active contribution 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. 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 March, 2004 in Indian Spinal Injuries Centre 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, ISIC, New Delhi

From the Editor's Desk

The last two decades have witnessed a tremendous advancement in out knowledge of the pathophysiology of spinal problems and the technology available to diagnose and treat them. Unfortunately, not all spine surgeries go without complications or result in a successful outcome. Once there is a complication or if the surgery fails, the medical and social costs to the society increase exponentially. Although patients with complications are appearing more frequently at tertiary level hospitals and we continue to face these problems in our practice, we often shirk from discussing the difficult problems of managing these patients.

Similarly complications in Spinal injuries not only result in significant morbidity and mortality of the patient, but also increases substantially the costs to the patients and the society.

Taking the above into consideration the theme of the conference was kept as "Complications in Spinal Injuries and Spine Surgery". We have tried to cover all aspects related to the theme in the scientific programme. We are fortunate in having the support of 33 distinguished international faculty members and 47 esteemed national faculty members for this conference. We assure you that we will leave no stones unturned to make this event an academic feast so that we can do justice to the efforts put in by our distinguished faculty members and to the time spared by all the delegates.

As the organising Secretary of ISSICON-2004 and the editor of the Souvenir it is my obligation to thank the whole team of ISIC and all others who have contributed towards making this event a reality.

I would want to thank the International Spinal Cord Society and International Collaboration on Repair Discoveries for having patronized the conference. I would also want to thank all the exhibitors who have sponsored the conference.

We welcome you to ISSICON-2004 and hope that we will be able to live up to your expectations. Hope to see you again at the next ISSICON.

With regards,

Harvinder Singh

Dr. H.S. Chhabra,

Addl. Medical Director,

Indian Spinal Injuries Centre, New Delhi

LIST OF INTERNATIONAL FACULTY MEMBERS OF ISSICON-2004

1. Dr. Jean Jacques Wyndaele, Prof. of Urology, University Hospital, Belgium Secretary of International Spinal Cord Society
2. Dr. Douglas Brown, Medical Director, Spinal Injuries Centre Melbourne, Australia
3. Prof. Sait Naderi, President, Spine Section of Turkish Neurosurgical Society
4. Prof. Dejan Popovic, Aalborg University, Denmark
5. Dr. Patrick Kluger, Spinal Surgeon, Stoke Mandeville Hospital, U.K.
6. Prof. Mehmet Zileli, Professor of Neurosurgery, Turkey
7. Dr. Paolo Marchettini, Director of Pain Medicine Centre, HSR, Milano, Italy
8. Mr. Gerry Towns, Consultant Neurosurgeon – Leeds UK
9. Prof. Haluk Berk, Professor of Orthopedic Surgery, Member of Executive, Committee of Spine Society of Europe
10. Dr. Stuart Ross, Neurosurgeon – Leeds, UK
11. Prof. Selcuk Palaoglu, Neurosurgeon, Ex-President of Spine Section of Turkish Neurosurgical Society
12. Mr. Abhay Rao, Orthopaedic Spinal Surgeon – Leeds, UK
13. Dr. Wee Fu Tan, Mediscdh' Centrum Alkmaar, Deptt. Neurosurgery, Netherlands
14. Ms. Martha Horn, Occupational Therapist, Murnau, Germany
15. Dr. Stanley Ducharme, Andrologist, Spinal Injuries Centre, Boston
16. Dr. Fahir Ozer, Ex. President, Spine Section of Turkish Neurosurgical society
17. Dr. Inder Perkash, MD, FRCS, FACS, Physiatrist, Stanford, USA
18. Dr. (Mrs.) Arundhati Perkash, MD PhD, Physiatrist, Stanford, USA
19. Dr. Ashwini Sharan, MD, Thomas Jefferson University, Department of Neurosurgery, PA, USA
20. Professor Dajue Wang, National Spinal Injuries Centre, Stoke Mandeville Hospital, Aylesbury, UK
21. Dr. John Steeves, Professor and Director of ICORD, UBC and Vancouver Hospital
22. Professor Mohamed A. Maziad, Ain Shams University, Caiso, Egypt
23. Mr. Nabil Alageli, M.Med, Sci (Trauma), FRCS Ed, DSR, Consultant Surgeon in Spinal Injuries, Yorkeshire Regional Spinal Injuries Centre.
24. Dr. Kamaljeet Paul, USA
25. Mr. Gurpreet Singh, UK
26. Dr. Julio Gallego, Spinal Surgeon – Memphis, USA
27. Dr. Anil Shrestha, Orthopaedic Surgeon, Kathmandu, Nepal,
28. Dr. M.A. Salam, Associate Professor Urology, Bangladesh.
29. Dr. Fazlul Hoque, Orthopaedic Surgeon, CRP, Bangladesh.
30. Prof. Md. Serajul Isalm, Secretary General, Bangladesh Orthopaedic Society
31. Dr. Mainul Haque Sarker, Secretary General, Bangladesh Neurosurgeons Association, Dhaka
32. Mr. Sanjeev Sharma, UK
33. Dr. Fahed Selmi, National Spinal Injuries Centre, Stoke Mandeville Hospital, Aylesbury, UK.

LIST OF INDIAN FACULTY

1. Dr. P. Sarat Chandra – AIIMS, New Delhi
2. Dr. Ashish Suri – AIIMS, New Delhi
3. Dr. Abhay Nene, Orthopaedic Spinal Surgeon, Mumbai
4. Dr. V. T. Ingalhalikar, Consultant & Surgeon for Spinal Affections, Thane, Maharashtra
5. Dr. Gautam Zaveri, Consultant Spine Surgeon, Zaveri Clinic, Ghatkopar, Mumbai
6. Dr. S.M. Hardikar, Hardikar Hospital, Pune
7. Dr. Raj Bahadur, Head of Deptt. of Orthopaedics, Medical Superintendent, Government Medical College & Hospital, Chandigarh.
8. Prof. Mazhar Hussain, Head of Department Neurosurgery, King George Medical College, Lucknow
9. Dr. Rajagopalan, St. John's Medical College & Hospital, Bangalore
10. Dr. Ashok N. Johari, M.S. Orth, Dr. Johari's Nursing Home, Mumbai
11. Dr. P.S. Bawa, Consultant Neurosurgeon, Mata Chanan Devi Hospital, New Delhi
12. Dr. Shekhar Bhojraj, P. D. Hinduja National Hospital, Mumbai
13. Dr. S. M. Tuli, Consultant Orthopaedic Surgeon, VIMHANS, New Delhi
14. Dr. P. K. Sahoo, Army Hospital, New Delhi

15. Dr. Ravi Kumar, Bhopal
16. Dr. Satish Chandra Gore, MBBS, MS (Ortho), FABMISS MRCPS (USA) (Hon.), Kamla Regencey, Pune
17. Dr. Yash Gulati, Apollo Hospital, Delhi
18. Dr. U. Singh, Head of Deptt., AIIMS, New Delhi
19. Dr. Navnender Mathur, Physical Medicine and Rehabilitation, SMS Medical College and Hospital, Jaipur
20. Prof. A. K. Singh, G. B. Pant Hospital, New Delhi
21. Dr. H. C. Goel, Deptt. of Rehabilitation, Safdarjung Hospital, New Delhi
22. Dr. (Capt.) Dilip Sinha, Assistant Professor Orthopaedics, Patna Medical College Hospital, Patna
23. Dr. Harash Mahajan, MRI Centre, Green Park, New Delhi
24. Dr. Sanjay Wadhwa, Addl. Professor, Deptt. of Physical Medicine and Rehabilitation, AIIMS, New Delhi
25. Dr. G. P. Dureja, AIIMS, New Delhi
26. Dr. Prashant Kekre, Orthopaedic Surgeon, Chennai
27. Prof. V. S. Mehta, Head of Neurosurgery Deptt, AIIMS, New Delhi
28. Dr. Rajender Prashad, Orthopaedic Department P.M.C.H., Patna
29. Dr. Sharad Shashank Kale, Assistant Professor, Neurosurgery, AIIMS, New Delhi
30. Dr. A. Jayaswal, AIIMS, New Delhi
31. Dr. Sajan Hegde, Consultant Orthopaedic Surgeon, Apollo Hospital, Chennai
32. Dr. Shankar Acharya, Consultant Spine Surgeon, Sir Gangaram Hospital, New Delhi
33. Dr. Raghava Dutt Mulukutla, Consultant Orthopaedic & Spine Surgeon, UDAI Clinic, Hyderabad
34. Dr. Anil Bahadur Shrestha, MD, Nepal Orthopaedic Hospital, Nepal
35. Dr. Sanjay Tyagi, Consultant Neurosurgeon, Apollo Hospital, New Delhi
36. Dr. S.L. Yadav,
38. Dr. Harsh Mahajan, GMR Institute, New Delhi.
39. Dr. Kailai Rajan,
40. Dr. Rajesh Kapur, Consultant Radiologist, New Delhi
40. Prof. P.K. Dave, Director, Rockland Hospital, New Delhi
41. Dr. T.S. Kanaka, Neurosurgeon, Chennai
42. Dr. H. S. Chhabra, Indian Spinal Injuries Centre, New Delhi
43. Dr. H. N. Bajaj, Indian Spinal Injuries Centre, New Delhi
44. Dr. Sunil Katoch, Indian Spinal Injuries Centre, New Delhi
45. Dr. Ritabh Kumar, Indian Spinal Injuries Centre, New Delhi
46. Dr. K. Das, Indian Spinal Injuries Centre, New Delhi
47. Dr. Deepak Raina, Indian Spinal Injuries Centre, New Delhi
48. Maj. HPS Ahluwalia, Indian Spinal Injuries Centre, New Delhi
49. Dr. P. K. Dave, Director, Rockland Institute, New Delhi
51. Prof. N. P. Gupta, HOD, Urology, AIIMS, New Delhi
52. Dr. S. K. Kame, Consultant Orthpaedic Surgeon, New Delhi
53. Dr. Sudhir Kapoor, Consultant Orthpaedic Surgeon, MAMC, New Delhi
54. Dr. R. K. Srivastava, Asst. Director General Health Services
55. Dr. A. D. Sehgal, Consultant Neuro Sergeon, SGRH & Sehgal Nursing Home, New Delhi
56. Dr. Kalai Rajan, Madurai, Chennai
57. Dr. P. S. Maini, Sri Gangaram Hospital, New Delhi
58. Dr. T. K. Shangmugha Sundaram, Chennai
59. Dr. Vinod Puri, Consultnat Neurology, G. B. Pant Hospital, New Delhi
60. Dr. A. K. Jain, UCMS, New Delhi
61. Col. V. S. Madan, Consultnat Neuro Sergeon, Sir Gangaram Hospital, New Delhi
62. Dr. Sudhir Kumar, UCMS, New Delhi
63. Dr. Arvind Jayaswal, All India Institute of Medical Sciences.

ISSICON 2002- PROGREAMME

PRE-CONFERENCE WORKSHOP ON "SPINE FIXATION"

Wednesday, 10th March 2004

CONFERENCE ROOM

9:30 – 5:30 PM Live demonstration of Surgeries

Thursday, 11th March 2004

AUDITORIUM Chairperson – Mr. Gerry Towns

9:00 – 9:20 Principles of Instrumentation
- **Dr. V. T. Ingalhalikar, Consultant & Surgeon for Spinal Affections, Thane, Maharashtra**

Upper Cervical Spine Fixation

Chairperson – Dr. Wee Fu Tan

9:20 – 9:30 Anterior Screw Stabilization of Odontoid
- **Dr. Ashwini Sharan, MD, Thomas Jefferson University, Department of Neurosurgery, PA**

9:30 – 9:40 Posterior Atlanto Axial Screw Fixation
- **Dr. Patrick Kluger, Spinal Surgeon, Stoke Mandeville Hospital, UK**

9:40 – 9:50 Other Techniques of Atlanto Axial Fixation
- **Dr. Rajender Prashad**

9:50 – 10:00 Occipito Cervical Fixation
- **Mr. Gerry Towns, Consultant Neurosurgeon, Leeds, UK**

10:00 – 10:10 Discussion

Lower Cervical Spine Fixation

Chairperson - Dr. Kamaljeet S. Paul

10:10 – 10:25 Indications, Biomechanics and Techniques of Anterior Lower Cervical Spine Instrumentation
- **Dr. Wee Fu Tan, Mediscdh' Centrum Alkmaar, Deptt. Neurosurgery, Netherlands**

10:25 – 10:35 Lower Cervical Spine Fixation - Wiring Techniques
- **Dr. Sharad Shashank Kale, Assistant Professor, Neurosurgery, AIIMS, New Delhi**

10:35 – 10:45 Lower Cervical Spine Fixation - Lateral Mass Plating
- **Dr. K. Das, Consultant Orthopaedics, ISIC, New Delhi.**

10:45 – 10:55 Indications, Biomechanics and Techniques of Cervicothoracic Spine Instrumentation
- **Mr. Gerry Towns, Consultant Neurosurgeon, Leeds, UK**

10:55 – 11:05 Discussion

11:05 – 11:20 Tea

11:20 – 12:05 Workshop – I

Thoracolumbar Instrumentation

Chairperson – Dr. Sajan Hegde

12:05 – 12:20 Indications, Biomechanics and Techniques of Anterior Thoracolumbar Instrumentation
- **Dr. H.N. Bajaj, Consultant Orthopaedic Surgeon, ISIC, New Delhi**

12:20 – 12:30 Pedicle Screw fixation – The State of the art
- **Dr. Sunil Katoch, Consultant Orthopaedic Surgeon, ISIC, New Delhi**

12:30 – 12:40 Thoracic Pedicle screw Fixation
- **Dr. H.S. Chhabra, Addl. Medical Director, ISIC, New Delhi.**

12:40 – 12:50 Sublaminar Wiring Techniques in Posterior Spinal instrumentation
- **Dr. Abhay Nene, Orthopaedic Spinal Surgeon, Mumbai**

12:50 – 13:00 Discussion

13:00 – 13:30 Lunch

13:30 – 14:45 Workshop – II

Deformity

Chairperson – Dr. Arvind Jayaswal

14:15 – 14:30 Principles of Scoliosis correction and instrumentation
- **Dr. Arvind Jayaswal, Professor, Deptt. of Orthopaedic, AIIMS, New Delhi**

14:30 – 14:45 3D – Correction of Neurogenic Scoliosis with K-Fixator
- **Dr. Raj Singhal, Senior Registrar, Stoke Mandeville Hospital, UK**

14:45 – 15:00 Principles of Kyphosis correction and instrumentation
- **Dr. Sajan Hegde**

15:00 – 15:15 Indications, Biomechanics and Techniques of Instrumentation for Management of Spondylolysthesis
- **Dr. Patrick Kluger, Spinal Surgeon, Stoke Mandeville Hospital, UK**

15:15 – 15:25 Discussion

Infections

Chairperson - Dr. Dr. Yash Gulati

15:25 – 15:37 Principle of Surgery and Instrumentation in Infections of the Spine
- **Mr. Stuart Ross, Neurosurgeon – Leeds, UK**

15:37 – 15:40 Discussion

Degenerative Disease

Chairperson – Dr. V.T. Ingalhalikar

15:40 – 15:50 Indication and Biomechanics of Cages in Cervical Spine
- **Mr. Stuart Ross, Neurosurgeon – Leeds, UK**

15:50 – 16:05 Indication and Biomechanics of Cervical Spine instrumentation for degenerative disorders of Cervical Spine
- **Dr. Kamaljeet S. Paul, Neurosurgeon, Wisconsin, USA**

16:05 – 16:15 Cervical Disc Replacement
- **Dr. P.K. Sahoo, Consultant Neurosurgeon, R & R Hospital, Delhi**

16:15 – 16:25 Indication and Biomechanics of Lumbar Intervertebral Cages for Degenerative Disc Disease
- **Dr. Sajan Hegde, Consultant Orthopaedic Surgeon, Apollo Hospital, Chennai**

16:25 – 16:35 Indication and Biomechanics of Lumbar Spinal instrumentation for degenerative disorders of the lumbar spine
- **Dr. Yash Gulati, Consultant Orthopaedic Surgeon, Apollo Hospital, Delhi**

16:35 – 16:40 Discussion

16:40 – 16:50 Tea

Minimally Invasive Surgery

Chairperson – Dr. Patrick Kluger

16:50 – 17:00 Minimally Invasive instrumentation and Stabilization of the Lumbar Spine
- Dr. Julio Gallego, Spinal Surgeon – Memphis, USA

17:00 – 17:10 Thoracoscopic Anterior Spine Surgery
- Dr. Arvind Jayaswal, Prof., Deptt. of Orthopaedics, AIIMS, New Delhi

17:10 – 17:20 Discussion

17:20 – 18:00 Workshop

PRE-CONFERENCE WORKSHOP ON "SEXUALITY AND FERTILITY IN SPINAL CORD INJURED PATIENTS"

Thursday, 11th March 2004

HALL B

9:00 – 9:15	Anatomy and Physiology of Normal and Spinal Cord Injured Male Genitourinary System - **Dr. Sanjeev Sharma**
9:15 – 9:35	Anatomy and Physiology of Normal and Spinal Cord Injured Female Genitourinary System - **Dr. Jean Jacques Wyndaele, Prof. of Urology, University Hospital, Belgium. President of International Spinal Cord Society, Education Committee**
9:35 – 9:45	Discussion
9:45 – 10:05	Psychosocial and Sexual adjustment of the Spinal Cord Injured and the Partner - **Dr. Stanley Ducharme, Andrologist, Spinal Injuries Centre, Boston, USA**
10:05 – 10:15	Discussion
10:15 – 10:30	Non-Surgical Techniques to restore Erection in Spinal Cord Injured - **Dr. Inder Perkash, M.D., M.S., F.R.C.S.,F.A.C.S, Professor Urology, P.V.A. Professor Spinal Cord Injuries and Professor P.M&R Stanford And Director Spinal Cord Injuries Center Palo Alto V.A. Health Care System, USA**
10:30 – 10:45	Surgical Techniques to restore Erection in Spinal Cord Injured - **Mr. Gurpreet Singh, Urologist, UK**
10:45 – 11:05	Techniques of Ejaculation in Spinal Cord Injured - **Dr. Inder Perkash, M.D., M.S., F.R.C.S.,F.A.C.S, Professor Urology, P.V.A. Professor Spinal Cord Injuries and Professor P.M&R Stanford And Director Spinal Cord Injuries Center Palo Alto V.A. Health Care System, USA**
11:05 – 11:20	Tea
11:20 – 11:35	Sexual Counselling of Couples with Spinal Cord Injury - **Dr. Stanley Ducharme, Andrologist, Spinal Injuries Centre, Boston, USA**
11:35 – 11:55	Protocol of Sexual Management of Spinal Cord Injury at ISIC - **Ms. Anuradha Rakesh, Mr. Shivjit Singh Raghav, M. Subhashini and Dr. S.V. Kotwal, ISIC, New Delhi**
11:55 – 12:40	Demonstration on Models and Video – I
12:40 – 13:25	Lunch
13:25 – 13:40	Medical Aspects of Sexuality and Fertility in Female Spinal Cord Injured - **Dr. Inder Perkash, M.D., M.S., F.R.C.S., F.A.C.S, Professor Urology, P.V.A. Professor Spinal Cord Injuries and Professor P.M&R Stanford And Director Spinal Cord Injuries Center Palo Alto V.A. Health Care System, USA**
13:40 – 13:55	Sexuality in spinal Cord Injured – The Indian Experience - **Dr. Dinesh Suman, Urologist, ISIC, New Delhi**
13:55 – 14:05	Discussion
14:05 – 14:20	Sexuality in spinal Cord Injured Males of India – The Peer Group Experience - **Mr. Shivjit Singh Raghav, Peer Counsellor, ISIC, New Delhi**
14:20 – 14:35	Sexuality in spinal Cord Injured Females of India – The Peer Group Experience - **Ms. Komal Kamra, ISIC, Consumer Group, New Delhi**
14:35 – 14:45	Discussion
14:45 – 15:00	When and How to Provide Fertility Counselling
15:00 – 15:20	Role of Assisted Reproductive Technologies in the management of Fertility in Spinal Injury - **Dr. Sanjeev Sharma, Consultant Obstetrician and Gynaecologist, Southport and Ormskirk Hospital, South port, UK**
15:20 - 15:35	Indian experience dealing with sexuality & Fertility in SCI - **Dr. Vijay Kulkarni, Consultant Andrologist & Microsurgeon, Bhatia General Hospital, Mumbai**
15:35 – 15:50	Parenting with a Spinal Cord Injury - **Dr. Stanley Ducharme, Andrologist, Spinal Injuries Centre, Boston, USA**
15:50 – 16:00	Discussion
16:00 – 16:15	Tea
16:15 – 16:45	Panel discussion – Sexuality & Fertility in Spinal cord Injured in Developing Countries
16:45 – 17:30	Demonstration on Models and video – II

SCIENTIFIC PROGRAMME
OF
INTERNATIONAL SPINE & SPINAL INJURIES CONFERENCE (ISSICON – 2004)

Venue: Indian Spinal Injuries Centre

Dates: 10th to 15th March 2004

Wednesday, 10th March 2004

CONFERENCE ROOM	PRE-CONFERENCE WORKSHOP ON "SPINE FIXATION"
9:00 – 18:00	LIVE DEMONSTRATION OF SURGERIES

Thursday, 11th March 2004

AUDITORIUM	PRE-CONFERENCE WORKSHOP ON "SPINE FIXATION"
9:00 – 17:30	TALKS AND HANDS ON WORKSHOP
CONFERENCE ROOM	PRE-CONFERENCE WORKSHOP ON "SEXUALITY AND FERTILITY IN SPINAL CORD INJURED PATIENTS"
9:00 – 17:30	TALKS AND DEMONSTRATION

Friday, 12th March 2004

7:30 – 8:45	REGISTRATION
8:45 – 9:00	WELCOME ADDRESS

Session – I

Chairperson	Dr. A.K. Mukherjee
9:00 – 9:50	SPINAL CORD SOCIETY ORATION – "FROM DISCOVERY TO CLINICAL PRACTICE: THE TRIALS AND TRIBULATIONS IN THE TRANSLATION OF SCIENCE" - **Dr. John Steeves, Director of International Collaboration on Repair Discoveries, Vancouver, Canada**

Session – II

Chairpersons	Dr. Douglas Brown, Dr. V.T. Ingalhalikar
9:50 – 10:30	SYMPOSIUM ON "COMPLICATION RATE IS HIGHER IN CONSERVATIVELY TREATED PATIENTS WITH SPINAL INJURY"
-	For – Dr. Patrick Kluger, Spinal Surgeon, Stoke Mandeville Hospital, U.K.
-	Against - Mr. Nabil Alageli, M. Med, Sci. (Trauma), FRCS Ed, DSR, Consultant Surgeon in Spinal Injuries, Yorkshire Regional Spinal Injuries Centre, UK
10:30 – 10:50	BREAK
11:00 – 13:00	**SCS GOLD MEDAL AWARDS**

Session – III

AUDITORIUM	PARALLEL FREE PAPER SESSION ON SURGICAL MANAGEMENT
Chairperson	Dr. Patrick Kluger, Dr. P.K. Dave
Judges	Mr. Gerry Towns, Mr. Stuart Ross, Dr. Wee Fu Tan, Dr. Ashwini Sharan, Prof. Selcuk Palaoglu, Prof. Haluk Berk, Dr. V.T. Ingalhalikar, Dr. H.N. Bajaj
11:00 – 11:10	MORPHOMETRIC ASSESSMENT OF T9 TO S1 VERTEBRA PEDICLES IN PATIENTS FROM THE INDIAN SUBCONTINENT - **Dr. Manish Chadha, Lecturer, UCMS & GTB Hospital, New Delhi**
11:10 – 11:20	PEDICLE MORPHOTMETRY IN A SAMPLE OF INDIAN POPULATION - **Dr. Meena Devkant, Dr. B. N. Upendra, Dr. Abrar Ahmed, Dr. Sanjay Sharma, Dr. B.D. Choudhury & Dr. Arvind Jayaswal, AIIMS, New Delhi**
11:20 – 11:30	PTB – AN INNOVATIVE METHOD FOR SPINE BIOPSY - **Dr. Mukesh Aggarwal, Orthopaedic – Spine, NDMVPS Medical College, Nasik, Maharashtra.**
11:30 – 11:40	INTRATHECAL SODIUM NITROPRUSSIDE SUPERFUSION IN VARIOUS ETIOLOGIES OF PARAPARETIC PATIENTS - **Dr. Vinod Kumar Tewari & Prof. Mazhar Husain, Department of Neurosurgery, KGMC, Lucknow, UP** - **Prof. Shashi Bhushan, Deptt. of Anesthesia, King George's Medical College, Lucknow, UP** - **Dr. Rajeshwar Nath Shrivastava, Deptt. of Orthopaedics, King George's Medical College, Lucknow, UP** - **Prof. Usha Kant Mishra, Head Neurology, SGPGI, Lucknow, UP**
11:40 – 11:50	SURGERY IN SPINAL CORD INJURY - **Prof. Dr. J. D. P. Sinha, Patna Medical College, Patna, Bihar**
11:50 – 12:00	APPROPRIATE EARLY SURGICAL INTERVENTION CAN PREVENT COMPLICATIONS AND DELAY IN REHABILITATION AFTER TRAUMATIC SPINAL CORD LESION: RETROSPECTIVE ANALYSIS OF 70 PATIENTS - **Dr. F. Selmi, Dr. M. Al-Maiyah, Dr. P. Kluger, National Spinal Injuries Centre (NSIC), Stoke Mandeville Hospital, Aylesbury, UK**
12:00 – 12:10	MANAGEMENT OF ODONTOID FRACTURES WITH ANTERIOR SCREW FIXATION - **Dr. Arun Bhanot, Orthopaedics, Govt. Medical College & Hospital, Chandigarh**
12:10 – 12:20	POST OP PROBLEMS IN LUMBAR SURGERY, CAN WE AVOID THEM? - **Dr. (Mrs.) Sandhya V. Ekbote, Dr. V.T. Ingalhalikar, Dr. (Mrs.) S.S. Kher, Dr. (Ms). Seema Nandkarni & Dr. (Mrs.) D.V. Joshi, Aditya Nursing Home, Maharashtra**
12:20 – 12:30	THE RESULTS OF SURGERY IN DORSAL KOCHS SPINE WITH NEUROLOGICAL DEFICIT - **Dr. Atit Kantawala, Department of Orthopaedics, Samved Orthopaedic Institute, Ahmedabad**
12:30 – 12:40	POSTERIOR VERTEBRECTOMY FOR DORSOLUMBAR KYPHOTIC DEFORMITIES - **Dr. Sanjay Dhar, T. N. Medical College & B. Y. L. Nair Hospital, Mumbai**
12:40 – 12:50	OUTCOME OF 46 CASES WITH SPONDYLOLYSTHESIS TREATED WITH POSTEROLATERAL FUSION AND TRANSPEDICULAR SCREW FIXATION - **Dr. Rajat Chopra (DNB), Dr. Shankar Acharya And Dr. K.L. Kalra, (MS), Sir Ganga Ram Hospital, New Delhi**

12:50 – 13:00	MULTIPLE FENESTRATIONS IN LUMBAR CANAL STENOSIS: OUTCOME & EVALUATION: A REVIEW OF 46 PATIENTS - **Dr. Rupinder Chahal, Dr. Shankar Acharya (MS, DNB, FRCS, MCH), Sir Ganga Ram Hospital, New Delhi**
11:00 – 13:00	SCS GOLD MEDAL AWARDS

Sessions – IV

CONFERENCE ROOM	PARALLEL FREE PAPER SESSION ON REHABILITATION MANAGEMENT
Chairpersons	Dr. A.K. Mukherjee, Mr. Nabil Alageli
Judges	Dr. Douglas Brown, Dr. Jean Jacques Wyndaele, Dr. Inder Prakash, Dr. Dajue Wang, Mr. Gurpreet Singh, Dr. Stanley Ducharme, Dr. U Singh
11:00 – 11:10	ONE BREATH COUNT – FOR BED SIDE MONITORING OF EXPIRATORY RESERVE VOLUME AND VENTILATORY MUSCLE ENDURANCE IN TETRAPLEGICS - **Dr. (Capt.) Dilip Kumar Sinha, Associate Professor, HOPE Hospital, Mithapur B Area, Patna, Bihar**
11.10 – 11:20	LEVEL SPECIFIC EFFECT OF SPINAL CORD INJURY ON RESPIRATORY FUNCTION - **Dr. Gondhiya Jatin A, Dr. Chilvana V. Patel and Dr. Dilip A. Patel, Govt. Physiotherapy College, Civil Hospital, Ahmedabad**
11:20 – 11:30	DEVELOPING GRAPHOMOTOR SKILL REGIME FOR TETRAPLEGICS - **Ms. Shiva Jasrotia, Occupational Department, ISIC, New Delhi**
11:30 – 11:40	HAND REHABILITATION REGIME FOR TETRAPLEGICS - **Ms. M. Subhashini, Coordinator, Department of Occupational Therapy, ISIC, New Delhi**
11:40 – 11:50	PREVALENCE OF MEDICAL COMPLICATIONS VIS-A-VIS PSYCHOSOCIAL COMPLICATIONS IN SPINAL CORD INJURY PATIENTS - **Dr. Sindhu Vijaykumar, Dr. Upinderpal Singh, Deptt. of Physical Medicine & Rehabilitation, AIIMS, New Delhi.**
11:50 – 12:00	SEXUALITY AND WOMEN WITH SPINAL CORD INJURY – INDIAN SCENARIO - **Dr. Roop Singh, Department of Orthopaedics, PGIMS, Rohtak, Haryana**
12:00 – 12:10	VICISSITUDE IN SEXUAL RELATIONSHIP AFTER SPINAL CORD INJURY: A MULTIDISCIPLINARY APPROACH - **Ms. Anuradha Rakesh, Clinical Psychologist, ISIC, New Delhi**
12:10 – 12:20	SPASTICITY & PHENOL NERVE BLOCKS - **Dr. Elluri Rajendra Kumar, Nizams Institute of Medical Sciences (NIMS), Hyderabad**
12:20 – 12:30	PROBLEM FACED DURING FITMENT AND CARE OF HALOBRACE - **Mr. Praveen Dubey, Head of Orthotic Department, ISIC, New Delhi**
12:30 – 12:40	PRESSURE SORES IN SPINAL INJURY PATIENTS - OUR EXPERIENCE - **Dr. Nalli R. Uvraj, Department of Orthopaedics, Madras Medical College & Govt. General Hospital, Chennai**
12:40 – 12:50	PEDIATRIC SPINE INJURY – A CLINICO – EPIDEMIOLOGICAL STUDY - **Dr. Rajendra Prasad, Dr. A.K. Manav, Prof. (Capt.) D.K. Sinha and Prof. (Dr.) Arjun Singh, Orthopaedic Department P.M.C.H., Patna.**
12:50 – 13:00	NEW DESIGN OF HALO BRACE - **Mr. Kaushal Kishore Ashutosh & Ms. Poonam Rani, Orthotic Department, ISIC, New Delhi**
13: 00 – 13: 45	BREAK & POSTER VIEWING
Judges For Best Poster Award	Dr. Douglas Brown, Dr. Jean Jacques Wyndaele, Mr. Gerry Towns, Dr. Wee Fu Tan, Dr. Kamaljeet Paul, Dr. Ashwini Sharan

Session – V

AUDITORIUM	COMPLICATIONS IN SPINAL INSTRUMENTATION
Chairpersons	Dr. S.M. Hardikar, Mr. Stuart Ross
13:45 – 13:55	"POSTERIOR FIXATION IN CRANIO VERTEBRAL JUNCTION ANAMALIES – EVOLUTION FROM STEEL TO TITANIUM CONSTRUCTS" - **Dr. P. Sarat Chandra – AIIMS, New Delhi**
13:55 – 14:05	"IMAGE GUIDANCE IN SPINAL INSTRUMENTATION" - **Dr. Ashish Suri – AIIMS, New Delhi**
14:05 – 14:20	COMPLICATIONS IN ANTERIOR LOWER CERVICAL SPINE INSTRUMENTATION - **Dr. Kamaljeet S. Paul, Neurosurgeon, Wisconsin, USA**
14: 20 – 14: 30	"SUBLAMINAR WIRING - THE ISSUE OF NEUROLOGICAL SAFETY" - **Dr. Abhay Nene, Orthopaedic Spinal Surgeon, Mumbai**
14: 30 – 14: 50	"PERILS AND PITFALLS OF SPINAL INSTRUMENTATION" - **Dr. V. T. Ingalhalikar, Consultant & Surgeon for Spinal Affections, Thane, Maharashtra**
14: 50 – 15: 00	DISCUSSION

Session – VI

CONFERENCE ROOM	SPINAL INJURY HEALTH IN INDIA
Chairperson	Major H.P.S. Ahluwalia
14: 00 – 14: 15	"SPINAL INJURY SCENARIO IN INDIA" - **Dr. A.K. Mukherjee, Director General, ISIC, New Delhi**
14:15 – 14:25	EPIDEMIOLOGY OF SPINAL CORD INJURIES IN RAJASTHAN - **Dr. Navnendra Mathur, Deptt. of Physical Medicine and Rehabilitation, SMS Medical College and Hospital, Jaipur**
14:25 – 14:35	EPIDEMIOLOGY OF SPINAL CORD INJURIES IN BIHAR - **Dr. (Capt.) Dilip Kumar Sinha, Associate Professor, HOPE Hospital, Mithapur B Area, Patna, Bihar**
14: 35 – 14: 50	EXPERIENCES OF SPINAL INJURY CONSUMER GROUP
14:500 – 15:00	DISCUSSION
15: 00 – 15: 20	BREAK

Session - VII

AUDITORIUM	COMPLICATIONS OF CERVICAL SPINE SURGERY
Chairpersons	Mr. Gerry Towns, Dr. A.K. Singh
15:20 – 15:35	COMPLICATIONS OF UPPER CERVICAL SPINE SURGERY - **Dr. Fahir Ozer, Ex. President, Spine Section of Turkish Neurosurgical society**
15:35 – 15:50	COMPLICATIONS OF ANTERIOR LOWER CERVICAL SPINE SURGERY - **Prof. Sait Naderi, President, Spine Section of Turkish Neurosurgical Society**
15:50 – 16:05	COMPLICATIONS OF POSTERIOR LOWER CERVICAL SPINE SURGERY - **Prof. Selcuk Palaoglu, Neurosurgeon, Ex-President of Spine Section of Turkish Neurosurgical Society**
16:05 – 16:20	AVOIDING COMPLICATIONS IN SUBAXIAL CERVICAL SPINE TRAUMA – CIRCUMFERENTIAL SURGERY FOR COMPLEX INJURIES - **Prof. Mehmet Zileli, Professor of Neurosurgery, Turkey**
16:20 – 16:30	DISCUSSION

Session - VIII

AUDITORIUM

16:30 – 17:00 Complications of Spinal Tumor Surgery

Chairpersons Prof. Mehmet Zileli, Dr. Fazlul Hoque

16:30 – 16:43 COMPLICATIONS OF INTRADURAL SPINAL TUMOR SURGERY
- **Dr. Sudheer Tyagi, Consultant Neurosurgeon, Apollo Hospital**

16:43 – 16:56 COMPLICATIONS OF OTHER (NON INTRADURAL) SPINAL TUMOR SURGERY
- **Dr. Gautam Zaveri, Consultant Spine Surgeon, Zaveri Clinic, Ghatkopar, Mumbai**

16:56 – 17:00 Discussion

Session – IX

CONFERENCE ROOM Complications During Acute Management of Spinal Injured

Chairperson Dr. Jean Jacques Wyndaele, Capt. Dilip Sinha

15:20 – 15:35 PREVENTION OF COMPLICATION AT THE SITE OF ACCIDENT AND DURING EVACUATION TO THE HOSPITAL
- **Mr. Nabil Alageli, M. Med, Sci (Trauma), FRCS Ed, DSR, Consultant Surgeon in Spinal Injuries, Yorkshire, Regional Spinal Injuries Centre, UK**

15:35 – 15:50 RESPIRATORY COMPLICATIONS IN THE SPINAL INJURED – PREVENTION AND MANAGEMENT
- **Dr. Douglas Brown, Medical Director, Spinal Injuries Centre Melbourne, Australia**

15:50 – 16:05 GASTROINTESTINAL COMPLICATIONS IN SPINAL INJURED
- **Dr. Inder Perkash, Professor Urology, P.V.A. Professor Spinal Cord Injuries and Professor P.M&R Stanford And Director Spinal Cord Injuries Center Palo Alto V.A. Health Care System, USA**

16:05 – 16:15 METABOLIC MANAGEMENT IN THE ACUTE SPINAL INJURED WITH A VIEW TO REDUCE COMPLICATIONS
- **Dr. P.K. Mangla, Chest Physician, ISIC, New Delhi**

16:15 – 16:30 COMPLICATIONS IN DEVELOPMENT OF HAND FUNCTIONS IN TETRAPLEGICS
- **Ms. Martha Horn, Occupational Therapist, Murnau, Germany**

16:30 – 16:45 COMPLICATIONS RELATED TO PHYSICAL REHABILITATION OF SPINAL INJURED
- **Mrs. Chitra Kataria, Chief Co-ordinator, Rehabilitation Deptt, ISIC, New Delhi**

16:45 – 17:00 DISCUSSION

17:15 – 18:30 OFFICIAL INAUGURATION

18:30 – 20:00 CULTURAL EVENING & COCKTAILS

Saturday, 13th March 2004

Session – X

8:30– 10:30 FREE PAPERS

AUDITORIUM PARALLEL FREE PAPER SESSION ON SURGICAL MANAGEMENT

Chairpersons Dr. Rajagopalan, Dr. Gautam Zaveri

8:30 – 8:38 OPERATIVE MANAGEMENT OF SPINE FRACTURES – SHIMLA EXPERIENCE (PRELIMINARY REPORT)
- **Dr. Manoj Kumar Thakur, Assistant Professor, Orthopaedics, IGMC, Shimla, HP**

8:38 – 8:46 SHORT TERM ANALYSIS OF STABILIZATION OF FRACTURE DISLOCATION OF DORSOLUMBAR SPINE WITH DEFICIT BY POSTERIOR DISTRACTION SYSTEM (PDS)
- **Dr. Biswajit Sahu, Dr. B.N. Mohapatra, Dr. T. Mohanty, Dr. M.R. Biswal and Dr. N.C. Mahakul, Deptt. of Orthopaedics, S. C. B. Medical College, Cuttack, Orissa**

8:46 – 8:54 ROLE OF ANTERIOR SURGERY IN THORACOLUMBAR TRAUMA
- **Dr. Devesh Dholakia, Orthopaedic, KEM Hospital, Mumbai**

8:54 – 9:02 OUTCOME OF SURGICAL MANAGEMENT OF THORACOLUMBAR TRAUMA
- **Dr. Prasoon Shamshery, Dr. Abrar Ahmed, Dr. B.N. Upendra, Dr. Meena Devkant & Dr. Arvind Jayaswal, AIIMS, New Delhi**

9:02 – 9:10 GUNSHOT WOUNDS OF THE SPINE
- **Lt. Col. H. S. Bhatoe, Army Hospital, New Delhi**

9:10 – 9:18 CERVICAL SPINE INJURY: ANTERIOR FUSION
- **Dr. M.L.A. Rahman and Dr. T.A. Rahman, Consultant Neurosurgeon, Downtown Hospital, Dispur, Guwahati, Assam.**

9:18 – 9:26 SURGERY FOR CRANIO – VERTEBRAL JUNCTIONAL INSTABILITY – 25 CASES
- **Dr. Vijay M. Menon, Dr. Veerendra S. Pawar and Dr. S. Prabhakar, Consultant Neurosurgeon, City Hospital, Kolhapur, Maharashtra.**

9:26 – 9:34 SURGICAL MANAGEMENT OF POTT'S SPINE
- **Dr. B. Mohapatra, Dr. Sunil Katoch & Dr. H.N. Bajaj, ISIC, New Delhi**

9:34 – 9:42 OUTCOME OF REDUCTION AND SHORT SEGMENT GLOBAL FUSION IN SPONDYLOLYSTHESIS
- **Dr. Abrar Ahmed, Dr. P. Shamshery, Dr. B.N. Upendra, Dr. Meena Devkant. Dr. B.D. Choudhary & Dr. Arvind Jayaswal, AIIMS, New Delhi**

9:42 – 9:50 OUTCOME BASED STRATEGIES OF LUMBAR & LUMBOSACRAL TUBERCULOSIS
- **Dr. B.N. Upendra, Dr. Prasoon Shamshery, Dr. Abrar Ahmed, Dr. Meena Devkant & Dr. Arvind Jayaswal, AIIMS, New Delhi**

9:50 – 9:58 TUMORS OF SPINE AND THEIR MANAGEMENT
- **Dr. Samir Dogra, Head Department of Orthopaedics, Mohan Dai Oswal Cancer Treatment & Research Foundation, Ludhiana**

9:58 – 10:06 POST OPERATIVE LUMBAR DISCITIS
- **Col. Prakash Singh, Lt. Col. H. S. Bhatoe, Lt. Col. TVSP Murthy and Lt. Col. Mrs. K. Sanohu, Army Hospital, New Delhi**

10:06 – 10:14 THE EFFECT OF CRANIOTOMY / SPINE SURGERY LOCATION ON THE INCIDENCE OF POSTOPERATIVE PAIN AND NAUSEA
- **Dr. Anurag Johari, Dr. Nitin Bhel, Dr. Ashutosh Bharadwaj, Dr. Gaurav and Dr. Shahla Haleem, Department of Anaesthesiology and Critical Care Medicine, Aligarh, UP**

10:14 – 10:30 DISCUSSION

Session – XI

8:30– 9:30 FREE PAPERS

CONFERENCE ROOM PARALLEL FREE PAPER SESSION ON REHABILITATION MANAGEMENT

Chairpersons Dr. Navnender Mathur, Dr. Sunil Katoch

8:30 – 8:38 TRAUMATIC SPINAL CORD INJURIES IN HARYANA – AN EPIDEMIOLOGICAL STUDY
- **Dr. Roop Singh, Department of Orthopaedics, PGIMS, Rohtak, Haryana**

8:38 – 8:46 EVOLUTION OF A REGIONAL SPINAL INJURY CENTRE
- **Dr. Tanmoy Mohanty, Dr. B.N.Mohapatra, Prof. M.R. Biswal, Mr. R.N. Das, Prof. N.C. Mahakul, RSIC, Cuttack, Orissa**

8:46 – 8:54	PLANNING OF A MINI – GYM FOR REHABILITATION OF SPINAL PATIENTS - **Dr. (Capt.) Dilip Kumar Sinha, Associate Professor, HOPE Hospital, Mithapur B Area, Patna, Bihar**
8:54 – 9:02	DEEP VEIN THROMBOSIS AND PULMONARY EMBOLISM IN SPINAL CORD INJURIES IN INDIAN PATIENTS - **Dr. S. K. Saraf and Dr. R.B.J. Rana, Department of Orthopaedics, Banaras Hindu University, Varanasi**
9:02 – 9:10	SURGICAL REHABILITATION OF HAND OF A TETRAPLEGIC PATIENT – A CASE PRESENTATION - **Dr. B.D. Athani, Director, All Indian Institute of Physical Medicine & Rehabilitation, Mumbai**
9:10 – 9:18	NEW PRESCRIPTION CRITERIA IN ORTHOTIC MANAGEMENT OF RHEUMATOID ARTHRITIS - **Ms. Poonam Rani, Orthotic Department, ISIC, New Delhi**
9:18 – 9:26	UROLOGICAL COMPLICATIONS AFTER SPINAL CORD INJURY - **Dr. Roop Singh, Department of Orthopaedics, PGIMS, Rohtak, Haryana**
9:26 – 9:34	SEXUALITY, LOVABILITY AND INTIMACY AFTER SCI IN RELATION TO QUALITY OF LIFE: AN IMPORTANT DOMAIN OF OCCUPATIONAL THERAPY - **M. Subhashini, Ms. Anuradha Rakesh, Clinical Psychologist, ISIC, New Delhi**
9:34 – 9:42	CHANGING A MEDIUM CAN BRING CHANGES IN THE LIVES OF PATIENTS: HYDROTHERAPY APPROACH - **Mrs. Chitra Kataria, Chief Co-ordinator, Rehabilitation, ISIC, New Delhi**
9:42 – 9:50	ROLE OF NEURO SURGEON IN THE MANGEMENT OF SPINAL INJURED PERSONS - **Dr. T.S. Kanaka, Neurosurgeon, Chennai**
9:50 – 9:58	ASIAN SPINAL CORD INJURY NETWORK – CURRENT STATUS - **Stephen Muldoon, Regional Programme Co-ordinator, John Grooms Overseas**
9:58 – 10:06	PROTOCOL OF PEER COUNSELLING AT ISIC - **Mr. Shivjeet Singh, Peer Counsellor, ISIC, New Delhi**
10:06 –10:14	SPECIAL NUTRITION REQUIREMENTS OF THE SPINAL INJURED - **Ms. Shelly Batra, Dietician, ISIC, New Delhi**
10:14 – 10:30	DISCUSSION
10:30 – 11:00	BREAK

Session – XII

AUDITORIUM	
Chairpersons	Dr. Prashant Kekre, Dr. Anil Shreshtha
11:00 – 13:00	COMPLICATIONS OF THORACIC AND THORACOLUMBAR SPINE SURGERY
11:00 – 11:13	ANATOMICAL CONSIDERATIONS IN LUMBAR SPINE PEDICLES WITH A VIEW TO PREVENT COMPLICATIONS - **Dr. Rajagopalan, St. John's Medical College & Hospital, Bangalore**
11:13 – 11:26	COMPLICATIONS IN POSTERIOR THORACIC & THORACOLUMBAR SPINE SURGERY - **Dr. H. S. Chhabra, Addl. Medical Director, Indian Spinal Injuries Centre, New Delhi**
11:26 – 11:39	COMPLICATIONS IN ANTERIOR THORACOLUMBAR & THORACIC SPINE SURGERY - **Dr. H. N. Bajaj, Sr. Consultant Orthopaedic Surgeon, ISIC, N. D.**
11:39 – 11:52	REDUCTION OF COMPLICATION RATE THROUGH SURGICAL MANAGEMENT OF THORACOLUMBAR SPINAL CORD INJURY – THE BANGLADESH EXPERIENCE - **Dr. Fazlul Hoque, Orthopaedic Surgeon, CRP, Bangladesh**
11:52 – 12:00	DISCUSSION

Session – XIII

12:00 – 13:00	COMPLICATIONS IN SPINAL DEFORMITY SURGERY
Chairpersons	Prof. P.K. Dave, Dr. Sajan Hegde
12:00 – 12:20	INTRA-OPERATIVE AND IMMEDIATE POST OPERATIVE COMPLICATIONS OF DEFORMITY SURGERY - **Prof. Haluk Berk, Professor of Orthopedic Surgery, Member of Executive, Committee of Spine Society of Europe**
12:20 – 12:40	REVISIONS FOR COMPLICATIONS AFTER SURGERY FOR SPINAL DEFORMITY - **Dr. Ashok N. Johari, M.S. Orth, Dr. Johari's Nursing Home, Mumbai**
12:40 – 12:50	EVOKED POTENTIAL MONITORING IN DEFORMITY SURGERY – ADDRESSING THE SAFETY FACTOR - **Prof. Haluk Berk, Professor of Orthopedic Surgery, Member of Executive, Committee of Spine Society of Europe**
12:50 – 13:00	DISCUSSION

Session – XIV

CONFERENCE ROOM	COMPLICATIONS OF THE URINARY TRACT
Chairpersons	Dr. Douglas Brown, Prof. N.P. Gupta
11:00 – 11:25	URINARY TRACT INFECTION: PREVENTION AND MANAGEMENT - **Dr. Jean Jacques Wyndaele, Prof. of Urology, University Hospital, Belgium. President of International Spinal Cord Society Education Committee**
11:25 – 11:45	MANAGEMENT OF AUTONOMIC DYSREFLEXIA - **Dr. Inder Perkash, Professor Urology, P.V.A. Professor Spinal Cord Injuries and Professor P.M&R Stanford And Director Spinal Cord Injuries Center Palo Alto V.A. Health Care System, USA**
11:45 – 12:05	MANAGEMENT OF CONTRACTED BLADDER - **Mr. Gurpreet Singh, Urologist, UK**
12:05 – 12:25	OTHER COMPLICATIONS RELATED TO NEUROGENIC BLADDER: PREVENTION AND MANAGEMENT - **Dr. S. V. Kotwal, Head of Urology Dept. ISIC, New Delhi**
12:25 – 12:40	UPPER TRACT COMPLICATIONS: PREVENTION AND MANAGEMENT - **Dr. Jean Jacques Wyndaele, Prof. of Urology, University Hospital, Belgium. Secretary of International Spinal Cord Society**
12:40 – 13:00	DISCUSSION
13:00 – 14:00	BREAK

Session - XV

AUDITORIUM	
13:45 – 15:00	POST OPERATIVE INFECTIONS
Chairpersons	Dr. H.N. Bajaj, Dr. Shankar Acharya
13:45 – 14:00	DIAGNOSIS OF POST – OPERATIVE INFECTIONS OF THE SPINE BY MODERN – IMAGING TECHNIQUES - **Dr. Harsh Mahajan, GMR Institute, New Delhi.**

14:00 – 14:15	PRE-OPERATIVE RISK FACTORS FOR WOUND INFECTIONS - **Dr. Daljit Singh, Associate Professor, Deptt. of Neurosurgery, GB Pant Hospital, New Delhi**
14:15 – 14:25	USE OF ANTIBIOTICS FOR WOUND PROPHYLAXIS IN SPINAL SURGERY - **Dr. Ritabh Kumar, Jr. Consultant Orthopaedics, ISIC, New Delhi.**
14:25 – 14:40	MANAGEMENT OF ADHESIVE ARCHNOIDITIS - **Dr. Rana Patir, Consultant Neurosurgeon, Sir Ganga Ram Hospital, New Delhi**
14:40 – 14:55	MANAGEMENT OF POST-SURGICAL INFECTIONS - **Mr. Abhay Rao, Orthopaedic Spinal Surgeon – Leeds, UK**
14:55 – 15:00	DISCUSSION

Session – XVI

CONFERENCE ROOM	
Chairpersons	Dr. S.K. Kame, Dr. S.Y. Kothari
13:45 – 15:00	COMPLICATIONS OF THE URINARY TRACT, COMPLICATIONS DURING SEXUALITY & FERTILITY MANAGEMENT AND PSYCHOSOCIAL COMPLICATIONS
13:45 – 14:00	INCONTINENCE IN SPINAL – CORD INJURY PATIENTS - **Mr. Gurpreet Singh, Urologist, UK**
14:00 – 14:15	COMPLICATIONS ARISING DURING MANAGEMENT OF SEXUALITY IN SPINAL CORD INJURED - **Dr. M.A. Salam, Neuro-urologist & Associate Professor, Department of Urology, BSMMU, Bangladesh.**
14:15 – 14:30	COMPLICATIONS ARISING DURING FERTILITY MANAGEMENT OF SPINAL INJURED - **Dr. Sanjeev Sharma, UK**
14:30 – 14:50	PSYCHOSOCIAL COMPLICATIONS AFTER SCI - **Dr. Stanley Ducharme, Andrologist, Spinal Injuries Centre, Boston, USA**
14:50 – 15:00	DISCUSSION
15:00 – 15:20	BREAK

Session – XVII

AUDITORIUM	
15:20 – 17:20	GRAFT RELATED COMPLICATIONS, BONE GRAFT SUBSTITUTES AND NON FUSION TREATMENT OPTIONS
Chairpersons	Prof. Haluk Berk, Dr. Raj Bahadur
15:20 – 15:40	GRAFT RELATED COMPLICATIONS IN SPINAL SURGERY - **Dr. Shekhar Bhojraj & Dr. Abhay Nene, P. D. Hinduja National Hospital, Mumbai**
15:40 – 15:55	BONE MORPHOGENETIC PROTEINS - ROLE IN SPINAL SURGERY - **Dr. Julio Gallego, Spinal Surgeon – Memphis, USA**
15:55 – 16:15	BONE GRAFT SUBSTITUTES - **Dr. S. M. Tuli, Consultant Orthopaedic Surgeon, VIMHANS, New Delhi**
16:15 – 16:30	NON FUSION TREATMENT OPTIONS OF DEGENERATIVE DISC DISEASE: AN EFFORT TO REDUCE ADJOINING MOTION SEGMENT COMPLICATIONS - **Dr. P. K. Sahoo**
16:30 – 16:45	CERVICAL DISC REPLACEMENT - **Dr. Wee Fu Tan, Mediscdh' Centrum Alkmaar, Deptt. Neurosurgery, Netherlands**
16:45 – 17:05	LUMBAR DISC REPLACEMENT - **Dr. Julio Gallego, Spinal Surgeon – Memphis, USA**
17:05 – 17:20	DISCUSSIONS

Session – XVIII

17:30 – 18:00	MINIMALLY INVASIVE SPINE SURGERY
Chairpersons	Dr. Julio Gallego, Dr. Sudhir Kapoor
17:30 – 17:40	ENDOSCOPIC MICRODISCECTOMY: A TECHNIQUE TO REDUCE COMPLICATIONS IN DISCECTOMY - **Dr. Arjun Srivatsa, Bhagwan Mahaveer Jain Hospital, Bangalore**
17:40 – 17:45	COMPLICATION IN TRANSFORAMINAL ENDOSCOPIC SURGERY - **Dr. Satish Chandra Gore, MBBS, MS (Ortho), FABMISS MRCPS (USA) (Hon.), Kamla Regencey, Pune**
17:45 – 17:55	THORACOSCOPIC AND LAPROSCOPIC SPINAL SURGERY: TECHNIQUES TO REDUCE COMPLICATIONS OF OPEN SURGERY - **Dr. Yash Gulati, Sr. Consultant, Department of Spine Surgery, Apollo Hospital, Delhi**
17:55 – 18:00	DISCUSSION

Session – XIX

CONFERENCE ROOM	
15:20 – 16:20	SYMPOSIUM ON FUNCTIONAL ELECTRICAL STIMULATION
Chairpersons	Dr. Jean Jacques Wyndaele, Mr. Gurpreet Singh
15:20 – 15:50	AUGMENTED INTENSIVE EXERCISE (AIE) BY ELECTRICAL STIMULATION FOR RECOVERY OF PARETIC ARM IN POST-STROKE HEMIPLEGIC SUBJECTS - **Prof. Dejan Popovic, Aalborg University, Denmark**
15:50 – 16:10	ROLE OF FES IN THE MANAGEMENT OF NEUROGENIC BLADDER - **Dr. Inder Perkash, Professor Urology, P.V.A. Professor Spinal Cord Injuries and Professor P.M&R Stanford And Director Spinal Cord Injuries Center Palo Alto V.A. Health Care System, USA**
16:10 – 16:20	DISCUSSION

Session – XX

16:20 – 16:45	SPINAL CORD REPAIR
Chairperson	Dr. U. Singh
16:20 – 16:40	SPINAL CORD REPAIR, AN EVOLUTION AND A DEVOLUTION PROCESS - **Prof. Dajue Wang**
16:40 – 16:45	DISCUSSION

Session – XXI

CONFERENCE ROOM	
16:45 – 18:00	MISCELLANEOUS COMPLICATIONS
Chairperson	Dr. R.K. Srivastava, Dr. S.K. Kame
16:45 – 17:15	"PROPHYLAXIS AND MANAGEMENT OF DEEP VEIN THROMBOSIS IN PATIENTS WITH SPINAL CORD INJURY" - **Dr. (Mrs.) Arundhati Perkash, M.D., DCP., PhD. Clinical Pathologist V. A. and Clinical Associate Prof., Stanford, USA**
17:15 – 17:30	HETEROTOPIC OSSIFICATION - **Dr. U. Singh, Head of Deptt., AIIMS, New Delhi**
17:30 – 17:45	COMPLICATIONS FOLLOWING SPINAL CORD INJURY – THE SMS JAIPUR EXPERIENCE - **Dr. Navnender Mathur, Physical Medicine and Rehabilitation, SMS Medical College and Hospital, Jaipur**
17:45 – 18:00	DISCUSSION

18:00 – 19:00	ANNUAL GENERAL BODY MEETING OF SPINAL CORD SOCIETY
19:00 – 21:30	BANQUET

Sunday, 14th March 2004

Session - XXII	
AUDITORIUM	Chairpersons – Dr. A.D. Sehgal, Dr. Kalai Rajan
9:00 – 10:30	LATE SURGICAL COMPLICATIONS
9:00 – 9:15	MANAGEMENT OF POST TRAUMATIC SYRINGOMYELIA - **Prof. A. K. Singh, Head of Neurosurgery, G. B. Pant Hospital, New Delhi**
9:15 – 9:35	MANAGEMENT OF IATROGENIC AND POST-OPERATIVE CERVICAL DEFORMITIES - **Mr. Gerry Towns, Consultant Neurosurgeon, Leeds, UK**
9:35– 9:55	IATROGENIC INSTABILITY OF THE CERVICAL SPINE FOLLOWING SURGERY - **Mr. Gerry Towns, Consultant Neurosurgeon, Leeds, UK**
9:55 – 10:15	Correction of non-satisfying results in previous treatment of spinal injuries - **Dr. Patrick Kluger, Spinal Surgeon, Stoke Mandeville Hospital, UK**
10:15 – 10:30	DISCUSSION

Session – XXIII

CONFERENCE ROOM	
9:00 – 10:30	PRESSURE SORES
Chairpersons	Dr. S. Karne, Capt. Dilip Sinha
9:00 – 9:15	PATHOPHYSIOLOGY AND PREVENTION OF PRESSURE SORES - **Dr. H. C. Goel, Deptt. of Rehabilitation, Safdarjung Hospital, New Delhi**
9:15 – 9:30	CONSERVATIVE MANAGEMENT OF PRESSURES SORES - **Dr. (Capt.) Dilip Sinha, Associate Professor Orthopaedics, Patna Medical College Hospital, Patna**
9:30 – 9:45	SURGICAL MANAGEMENT OF SACRAL AND COCCYGEAL PRESSURE SORES - **Dr. H.N. Bajaj, Consultant Orthopaedic Surgeon, ISIC, New Delhi**
9:45 – 10:00	SURGICAL MANAGEMENT OF PRESSURE SORES OVER THE ISCHIALTUBEROSITY - **Dr. Sunil Katoch, Consultant Orthopaedic Surgeon, ISIC, New Delhi**
10:00 – 10:15	SURGICAL MANAGEMENT OF TROCHANTERIC PRESSURE SORES - **Dr. K. Das, Jr. Consultant Orthopaedic Surgeon, ISIC, New Delhi**
10:15 – 10:30	DISCUSSION
10:30 – 11:00	BREAK

Session – XXIV

AUDITORIUM	FAILED BACK
Chairpersons	Dr. P.S. Maini, Dr. Ashwini Sharan
11:00 – 11:15	FAILED BACK – ETIOLOGY AND EVALUATION - **Prof. Mohamed A. Maziad, Ain Shams University, Cairo, Egypt**
11:15 – 11:30	RADIOLOGICAL EVALUATION OF THE FAILED BACK - **Dr. Rajesh Kapur, Consultant Radiologist, New Delhi**
11:30 – 11:50	COMPLICATIONS IN SPINAL SURGERY – AN OVERVIEW - **Dr. S.M. Hardikar, Hardikar Hospital, Pune**
11:50 – 12:15	CHRONIC POST-OP PAIN – THE COMMONEST COMPLICATIONS IN LUMBAR SPINE SURGERY & CHRONIC POST-OP RADICULOPATHY - **Dr. V. T. Ingalhalikar, Consultant & Surgeon for Spinal Affections, Thane, Maharashtra**
12:15 – 12:30	CHEAPER IMPLANTS – ARE THEY MORE PRONE TO COMPLICATIONS - **Dr. Raj Bahadur Government of Medical College & Hospital Department of Orthopaedics, Chandigarh**
12:30 – 12:45	CONSERVATIVE MANAGEMENT OF FAILED BACK - **Dr. Sanjay Wadhwa, Addl. Professor, Deptt. of Physical Medicine and Rehabilitation, AIIMS, New Delhi**
12:45 – 13:00	NON-SURGICAL INTERVENTIONS IN MANAGEMENT OF FAILED BACK - **Dr. G. P. Dureja, Professor Pain Medicine, AIIMS, New Delhi**

Session – XXV

CONFERENCE ROOM	
Chairperson	Dr. T.K. Shanmuga Sundaram
11:00 – 12:00	SYMPOSIUM ON PREVENTION OF SPINAL CORD INJURIES
11:00 – 11:12	PREVENTION OF SPINAL CORD INJURIES – THE AUSTRALIAN EXPERIENCE - **Dr. Douglas Brown, Medical Director, Spinal Injuries Centre Melbourne, Australia**
11:12 – 11:24	PREVENTION OF SPINAL CORD INJURIES – THE AMERICAN EXPERIENCE - **Dr. Inder Perkash, Professor Urology, P.V.A. Professor Spinal Cord Injuries and Professor P.M&R Stanford And Director Spinal Cord Injuries Center Palo Alto V.A. Health Care System, USA**
11:24 – 11:36	PREVENTION OF SPINAL CORD INJURIES – THE EUROPEAN EXPERIENCE - **Dr. Jean Jacques Wyndaele, Prof. of Urology, University Hospital, Belgium. Chairman of International Spinal Cord Society of Educational Committee**
11:36 – 11:48	PREVENTION OF SPINAL CORD INJURIES IN DEVELOPING COUNTRIES LIKE INDIA - **Dr. (Capt.) Dilip Kumar Sinha, Associate Professor, HOPE Hospital, Mithapur B Area, Patna, Bihar**
11:45 – 12:00	Discussion

Session – XXVI

AUDITORIUM	
15: 20 – 16:20	SYMPOSIUM ON PAIN
Chairpersons	Dr. Vinod Puri, Dr. G.P. Dureja
15:20 - 15:35	PREVALENCE, CLINICAL FEATURES, NEUROBIOLOGY AND TAXONOMY OF PAIN FOLLOWING SPINAL CORD INJURY - **Dr. Douglas Brown, Medical Director, Spinal Injuries Centre Melbourne, Australia**
15:35 – 15:50	PHARMACOLOGICAL MANAGEMENT OF PAIN FOLLOWING SCI - **Dr. Douglas Brown, Medical Director, Spinal Injuries Centre Melbourne, Australia**
15:50 – 16:05	SPINAL CORD STIMULATION AND OTHER RECENT ADVANCES IN MANAGEMENT OF NEUROPATHIC PAIN - **Dr. Paolo Marchettini, Director of Pain Medicine Centre, HSR, Milano, Italy**
16:05 - 16:20	DISCUSSION
13:00 – 13.45	BREAK

Session – XXVII

AUDITORIUM

Chairpersons — Dr. B.K. Dhaon, Dr. A.K. Jain

13:45 – 15:00 — SURGICAL MANAGEMENT OF FAILED BACK

13:45 – 13:58 — FUSION STRATEGIES IN PREVIOUSLY OPERATED BACK
- **Dr. Prashant Kekre, Orthopaedic Surgeon, Chennai**

13:58 – 14:13 — ROLE OF ENDOSCOPIC SURGERY IN MANAGEMENT OF FAILED BACK
- **Dr. Satish Chandra Gore, MBBS, MS (Ortho), FABMISS MRCPS (USA) (Hon.), Kamla Regency, Pune**

14:13 – 14:38 — SURGICAL MANAGEMENT OF FAILED BACK
- **Mr. Stuart Ross, Neurosurgeon – Leeds, UK**

14:38 – 14:50 — REVISION SURGERY FOR FAILED CERVICAL SPINE FIXATION
- **Prof. Mazhar Hussain, Head of Department Neurosurgery, King George Medical College, Lucknow, UP**

14:50 – 15:00 — DISCUSSION

Session – XXVIII

CONFERENCE ROOM

Chairpersons — Dr. Stanley Ducharme, Dr. S.S. Sangwan

14:00 – 15:00 — COMPLICATIONS OF AGING IN SPINAL INJURIES

14:00 – 14:15 — CARDIOVASCULAR COMPLICATIONS OF SPINAL INJURED – PREVENTION AND MANAGEMENT
- **Dr. S.L. Yadav, Deptt. of Physical Medicine and Rehabilitation, AIIMS, New Delhi**

14:15 – 14:30 — OSTEOPOROSIS IN SPINAL INJURED – PREVENTION AND MANAGEMENT
- **Dr. Deepak Raina, ISIC, New Delhi**

14:30 – 14:45 — CAUSES OF MORBIDITY AND MORTALITY IN SPINAL INJURED: CHANGING TRENDS
- **Dr. Sanjay Wadhwa, Addl. Professor, Deptt. of Physical Medicine and Rehabilitation, AIIMS, New Delhi**

14:45 -15:00 — DISCUSSION

15:00 – 15:20 — BREAK

Session - XXIX

AUDITORIUM

Chairpersons — Prof. Selcuk Palaoglu, Col. V.S. Madan

15:20 – 16:10 — NEUROGENIC AND VASCULAR COMPLICATIONS IN SPINAL INJURIES

15:20 - 15.35 — NEUROGENIC COMPLICATIONS IN SPINE SURGERY
- **Dr. Aditya Gupta, Asst. Professor, Neurosurgery Deptt, AIIMS, New Delhi**

15.35 – 15:50 — CSF LEAKS: ETIOLOGY AND REPAIR
- **Dr. P.S. Bawa, Consultant Neurosurgeon, Mata Chanan Devi Hospital, New Delhi**

15:50 - 16:00 — VASCULAR COMPLICATIONS IN SPINAL SURGERY
- **Dr. Sharad Shashank Kale, Assistant Professor, Neurosurgery, AIIMS, New Delhi**

16:00 – 16:10 — DISCUSSION

Session – XXX

16:10 – 17:30 — COMPLICATIONS OF SPINAL SURGERY IN SPECIAL CONDITIONS

Chairpersons — Dr. Sudhir Kumar, Prof. Sait Naderi

16:10 – 16:25 — COMPLICATIONS OF SPINAL SURGERY IN ANKYLOSING SPONDYLITIS
- **Dr. Sajan Hegde, Consultant Orthopaedic Surgeon, Apollo Hospital, Chennai**

16:25 – 16:40 — COMPLICATIONS OF SPINAL SURGERY IN RHEUMATOID ARTHRITIS
- **Mr. Stuart Ross, Neurosurgeon – Leeds, UK**

16:40 – 16:55 — COMPLICATIONS OF SPINAL SURGERY IN CHILDREN
- **Dr. Sajan Hegde, Consultant Orthopaedic Surgeon, Apollo Hospital, Chennai**

16:55 - 17:08 — COMPLICATIONS OF SPINAL FUSIONS IN ADULTS MORE THAN 60 YEARS OF AGE
- **Dr. Shankar Acharya, Consultant Spine Surgeon, Sir Gangaram Hospital**

17:08 – 17:20 — MANAGEMENT OF THORACOLUMBAR FRACTURES IN GERIATRIC AGE GROUP: VERTEBROPLASTY – AN EFFECTIVE OPTION
- **Dr. Raghava Dutt Mulukutla, Consultant Orthopaedic & Spine Surgeon, UDAI Clinic, Hyderabad**

17:20 - 17:30 — DISCUSSION

Session – XXXI

CONFERENCE ROOM

15:20 – 16:20 — PANEL DISCUSSION – CHALLENGES IN PREVENTION AND MANAGEMENT OF COMPLICATIONS OF SPINAL CORD INJURED IN DEVELOPING COUNTRIES

Dr. A.K. Mukherjee, Dr. Anil Shreshtha, Dr. Fazlul Hoque, Dr. U. Singh, Dr. Navnender Mathur, Dr. Inder Prakesh, Dr. Jean Jacques Wyndaele, Dr. Douglas Brown, Dr. S.K. Kame

Session – XXXII

CONFERENCE ROOM

16:20 – 17:30 — MUSCULOSKELETAL COMPLICATIONS & SPASTICITY

Chairpersons — Dr. T.S. Kanaka, Dr. Rana Patir

16:20 - 16:32 — MUSCULOSKELETAL COMPLICATIONS IN SCI – PREVENTION AND MANAGEMENT
- **Dr. S.S. Sangwan, Department of Orthopaedics, Postgraduate Institute of Medical Sciences, Rohtak, Haryana.**

16:32 – 16:45 — PATHOPHYSIOLOGY OF SPASTICITY – CAUSES & PREVENTION
- **Dr. Ashwini Sharan, MD, Thomas Jefferson University, Department of Neurosurgery, PA**

16:45 - 17:00 — NON-SURGICAL MANAGEMENT OF SPASTICITY
- **Dr. S.Y. Kothari, Orthopaedic Surgeon, Spinal Ward, Safdarjung Hospital, New Delhi.**

17:00 – 17:20 — INTRATHECAL BACLOFEN PUMP AND OTHER SURGICAL PROCEDURES IN MANAGEMENT OF SPASTICITY
- **Dr. Ashwini Sharan, MD, Thomas Jefferson University, Department of Neurosurgery, PA**

17:20 - 17:30 — DISCUSSION

17:30 – 18:00 — VALEDICTORY FUNCTION

Monday, 15th March 2004

POST-CONFERENCE WORKSHOP ON "FUNCTIONAL ELECTRICAL STIMULATION"

9:00 – 13:00 — WORKSHOP AND DEMONSTRATION

POST-CONFERENCE WORKSHOP ON "FUNCTIONAL ELECTRICAL STIMULATION (FES)"

GUEST FACULTY: Prof. Dejan Popovicz

Monday, 15th March 2004

9:00 – 9:30	Principles of FES
9:30 –9:40	Discussion
9:40 – 10:10	Instrumentation for Electrical Stimulation
10:10 – 10:20	Discussion
10:20 –10:50	BREAK
10:50 – 11:20	Neural Prosthesis For Movement Restoration
11:20 – 11:30	Discussion
11:30 – 12:20	Demonstration
12:20 – 12:50	Therapeutic effects of functional electrical stimulation – Neuro-rehabilitation
12:50 – 13:00	Discussion

ABSTRACTS

Session - III – Auditorium
PARALLEL FREE PAPER SESSION ON SURGICAL MANAGEMENT

MORPHOMETRIC ASSESSMENT OF T9 TO S1 VERTEBRAE PEDICLES IN PATIENTS

Dr. Manish Chadha
Lecturer, UCMS & GTB Hospital, New Delhi

STUDY DESIGN: Retrospective and prospective analysis of morphometric data obtained from CT scans in relation to the lower thoracic, lumbar and S 1 pedicle in patients from Indian subcontinent.

OBJECTIVES: To record the surgically relevant parameters of transverse pedicle isthmus width, transverse pedicle angle, depth to anterior cortex along (a)midline axis and (b)pedicle axis, and compare the results with similar studies in literature.

SUMMARY OF BACKGROUND DATA: Most studies reported are for Caucasian population. Considerable differences are documented in few reports in Oriental population compared to the West. To the authors' knowledge, no similar study has been published for patients from Indian subcontinent.

METHODS: CT scans of the lower thoracic and lumbosacral spine of patients from the Indian subcontinent were reviewed. 86 vertebrae in 31 patients were selected and analysed. Parameters recorded were transverse pedicle isthmus width ,transverse pedicle angle ,depth to anterior cortex along midline axis and pedicle axis.

RESULTS: The smallest transverse pedicle isthmus width was at T9 level (5.02 mm). 46.15% pedicles at T9 had a diameter of less than 5 mm followed by T10 (12.5%), T11 (11.11 %) and L1 (11.11%).

76.92% of pedicles at T9 level had a diameter of less than 6 mm followed by T11 (33.33%), L1 (33.33%), T10 (25.00%), T12 (25.00%), L2 (20.00%) and L3 (5.56%).

The transverse pedicle axis faced laterally at T11 (-2.97 degrees) and T12 (-3.00 degrees) being least at T12.

The depth to the anterior cortex was more along the pedicle axis at all levels except T11 and T12, consistent with the laterally facing pedicles at these levels.

CONCLUSION: Significant differences exist between the pedieles of the Indian' and Caucasian population. It is hazardous to use a 6mm-diameter screw in the lower thoracic and upper lumbar spine in Indian patients. Even the use of a 5-mm screw may not be entirely safe. Preparation of the pedicle intraoperatively should take into account the orientation of the transverse pedicle angle.

PEDIELE MORPHOMETRY IN A SAMPLE OF INDIAN POPULATION

Dr. Meena Devkant, Dr. B. N. Upendra, Dr. Abrar Ahmed, Dr. Sanjay Sharma, Dr. B.D. Choudhury & Dr. Arvind Jayaswal
AIIMS, New Delhi

Study design: A prospective radiological study of thoracic and lumbosacral pedicular morphometry.

Objective: To define the radiological anatomy of the pedicle in Indian population and to compare it with the available studies.

Methods: 90 patients suffering from various spinal disorders were evaluated using plain x-rays and CT scan. Assessment of transverse isthmus width of pedicle, depth to anterior cortex, transverse pedicle angle, and cephalocaudal pedicle angle was done. In addition spinal canal and vertebral body diameter was also done.

Results: Narrowest pedicle in transverse plain was seen at T4 (4mm) and widest at S 1 -17.88mm (range-14-21mm). Maximum transverse angle was at T1 (29° range-25-33°) and minimum at T12 (7.44'range-4-10°). Cephalocaudal angle was maximum at T2 (17.50°) and minimum at L2 (-6.25'range-12 to 1°). Narrowest canal seen was at T5(14.35'range-14-15°). Transverse pedicle isthmus width was significantly smaller in Indian patients than western population(p=0.01 to 0.001)except at T8 & T10. Similarly transverse pedicle angle was significantly higher in Indian patients than in western population except at T8 & T9_

Conclusion: Vertebral pedicle in Indian population were found to be smaller, shorter, & more converging than the reported western population.

PTB – AN INNOVATIVE METHOD FOR SPINE BIOPSY

Dr. Mukesh Aggarwal, Orthopaedic – Spine, NDMVPS Medical College, Nasik, Maharashtra.

Introduction: posterolateral approach for thoracic and lumbar spine biopsy needs ct guidance, has high chance of pleura, vascular injury. Minimally invasive percutaneous transpedicular approach for thoracic, lumbar vertebral biopsy under fluoroscopy using disc forceps, an innovative technique.

Material: between Oct. 2002 and Dec. 2004, 22 patients (13 males, 9 females from 28 yrs. To 78 yrs) with vertebral lesions underwent transpedicular biopsy under c-arm control.

Purpose: to establish definitive diagnosis (evidence based), and present an innovative technique.

Technique : all biopsied in prone, general anaesthesia, c-arm. Pedicle localised, stab incision, guide wire in pedicle, 3 mm sheath mounted on guide wire till pedicle base, guide wire removed 6 mm sheath mounted on 1st sheath which is then removed. Through 6mm sheath, steinman pin hammered to make entry in pedicle. Steinman removed and 1-2 mm disc forceps negotiated through the portal in pedicle upto the vertebral body. Biopsy specimen removed, sent for histopath, cytology and culture. Sheath removed, closure.

Results: adequate material obtained. Diagnosis were -4 subacute chronic inflammatory 7 tuberculous, 6 osteoporotic compression, 4 metastasis, 1 lymphoma no false negative, no complications procedure 45-60 minutes.

Discussion: pedicle is used as bony tunnel through which body is accessed by disc forceps for structural biopsy. Its pathway is definitive and readily seen on c-arm, making it the safest route to vertebral body biopsy for definitive diagnosis.

INTRATHECAL SODIUM NITROPRUSSIDE SUPERFUSION IN VARIOUS

Dr. Vinod Kumar Tewari & Prof. Mazhar Husain (M.CH)
Department of Neurosurgery, KGMC, Lucknow, UP

Prof. Shashi Bhushan (MD)
Deptt. of Anesthesia, King George's Medical College, Lucknow, UP

Dr. Rajeshwar Nath Shrivastava (MS)
Deptt. of Orthopaedics, King George's Medical College, Lucknow, UP

Prof. Usha Kant Mishra (MD)
DM, Head Neurology, SGPGI, Lucknow, UP

Background: The applications of intrathecal superfusion with Sodium Nitroprusside are gradually increasing as for ruptured aneurysms. We present our experience of 50 cases of paraplegia of diverse spinal lesions, including infections, trauma and neurofibroma managed by superfusion with Sodium Nitroprusside in sub arachnoid space via lumbar puncture in neurosurgical and orthopedic department of the King George's Medical College Lucknow U.P INDIA.

Material and Methods: 50 patients from September 2001 to September 2003 formed the study group. Two study groups of paraparetic patients of various etiologies of compressed or noncompressed spinal cord at the level of thoracic, lumbar or thoracolumbar region were formed, the operative and the non operative. In the first group (30 patients), the spinal compression by various etiologies is first decompressed (with or without stabilization of the spine) and then Sodium Nitroprusside is superfused after a few days in sub arachnoid space thereby giving full time to rover the spinal cord's function spontaneously. In the second group (20 patients), where no operative intervention was indicated, Sodium Nitroprusside is superfused in sub arachnoid space. Outcomes of the study were evaluated with respect to clinical (ASIA GRADING in each case) and electrophysiological studies (in few cases n=6).

Findings: In those patients in which the clinical presentation is of spinal shock (14/50) responded excellently with in 30 minutes of perfusion, in those patients in which compression was there due to some pathology, decompression done, and on superfusion good response is seen, in those patients in which neurological level along with Zone of Partial Preservation was there fair response is seatin along with incremental increase (in due course of time) in Zone of Partial Preservation, but no or poor response is seen in caseated, transected and/or contused spinal cord.

Interpretation: Sodium nitroprusside superfusion may prove very helpful in effective treatment of patients with spinal shock, merely because of vasospasm of the perforators either due to operative, traumatic, infective or neoplastic insult to spinal cord, reduces hospital stay, increases confidence on the result declaration and reduces cost of the treatment. Even in those cases in which the spinal cord is transected (partial or complete) and edema is there with Zone of Partial Preservation clinically, the sodium nitroprusside superfusion causes benefit to the patient in terms of sensory and motor level's recovery upto Zone of Partial Preservation level. Patients in which clinical recovery is there but with Electrophysioiogical Studies there is deterioration in terms of latency of the response of the stimulus thereby giving the idea that there is some other mechanism too along with the vasodilatation of perforators responsible for clinical recovery of the patients.

SURGERY IN SPINAL CORD INJURY

Prof. Dr. J. D. P. Sinha
Patna Medical College, Patna, Bihar

Spinal cord injury is one of the most devastating injuries. Usually it makes the person totally functionless and thus major impact to the society and country. Surgery although remains controversial but has definite advantage. Although it is matter of debate that early decompression and stabilization of spine would be effective in the recovery of damaged central nervous tissue. But here goal is to create optimum condition for preservation of the undamaged nervous tissue that may be left after injury.

There are various approaches, but we are more experienced with posterior one. Surgical treatment offers significant advantages in select cases. It restores sagittal plane alignment, corrects translation and decompress neural structures- Timing of surgical intervention again controversial, but earlier the surgery better is the outcome. There are a no. of internal fixation devices selected for a certain case depending on the level of fracture , instability availability of image intensifier TV and of course affordability of the patient. The newer devices such as posterior pedicle implants provide rigid and three column fixation.

We have been more experienced with Hartshill rectangle ring and Drummond interspinous I sub laminar segmental spinal instrumentation as it suits more to our patients from low socioeconomic class _ The precautions recommended are - correct selection of the implant, implants can break when subjected to the increased loading associated with delayed or non- union , mixing metals can cause corrosion and at last correct selection of the patient . Surgery in form of decompression and stabilization provide better condition for undamaged neural tissue and aided early rehabilitative measures and better care of the injured as a whole.

APPROPRIATE EARLY SURGICAL INTERVENTION CAN PREVENT COMPLICATIONS AND DELAY IN REHABILITATION AFTER TRAUMATIC SPINAL CORD LESION: RETROSPECTIVE ANALYSIS OF 70 PATIENTS

Dr. F. Selmi, Dr. M. Al-Maiyah, Dr. P. Kluger
National Spinal Injuries Centre (NSIC), Stoke Mandeville Hospital, Aylesbury, UK

Introduction: There is no evidence, that emergency. spinal intervention influences neurological recovery and outcome. However, patients often undergo operations performed by inexperienced surgeons under sub-optimal conditions, before transfer to a specialist unit.

Objective: Our aim was to determine the morbidity and subsequent delay in rehabilitation of inappropriately managed patients.

Method: Retrospective analysis of medical notes.

Results: 243 new patients were admitted to NS1C over a period of 18 months. 65 patients required our surgical intervention. 22 of these operations were performed, to correct unsatisfactory results of primary surgical treatment; 10 in an early phase after injury. The reasons for early correction were surgery at wrong level (n1), infection (n2); CSF leak (n3) and haematoma (n4), looserting and fracture of the metal constructs resulting to persistent instability (n5). Progressive neurological-deterioration was not reported in any of those cases.

Comparing parameters of surgical morbidity between 43 patients with appropriate initial treatment and the 22 corrective cases, significant differences were found:

	Primary intervention (appropriate)	Corrective intervention
Surgery Time	Av. I50 minutes(105 - 300)	Av. 240 minutes (120 - 300)
Blood loss	Av. 600 ml (0 - 2400)	Av. 1720 ml (0- 9000)
Rehabilitation	Av. 16 weeks	Av. 28 weeks

Conclusion: As progressive neurological deterioration seldom occurs, there should be no place for inappropriate emergency surgery. Long term and short term complications require skilled and demanding corrective surgery with implications for a specialist spinal unit to provide such a service.

MANAGEMENT OF ODONTOID FRACTURES WITH ANTERIOR SCREW FIXATION

Dr. Arun Bhanot
Orthopaedics, Govt. Medical College & Hospital, Chandigarh

Type II odontoid fractures are prone to undergo non-union. Stabilization of such fractures with anterior screw fixation provides rigid internal fixation and preserves C1-C2 motion. During a 5-year period, we received 17 patients with displaced type II fractures of odontoid. 13 were male and 4 female with mean age of 34.7 years. All patients were operated for anterior screw fixation within a mean of10.1 days from injury. Post-operatively, clinical and radiological evaluation was done at regular intervals. With a mean follow up of 2.2

years, union was observed in 16 of 17 patiens (94%). One patient developed non-union for which he requires secondary C1-C2 fusion. Screw backout by a few millimeter was seen in another patient who had mild restriction of neck Movements. No approach related complications were noted. Anterior odontoid screw fixation has relatively low complication and high fusion rates. It not only restores normal anatomy but also gives better functional results by preserving intrinsic CI-C2 motion.

POST OP PROBLEMS IN LUMBAR SURGERY, CAN WE AVOID THEM?

Dr. (Mrs.) Sandhya V. Ekbote, Dr. V.T. Ingalhalikar, Dr. (Mrs.) S.S. Kher, Dr. (Ms). Seema Nandkarni & Dr. (Mrs.) D.V. Joshi
Aditya Nursing Home, Maharashtra

For a successful outcome, any Spinal surgical procedure needs meticulous pre-operative planning.
well performed surgery.
well planned post-operative rehabilitation programme.

Generally. first two phases are well emphasized during deliberations on spinal surgery. The Proper rehab care in the post operative stage which is equally important, is hardly talked about. Inspite of competently carried out surgery certain commonly seen Post op problems produce unsatisfactory results. Generally the surgeons / the rehab therapists empirically follow ether the delayed onset, extra-cautious non-aggressive or supra fast, sometimes unsafe aggressive rehab care as per the prevalent trends. The proper post op care needs very mature understanding of the patient's spinal disorder, of the surgery carried out, of the biomechanical status of the post op spine. It also needs proper knowledge of healing process of the body and the effects of rehab process on the heating. The imaging studies of post op cases showed variable health and structural disposition of the post. op musculature. The infra-op stimulation (without anaesthetic relaxant effect) of the stripped muscles showed erratic contractions. The paper presents our 20 year's experiences of a post. op rehab protocol in lumbar spine which is based on biomechanical and other considerations like age, pre-surgery spinal health, presence of complications like infections etc.

THE RESULTS OF SURGERY IN DORSAL KOCHS SPINE WITH NEUROLOGICAL DEFICIT

Dr. Atit Kantawala, Department of Orthopaedics
Samved Orthopaedic Institute, Ahmedabad

Objective: To review and analyze clinical and radiological data on patients of Dorsal Kochs spine with neurological deficit treated by anterior decompression and bone grafting.

Materials and methods: A retrospective study of 20 patients is carried out with mean follow up of 24.8 months (range 9-58 months). Final evaluation was based on fusion (Bridwell grading system), pain and functional ability (Dennis scale), neurological improvement (modified frankel grade), and modified functional outcome scale (Seybold and bailey).

Results : All the patients treated have improved neurologically. In 95% of the patients, neurological improvement was excellent, while in 5% of the patients, it was good. All the patients had bowel and bladder recovery. When ≥ 3 vertebrae are involved, loss of correction is 26.05° as compared to average loss of correction in the series, 11.1 °. In patients with < 2 vertebral body, involvement of fusion was seen in 96% of patients, while in patients with > 2 vertebrae involved, fusion was seen in 75% of the patients. With instrumentation, fusion is seen in 100% of the cases. Fracture of the graft, absorption of graft, sinking of cage and breakage of screw is seen in 10% of cases and displacement of the graft in 5% of the cases. Non union was seen in all patients in whom graft was displaced or absorbed. Finally 80% had excellent

Based on this analysis, we conclude that all patients of dorsal kochs spine with neurological deficit should be treated by anterior decompression with bone grafting. Instrumentation is recommended in patients with > 2 vertebral body involvement.

Objective: To review and analyze clinical and radiological data on patients of Dorsal Kochs spine with neurological deficit treated by anterior decompression and bone grafting. Materials and methods :- A retrospective study of 20 patients is carried out with mean follow up of 24.8 months (range 9-58 months). Final evaluation was based on fusion (Bridwell grading system), pain and functional ability (Dennis scale), neurological improvement (modified frankel grade), and modified functional outcome scale (Seybold and bailey). Results :- All the patients treated have improved neurologically. In 95% of the patients, neurological improvement was excellent, while in 5% of the patients, it was good. All the patients had bowel and bladder recovery. When >_ 3 vertebrae are involved, loss of correction is 26.05° as compared to average loss of correction in the series, 11.1 °. In patients with < 2 vertebral body, involvement of fusion was seen in 96% of patients, while in patients with > 2 vertebrae involved, fusion was seen in 75% of the patients. With instrumentation, fusion is seen in 100% of the cases. Fracture of the graft, absorption of graft, sinking of cage and breakage of screw is seen in 10% of cases and displacement of the graft in 5% of the cases. Non union was seen in all patients in whom graft was

displaced or absorbed. Finally 80% had excellent relults, 10% good results and 10% had fair results.

Conclusion: Based on this analysis, we conclude that all patients of dorsal kochs spine with neurological deficit should be treated by anterior decompression with bone grafting. Instrumentation is recommended in patients with >2 vertebral body involvement.

POSTERIOR VERTEBRECTOMY FOR DORSOLUMBAR KYPHOTIC DEFORMITIES

Dr. Sanjay Dhar
T. N. Medical College & B. Y. L. Nair Hospital, Mumbai

Introduction: Rigid Kyphotic deformities are the long term sequelae of congenital hemivertebrae, chronic infections like tuberculosis and even neglected trauma where there is significant anterior column loss. Traditional approaches to spinal corrective surgery including fusion in situ, convex growth arrest, and hemi vertebra excision, or two stage corrective procedures can achieve only limited correction. Posterior correction of severe sagittal deformity can be accomplished by a trans-pedicular decompression procedure followed by a wedge resection/ vertebrectomy. Correction must be stabilized with the help of instrumentation. An additional anterior procedure to strengthen the anterior column may _ be prefered.

Material & methods: Ten patients with severe angular Kyphotic deformity of the spine were treated by circumferential spinal wedge osteotomy using a single posterior approach (modified eggshell procedure).

A wedge of vertebral body at the apex of the deformity was excised with center of rotation at the ALL. The cortical end plates were preserved and adjacent disc spaces were not violated. Pedicle rod-screw instrumentation was used to close the wedge and provided a posterior tension band.

Results: The preoperative kyphosis in our study group ranged from 55 to 100 deg. with mean of 78 deg. The mean residual kyphosis was 22 deg with range from 10 deg to 30 deg. Correction upto 70 deg with mean of 56 deg was obtained There were no intraoperative complications, neurological deficit or infection. One patient early in the series was mobilized early and suffered fixation failure with a 30 deg loss of correction. No significant change in the corrected kyphus angle was noted in the remaining patients at last follow up (mean 1 year).

Conclusion: The technique of posterior vertebrectomy offers the advantage of one stage correction of deformity, early union, good stability and short fusion segment. It allows major corrections with least morbidity. Instrumentation must be meticulous and extend to at least two segments on either end. The procedure is technically demanding and has long learning curve.

OUTCOME OF 46 CASES WITH SPONDYLOLYSTHESIS TREATED WITH POSTEROLATERAL FUSION AND TRANSPEDICULAR SCREW FIXATION

Dr. Rajat Chopra, Dr. Shankar Acharya and Dr. K.L. Kalra
Sir Ganga Ram Hospital, New Delhi

We present our series of 46 patients with Spondylolisthesis treated with Posterolateral fusion and Transpedicular Screw Fixation. This study was carried out from July 1997 to July 2001. Average Age was 48 yrs. (Range 14-75yrs). There were 30 females and 16 males. We classified Spondylolisthesis according to Macnab Classification. 18 patients had Isthmic Spondylolisthesis, 8 patients had congenital Spondylolisthesis, and 14 patients of degenerative Spondylolisthesis and 6 patients had post surgery Spondylolisthesis. Follow up was min for 24 months and max of 56 months. Avg. was 29 months. In our analysis, In Isthmic Spondylolisthesis overall Improvement was in 15 out of 18 cases (83%) and radiological fusion was seen in 15 out of 18 cases (83%). In Degenerative Spondylolisthesis overall Improvement was in 12 out of 14 cases (85%) and radiological fusion was seen in 12 out of 14 cases (85%). In Congenital Spondylolisthesis overall Improvement was in 7 out of 8 cases (87%) and radiological fusion was seen in 7 out of 8 cases (87%). In Post Surgical Spondylolisthesis overall Improvement was in 3 out of 6 cases (50%) and Radiological fusion was seen in 3 out of 6 cases (50%). We feel that posterior Transpedicular screw fixation along with bilateral Posterolateral fusion in situ works well in Isthmic and degenerative Spondylolisthesis. In congenital though there is consensus on global fusion. We had just 6 cases so it's difficult to comment. But the management in Post surgical Spondylolisthesis is difficult and our results are not very encouraging.

MULTIPLE FENESTRATIONS IN LUMBAR CANAL STENOSIS: OUTCOME & EVALUATION; A REVIEW OF 46 PATIENTS

Dr. Rupinder Chahal, Dr. Shankar Acharya
Sir Ganga Ram Hospital, New Delhi

ONE BREATH COUNT – FOR BED SIDE MONITORING OF EXPIRATORY RESERVE VOLUME AND VENTILATORY MUSCLE ENDURANCE IN TETRAPLEGICS

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Introduction: Pulmonary complication is a threat to the life of tetraplegics during Acute Care. Respiratory insufficiency is neurogenic and mostly irreversible. There is marked reduction of Vital Capacity and Expiratory Reserve Volume. Expiratory dysfunction decreases the patient's ability to cough effectively and exposes tetraplegics to pulmonary infection. In Tetraplegics, day-to-day monitoring of Pulmonary function is essential to prevent or pre-empt, the lung infection. Proper monitoring requires different gadgets, not available in smaller hospitals and needs trained staff to use it and interpret the results. Material & Method - One Breath Count- (After a full inspiration, counting of numbers, to the maximum, in one breath.) In Acute stage it gives an idea of the level and extent of lesion. Daily recording of the OBC gives an idea of the .expiratory volume and ventilatory capacity. Any decrease in OBC gives an indication about an impending infection or failure of pulmonary compliance. Timely review may save the patient. A repetitive effort of counting maximum numbers, in one breath, set an assessable target to the patient and serves the purpose of Anaerobic Exercise to increase Ventilatory muscle endurance. In 46 Tetraplegic patients admitted in HOPE, (Acute and Rehabilitation Care Hospital for Spinal Cord Injury Patients) Hospital, OBC was used as bedside monitoring tool to assess changing lung volumes and Ventilatory compliance. OBC was compared with Peak Expiratory Flow rate. Repetitive OBC was done as a part of Pulmonary Rehabilitation. Conclusion - Daily recording of OBC gives a fairly dependable assessment of Ventilatory compliance, restrictive Ventilatory status (due to infection or bronchospasm). It increases the endurance of the respiratory muscles. This is a safe, easy to interpret, gadget free, patient oriented, reproducible and fairly dependable method in the management of post traumatic Tetraplegic patients.

LEVEL SPECIFIC EFFECT OF SPINAL CORD INJURY ON RESPIRATORY FUNCTION

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Govt. Physiotherapy College, Civil Hospital, Ahmedabad

PURPOSE OF STUDY: To know that how different level of spinal cord injury is responsible to produce Impairment in respiratory function-Primarily and Secondarily; a kind of comparative study of human samples;

PROPOSED HYPOTHESIS: Primary muscles for Inspiration (Diaphragm and External Inter costal) and Forced Expiration (Internal Inter costal and Abdominals) along with Accessory muscles of Respiration represents a kind of Balanced Forces normally; which may get destabilized when one group paralyzed/weakened in respect to others- depending upon the level of lesion at spinal cord level and myotomes affected. Which may lead to Paradoxical Breathing with alteration in normal lung volumes and capacities; specific to such alterations Primarily and Secondarily Respiratory Complications may arise.

MATERIALS AND METHODS: Comparative Study of 30 human samples with spinal cord injury at different levels. Comparison of IV (inspiratory volume), ER V (expiratory reserve volume), FE VIIFFVC [Spirometry Studies] Paradoxical Breathing [Subjective assessment by observation] Presence of Respiratory complications [Medical Reports] after 20 days of conservative/operative intervention.

SUMMARY OF RESULTS: Study is ongoing at present but available data till date suggest Progressively greater loss of respiratory function with increasingly higher level lesions.

CONCLUSION: Not yet arrived. Yet only 10 subjects have assessed out of proposed 30(minimum).

DEVELOPING GRAPHOMOTOR SKILL REGIME FOR TETRAPLEGICS

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Occupational Department, ISIC, New Delhi

Graphomotor skill is the most advanced skill of the hand which needs a meticulous and elaborate research work. The objective of the presentation is to study the components of graphomotor skills and the method of developing them according to the available muscles. Development of graphomotor skills needs an extensive and specialized training regime according to the levels of tetraplegia. The study was conducted on 25 patients who were observed for a period of four months. Two approaches were used -Compensatory and Adaptive approach. The results obtained by using the two approaches were analysed. Based on the assessment tools, patients were treated with both compensatory and adaptive approaches. Assessment tools for gross motor and fine motor skills were used for the same.

Though graphomotor skills are the finest skills, they can be achieved through intensive training and thorough practice. A detailed research work is further needed on the subject

HAND REHABILITATION REGIME FOR TETRAPLEGICS

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Department of Occupational Therapy, ISIC, New Delhi

The purpose of the study is to throw light on the fact that combination of various concepts works better in obtaining the functional outcome rather than a single technique. The development of hand functions in tetraplegics has always been a challenge for Occupational therapists. This is an attempt to emphasize the fact that different strategies are required at different levels of Spinal injuries in tetraplegics. Retrospective analysis of various techniques in developing hand functions in tetraplegics was done. Twenty-five patients were observed for a period of four months. Pre- and post-therapy assessments of hand were done using scales for gross motor, fine motor and in-hand manipulations. Results indicated that the C5-6 group performed better with tenodesis grasp whereas C67 group benefited with development of tripod grasp and lateral apprehension. Thus, it can be concluded that functional outcome of tetraplegic hand was highly dependant on the level of spinal injury and henceforth hand rehabilitation programme varies accordingly.

PREVALENCE OF MEDICAL COMPLICATIONS VIS-A-VIS PSYCHOSOCIAL COMPLICATIONS IN SPINAL CORD INJURY PATIENTS

Dr. Sindhu Vijaykumar, Dr. Upinderpal Singh
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The management of Spinal Cord Injury (SCI) has come a long way from "ailment not to be treated" of Edwin Smith papyrus to present day interdisciplinary approach, considering Spinal Cord Injury Medicine as a subspecialty of Physical Medicine and Rehabilitation (PM&R). Multiple complications occur after SCI which interfere with rehabilitation in these patients. Medical complications like pressure ulcers, autonomic dysreflexia, heterotopic ossification, osteoporosis with fractures, deep vein thrombosis (DVT) etc. are well reported in literature and necessitate frequent hospitalizations. There are'other associated problems of psychological, social or vocational nature, which often go unrecognized. In India, there is tendency not to express psychological and sexual issues, which are considered shameful or taboo. An attempt is made here to take note of the prevalence of medical as well as psychosocial complications in SCI patients attending PM&R department.

SEXUALITY AND WOMEN WITH SPINAL CORD INJURY – INDIAN SCENARIO

Dr. Roop Singh
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The objectives of this study were to clarify sexuality issues after spinal cord injury (SCI) and to identify the appropriate areas of improvement in rehabilitation. A representative sample of 28 women with SCI ranging in age from 18-56years (mean 31.8years) and duration of injury ranging from 6 months to 13 years (mean 2.7 years) were su veyed. Each Woman was interviewed and question related to social, medical and sexual activity were asked. 63% females had interest in sex, 86% know the importance of sex in life, 79% had decreased desire, and 43% rated their sex life worse than preinjury level. Only 36% woman and 57% of their partners were satisfied with their current sex life. 86% rated their overall relationship as cordial and sexual part of this relationship was cordial in 57%. 43% females never got cooperation during sexual activities and 7% had divorce post injury. Only 7% got information about the sex in their rehabilitation. Only two women become pregnant and delivered. Important outcome of the study are sexual desire and sexual aspect of the overall relationship are the worst affected after SCI. Most important reasons cited are complications of SCI like bed sores, urinary accidents, spasticity, lack of privacy and less partner cooperation. To add to woos there is no comprehensive rehabilitation programme to include sexual rehabilitation in India.

VICISSITUDE IN SEXUAL RELATIONSHIP AFTER SPINAL CORD INJURY: A MULTIDISCIPLINARY APPROACH

Ms. Anuradha Rakesh
Clinical Psychologist, ISIC, New Delhi

Independence is the huge accomplishment to live a serene life but to enjoy life to the tent, just taking care of primary function of the body is not enough, it is something beyond this. The concept of sexuality in spinal injury promises to offer strong possibilities of understanding the phase of transition. By now, the sexuality of people with disabilities has been widely recognized & accepted, but they are confronted by many practical problems or issues. Like, the availability of community activities where one findsright people, tactics of

approach, communication, clearing up sexual misconception finding a location, sexual position, and props and aids. The pilot study has been already one to see the psycho-social and sexual aspect associated with spinal injury. The objective of present study is to see the changes in the relationship in terms of love, intimacy, expression of feelings, openness and exploration as an effect of complete sexual rehabilitation program. It is a phenomenological study comprises of semi- structured interviews of the couple pre and post intervention. Cluster analysis has been performed to identify the factors involved in the vicissitude of relationship and to see the impact & importance of sexual rehabilitation on that. During intervention the couple has been well inform on all the issues of sexuality and sexual options through counseling by various team members. After that, the couple needs to given a private room for them to interact have some real quality time to themselves, to build their relationship in the light of new changes after SCI. It has been observe that sexuality is the main concern of each individual besides physical, psychological, social and cultural barriers. Couple reported that complete sexual rehabilitation should definitely be part of comprehensive rehabilitation program. It helps in developing a relationship in terms of attitude, communication, faith, reciprocity and receptivity towards each other. However, a loving, determined, and resourceful couple, regardless of the disability of one or both partners can find ways to fulfill their sexual needs and give each other maximum pleasure.

SPASTICITY & PHENOL NERVE BLOCKS

Dr. Elluri Rajendra Kumar
Nizams Institute of Medical Sciences (NIMS), Hyderabad

Spasticity is one of the most disabling aspects of traumatic & nontraumatic Spinalcord injury patients. The management of spasticity is a long-term process and needs to be undertaken 24 hours a day by patients, their care givers and the multidisciplinary team. The common measures to control spasticity include passive stretching, serial casting, orthotics, medications, and interventions such as Nerveblocks, Intrathecal blocks, surgical neurectomies & Tendon releases. Most of the procedures are expensive and can be safely undertaken in a large hospital as compared to local chemical neurolytic agent. Chemical Neurolytic agents like= 6% -phenol, and botulinum toxin A can be used for treating localized Spasticity. Botulinum toxin A is extremely expensive Which Prevents the widespread administration of this drug. 6%Phenol is a widely available neurolytic agent, which is not expensive with a wide margin of safety. Therefore Phenol was chosen as a neurolytic agent to Reduce loaclised spasticity in this study. It was a cross over Study to establish effectiveness of phenol blocks to Peripheral nerves. 17 patients who were having disabling spasticty and difficulty in performing self care activities and loco motor activities were included. In this study it was proved that there is definite reduction of spasticity by more than 2 grades as Measured by modified Ashworth scale and also showed that there is significant improvement in range of motion in neighboring joints. Following Phenol blocks there was a reduction in H-Reflex amplitude Electrophysiologically, However fall in H:M Ratio was not Significant. It was also proved in this study that phenol Blocks doesn't cause any side effects and it is also a cheaper Alternative to currently used medications. Phenol blocks to peripheral nerves improve functional independence measure and decrease the disability.

PROBLEM FACED DURING FITMENT AND CARE OF HALOBRACE

Mr. Praveen Dubey
Head of Orthotic Department, ISIC, New Delhi

Early mobilization of people with Spinal Cord Injury facilitates better rehabilitation and reduces hospital stay. Halo Brace is of paramount importance for stabilization of Injured Cervical spine. The purpose of presenting this article is to highlight the problems faced during fitment and care of Halo Brace.

PRESSURE SORES IN SPINAL INJURY PATIENTS - OUR EXPERIENCE

Dr. Nalli R. Uvraj
Department of Orthopaedics, Madras Medical College & Govt. General Hospital, Chennai

PEDIATRIC SPINE INJURY – A CLINICO – EPIDEMIOLOGICAL STUDY

Dr. Rajendra Prasad, Dr. A.K. Manav, Prof. (Capt.) D.K. Sinha and Prof. (Dr.) Arjun Singh
Orthopaedic Department P.M.C.H., Patna.

Introduction: Spinal injury in children differ significantly from that of adult in its epidemiology, nature, and outcome. There are only few series in which these aspects are analyzed. In a developing country like India the differences will be significant. This study is aimed to study the epidemiological pattern and clinical aspects of SCI in children in our scenario.

Method: 30 cases, below 15 yrs age of SCI with neuro-deficit admitted in PMCH Patna during- 2000-2003 were included in this study. The epidemiological characters like, age, sex, socioeconomic groups, mode of injury,

seasonal variation, transportation, number of times transferred, time since injury, social awareness and social belief regarding the injury were studied in detail. The clinical pictures in terms of type of injury, associated injuries, neurological status, radiological findings. method of treatment, complications and early outcomes were documented.

Result: The epidemiological data, clinical findings, complications, neurorecovery and early outcome are evaluated. Average age was 11.2 years (1-15 yrs) with male/ female ratio 2:1. One except all was of low socioeconomic group. Average time since injury was 40 hours and no of transfer was 4. Fall from medium to low height like guava trees, jamun trees, and back of buffalo were most common cause of injury. SCI WORA was noted in 20% , cases. Age was the most important determinant of type& severity of injury and outcome.

Discussion/Conclusion: spinal injury in children demonstrates a definitive epidemiological pattern and outcome that relates to the specific biomechanical properties of developing spine and social activities of pediatric age.

NEW DESIGN OF HALO BRACE

Mr. Kaushal Kishore Ashutosh
Orthotic Department, ISIC, New Delhi

Halo brace is commonly used to immobilize the cervical spine. But many problems are faced by the orthotist as well as the patient at the time of fitting. One of the main problem is fitting of Posterior telescopic rods.

Psychological uncomfortably with anterior telescopic rods.

This forced us to look for a new design, which has been developed at ISIC & forwarded for manufacturing.

The blue print is with us. One of the main feature of the new design is that it eliminates the posterior vest & posterior rods. All the rods come anteriority along with complete body contours.

Session – X - Auditorium
PARALLEL FREE PAPER SESSION ON SURGICAL MANAGMENT

OPERATIVE MANAGEMENT OF SPINE FRACTURES – SHIMLA EXPERIENCE (PRELIMINARY REPORT)

Dr. Manoj Kumar Thakur
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After July, 2002, 44 patients who had unstable fracture of the thoracolumber spine , and 12 patients with cervical spine fracture or fracture dislocation with or without neurological deficit were managed at Indira Gandhi Medical College ,Shimla (H.P.). Thoraco-lumber spine fracture fixation done through anterior or posterior approach by a MOSS MIAMI System, USS-SOPS (Synthes) and Steffee plating. Posteriorly, decompression with bone grafting was done in patients who had neurological deficit in 39 patients. Anteriorly , tricortical bone graft with cancellous graft after corpectomy done only in 5 patients having bone fragment compromising the canal space significantly on CATscan. Cervical spine fracture in 8 patients with burst # with or without dislocation fixed with CSLP & tricortical graft after corpectomy & OR. 3 patients fixed anterior as well as posterior who were had irreducible dislocation of unilateral facet joint. None of our patients had iatrogenic neurological deficits. After decompression of patients who were having neurological deficit, improvement occurred in all patients up to Frankel Grade 1 minimal in thoracolumber spine Two of our paraplegic patient recovered to Frankel Grade E. 5 paraplegic recovered to Frankel Grade D& C each. 2 quadriplegic recovered completely , I partially, & 2 had no recovery. Vertebral height maintained to significant level. Complications like bed sores, DVT, Significant UTI, & Chest infections were only minimal. We concluded that patients with unstable fracture of thoracolumber with neurological deficit should be decompressed, stabilized with implants and arthrodised as early as possible. In cervical spine, with burst fracture & canal compromise , anterior decompression , B.G, & fixation done at earliest. And subluxation with disc protrusion & irreducible facet dislocation- Posterior Facetectomy and anterior fixation.

Key Words: Thoracolumber spine, MOSS MIAMI system, USS-SOPS, CSPL, Frankel grade.

SHORT TERM ANALYSIS OF STABILIZATION OF FRACTURE DISLOCATION OF DORSOLUMBAR SPINE WITH DEFICIT BY POSTERIOR DISTRACTION SYSTEM (PDS)

Dr. Biswajit Sahu, Dr. B.N. Mohapatra, Dr. T. Mohanty, Dr. M.R. Biswal and Dr. N.C. Mahakul
Deptt. of Orthopaedics, S. C. B. Medical College, Cuttack, Orissa

Unstable spinal injuries of dorso-lumbar (D.L) spine region leave a devastating impact on the person due to involvement of spinal cord, nerve root with associated physical, social and psychological problems. Surgical

management is commonly used now-a-days which results in early stabilization and mobilisation, thus reducing the complications. 12 cases of D.L. spinal injuries with partial or complete neurological deficit were treated by posterior distraction system and were analysed over a period of one & half years with regards to the outcome, both clinically and radiologically. P.D.S. consists of laminar hooks, rods and transverse crosslinks. Laminar hooks were placed 2 levels proximal and 2 levels distal to lesion. Involved segments were distracted over rod stabilised by sublaminar wires and transverse crosslinks. Out of 12 patients, 7 had neurological recovery by 1 to 3 grades. Complications associated with conservative treatment were not encountered due to correction of deformity and early ambulation following stabilisation of spine. Though surgery plays less role in improving neurological status in unstable D.L. spine with deficit, operative stabilization by P.D.S. provides rigid fixation leading to stability and permits early rehabilitation.

ROLE OF ANTERIOR SURGERY IN THORACOLUMBAR TRAUMA

Dr. Devesh Dholakia, Orthopaedic
KEM Hospital, Mumbai

Study Design. A retrospective study with an inclusion & exclusion criteria, where we assess the neurological recovery after anterior surgery for thoraco lumbar trauma

Objectives The aim of this study is to highlight the role of anterior surgery in thoraco lumbar trauma.

Summary of Background Data Inspite of the fact that the first impact of injury to neural tissue decides the ultimate fate of neural recovery, neural decompression, canal alignment and internal fixation to an anstable column prc vides a proper environment for neural tissue to recover its function. There have been controversies regarding the management of fracture spine to an extent that one extreme group feels that it should be left to nature and the result of conservative treatment is almost same as operative treatment. However, recent literature has shown that this is not the case. The type of surgical intervention is extremely important and significantly alters the outcome

Methods: A series of 40 operated cases of fracture/ fracture dislocation of T-L spine is presented with more than one year follow-up, where anterior surgery was performed. Excluding the period of neurogenic shock, complete neurological charting was done (Grade 0 to Grade V - British Medical Research Council Grading) and the patients were ultimately categorized under four broad groups as functional grading Depending on the clinico - radiological assessment a surgical protocol was formulated to guide the surgical intervention

Results: There was no neurological worsening. 14% of patients in Group I and 100% of patients in Group 11 recovered to be in the ambulatory power group (Gp 111, IV). 80% of patients in Group III recovered normal power There was one implant failure for which a revision surgery was done There were two cases of wound dehiscence, one of the posterior incision and the other of the iliac crest.

Conclusion: The overall efficacy of anterior decompression and reconstruction of column anteriorly in indicated cases is evident. Anterior surgery is a direct, safe and complete way of neural decompression with an opportunity to reconstruct the column anteriorly in traumatic thoraco lumbar fractures.

Key Words: thoraco lumbar fracture, anterior reconstruction

OUTCOME OF SURGICAL MANAGEMENT OF THORACOLUMBAR TRAUMA

Dr. Prasoon Shamshery, Dr. Abrar Ahmed, Dr. B.N. Upendra, Dr. Meena Devkant & Dr. Arvind Jayaswal
AIIMS, New Delhi

Introduction: Previously surgical management of these fractures was posterior instrumentation alone which was associated with high rates of screws breakage and loss of correction. With advent of load-sharing concept, anterior column reconstruction with instrumentation allowed short-global fusion.

Study: This prospective study (1999-2003) involved 36 patients who underwent short global fusion. Anterior and posterior instrumentation with interbody cages were used in 20 and 16 patients respectively.

Results: 73.5% correction of deformity was achieved with 92% fusion rate on 2 year follow up. Functionally, patients achieved fair ratings on Prolo's scale. Pseudoarthrosis and rod-breakage was encountered in one patient.

Conclusion: Short global fusion results in better deformity correction and maintenance, excellent fusion rate, scoring of motion segments, early mobilization, rehabilitation and minimal instrument failure.

GUNSHOT WOUNDS OF THE SPINE

Lt. Col. H. S. Bhatoe, Army Hospital, New Delhi

CERVICAL SPINE INJURY: ANTERIOR FUSION

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Consultant Neurosurgeon, Downtown Hospital, Dispur, Guwahati, Assam.

Thirty-two patients with cervical spine injury had undergone anterior decompression and fusion in the deptt of Neurosurgery at DOWNTOWN HOSPITAL,GUWAHATI, from 1st January 1995 to 31st December 2003. Our results in relation to the pathology time of intervention, methods of fixation and outcome will be discussed.

Salient points observed are

1. corpectomy , iliac crest bone graft and implant fixation gives the most stable construct,
2. better outcome in C2/ C3 level.
3. mart off the patients presented after 48 hours of injury, surgical decompression in these patients is still helpful,
4. surgical fixation makes early rehabilitation possible.

SURGERY FOR CRANIO – VERTEBRAL JUNCTIONAL INSTABILITY – 25 CASES

Dr. Vijay M. Menon, Dr. Veerendra S. Pawar and Dr. S. Prabhakar
Consultant Neurosurgeon, City Hospital, Kolhapur, Maharashtra.

Any patient with craniovertebral instability requires surgical intervention most of the time. Surgery on craviovertebral junction is difficult and can lead to very serious complications. The clinical presentation is variable and a high index of suspicion is essential for early diagnosis X-rays of the CVJ inflexion and mere diagnostic in most of the cases. MRI tells us about the cord status. Pre and sometimes only intra operative skull traction with Gardner Wells tongs is necessary. Postoperative traction is obsolete. Selecting the surgical approach i.e. anterior versus posterior and sometimes both anterior and posterior has to be individualized to the patient. Early postoperative mobilization with cervical collar is recommended in all cases. Our experience in last two and half years in a district level set up is presented. Reduction under radiographic control with internal fixation done in 25 patients. Transarticular screw fixation for atlantoaxial dislocation was the most commonly done procedure. It was observed that this procedure gives the best possible results.

SURGICAL MANAGEMENT OF POTT'S SPINE

Dr. B. Mohapatra, Dr. Sunil Katoch & Dr. H.N. Bajaj
ISIC, New Delhi

OUTCOME OF REDUCTION AND SHORT SEGMENT GLOBAL FUSION IN SPONDYLOLYSTHESIS

Dr. Abrar Ahmed, Dr. P. Shamshery, Dr. B.N. Upendra, Dr. Meena Devkant. Dr. B.D. Choudhary & Dr. Arvind Jayaswal
AIIMS, New Delhi

OUTCOME BASED STRATEGIES OF LUMBAR & LUMBOSACRAL TUBERCULOSIS

Dr. B.N. Upendra, Dr. Prasoon Shamshery, Dr. Abrar Ahmed, Dr. Meena Devkant & Dr. Arvind Jayaswal
AIIMS, New Delhi Study design : A prospective study.

Objective: To assess the restoration of normal sagittal contour and functional outcome of decompression & modern instrumentation using cages and pedicular screw-rod systems with interbody fusion in patients treated for lumbar & lumbosacral tuberculosis.

Methods: 21 patients (avg age - 44years) with lumbarALumbosacral tuberculosis were selected between 1999 - 2002 for the study at the All India Institute of Medical Sciences. Lumbar spine was affected in 15 patients & Lumbosacral junction in 6 patients. All the patients underwent Decompression & stabilization using modern instrumentation. Patients were assessed for restoration of Lumbar lordosis, Inter body fusion & associated complications using radiographs & CT scan. Functional outcome was determined using Prolo's ratings.

Results: Average immediate post-op kyphosis correction was 78.4% (avg preop kyphosis - 26.7° avg postop kyphosis - 5.77°). There was an average loss of 4.78° of correction at 2 years follow up (kyphosis - 10.55°). 72.22% had Grade I fusion & 32.22 had GradeII fusion at 2 years follow up. Screw breakage was seen in 1 case , Cage tilting 3 cases & average cage sinkage was 1.3mm. Functionally Prolo's ratings improved from 3.8 preoperatively to 7.83 postoperatively.

Conclusion: Decompression with global fusion using pedicular screw-rod system & cages give good functional outcome with reasonable correction of lumbar kyphosis & minimal complications

TUMORS OF SPINE AND THEIR MANAGEMENT

Dr. Samir Dogra, Head Department of Orthopaedics
Mohan Dai Oswal Cancer Treatment & Research Foundation, Ludhiana

Primary bone tumors of spine are common in children & young adults while metastatic lesion of spine predominate in middle age. There is equal involvement of males & females. Most of the benign tumors were common in posterior elements while malignant was housed in anterior body. Carcinoma breast had the highest frequency amongst the metastatic tumors, which were commonly seen in thoracic spine (50- 60 %) Pain was the predominant symptom (seen in 85 %) & neurological dysfunction in 5 % of cases. Our mainstay of treatment was to relieve pain, to achieve mechanical stability and to maximize neurological function. we found RT+ CCT useful in cases with no significant neurological involvement and in cases where there is bony involvement without collapse. RT was the main stay of the treatment in cases of neurological involvement with bony involvement. Surgery along with RT+CCTwas useful in the case where there was vertebral collapse without significant neurological involvement or in those cases where the collapse was associated - with neurological involvement. Surgical treatment consisted of excision of tumor tissue by curettage and bone grafting/ verteberectomy / Hemiverteberectomy /Corpectomy & Stabilization was done in the form of DCP/ Pedicle Screw fixation (Stephe)/ Hartshill. Analgesics and steroids were given to decrease cord compresion , deminisesh pain and decrease the neurological deficit.

POST OPERATIVE LUMBAR DISCITIS

Col. Prakash Singh, Lt. Col. H. S. Bhatoe, Lt. Col. TVSP Murthy and Lt. Col. Mrs. K. Sanohu
Army Hospital, New Delhi

During a period of 12 years from 1990 to 2002, 21 cases of post operative lumbar discitis following surgery for disc herniation were reviewed retrospectively. 18 were male and 3 female. Their age varied from 25 years to 64 years. Most of patient developed pain between 1st and 3rd week after surgery. Severe back pain which radiated to buttocks, groin and abdomen and worsened by movement was most common. Fever was present in 6 cases only and wound sepsis in 1. Paraspinal spasm and reduced straight leg raising was found in all. ESR was raised in 15 cases only. C-reactive protein done in 3 recent cases was raised in all 3: Early X-ray L-spine did not help in establishing the diagnosis but MRI was diagnostic. Needle aspiration was done in 5 cases but no organism were grown. All patients were treated with antibiotics, bed rest and bracing and all responded well, no patient required surgery.

THE EFFECT OF CRANIOTOMY / SPINE SURGERY LOCATION ON THE INCIDENCE OF POSTOPERATIVE PAIN AND NAUSEA

Dr. Anurag Johari, Dr. Nitin Bhel, Dr. Ashutosh Bharadwaj, Dr. Gaurav and Dr. Shahla Haleem,
Department of Anaesthesiology and Critical Care Medicine, Aligarh, UP

PURPOSE: this study was performed to examine the hypothesis that patients who have had inferatettorial craniotomy experienced more severe pain and more frequent nausea than those with supratentorial procedures. Methods: postop. Outcomes of ,14 patients with the inferatentorial craniotomy, 26 with supratentorial and 24 with complex spinal cord surgery, taken as the cowl group were taken, all of whom have undergone surgery under GA, the mean arterial pressure was kept within 30%of preoperative values. Severity of pain and frequency of nausea and vomiting were recorded form 24h a$ersuugery. pam was assessed with a verbal pain scale of i -i 0. being collected for 24h posytoperatively. Results because the nausea and the pain diminish drastically 2h after the surgery, pair wise differences were assesed at each point within the first 30 min of the extubation, median pain scores in the satentorial aid spine groups rose to 2 and in the inferatentorisi group to S the statical differences between the groups were not significant (p>0.006) by logistic regression. also, the incidence of nausea was not significantly different (57% supratentorial, 57% spine, b7°/ninferatentorial: P+0.63)

Conclusion. there were no significant differences in the severity of pain or the frequency of nausea based on the cran'otomy site.

Keywords: neurosurgical anaesthesia, spine surgery, craniotomy, pain nausea, postoperative.

TRAUMATIC SPINAL CORD INJURIES IN HARYANA – AN EPIDEMIOLOGICAL STUDY

Dr. Roop Singh
Department of Orthopaedics, PGIMS, Rohtak, Haryana

Research Question: What are the preventable risk factors in traumatic spinal cord injury (SCI). Objectives: The present prospective study was conducted to survey the new SCI cases during 2000-2001. Study design: An epidemiological study conducted in tertiary care centre. Setting: Accident and emergency services and department of Orthopaedic Surgery & Rehabilitation of Pt. B.D. Sharma PGIMS, Rohtak. Participants: New traumatic SCI patients.

Study variables: Age, sex, mode of injury, SCI level, seasonal variance , associated trauma, duration of ho ital stay, socio economic status. Results: Four hundred and eighty three new ISCI cases reported in 2000-8001. Mate to female ratio was 2.96/1 and the average age at injury was 35.4 years. Fall from height was most common cause of trauma 4.4..5%, followed by Motor vehicle accidents 34.7%. One hundred and sixty four patients were tetraplegics and 283 patients were paraplegics, while 36 patients had no neurological deficit. Most common level of injury was first lumbar vertebra among paraplegics and fifth cervical vertebra among tetraplegics. There was increase in incidence of SCI during summer and rainy season. Average hospital stay was 39.5 days. Conclusion: Certain preventable risk factors in traumatic SCI (falls, vehicular accidents, improper Pre hospital care and improper transportation) need to be addressed in order to reduce the frequency and morbidity of SCI, burden on meager financial and health resources.

EVOLUTION OF A REGIONAL SPINAL INJURY CENTRE

Dr. Tanmoy Mohanty, Dr. B.N.Mohapatra, Prof. M.R. Biswal, Mr. R.N. Das, Prof. N.C. Mahakul,
RSIC, Cuttack, Orissa

PLANNING OF A MINI – GYM FOR REHABILITATION OF SPINAL PATIENTS

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Introduction: The primary aim of management of Spinal Cord Injury is Rehabilitation. For rehabilitation patient must develop certain basic abilities like ability to change side, hold simple articles needed for personal hygiene, ability to sit down, ability to move his body from one place to other, stand supported or unsupported and if possible to walk supported or unsupported. All these stages require properly planned physiotherapy based on available muscle power. Like operation theater of a surgeon a well-planned Gym is a must for rehab of SCI patients An ideal gym is an imaginary concept as all the requirement of the ideal gym is difficult to achieve. But a good gym can be planned as per the minimum requirement of the patient it is going to serve- With the better understanding of Pathophysiology of spinal cord injury patients more number of patients are surviving and being discharged to villages. In the medical colleges or SCI hospitals good Gyms are present. But Gyms are required to serve patients reporting to smaller hospitals also. Present paper deals with our experience to develop a full functioning gym at a minimum cost, with minimum space with maximum modification of available resources. Hope Hospital is 30-bedded self-financed, only private SCI hospital with 15 beds specially earmarked for patients undergoing different rehabilitation programme. A room of 15ft by 21ft with a preliminary minimum budget sufficient to undertake simple repairs was allotted for the Gym. A simple hospital bed was modified to serve for suspension exercises, standing frame and turntable. Thus at any given time it could serve two patients. One. corner of the room Parallel Bar was placed with just sufficient space for movement of wheel chair. An 8ft by 10 ft Divan was used for spinal Exercises. At other corner a table was modified for different types of pulley exercises. Ramp of the hospital was used for gait training against different gradients of slope. With this modified accessories the Hope hospital from Jan 2003 to January 2004 was able to provide basic physiotherapy practices to 43 Tetraplegic patients and 59 paraplegic patients.

DEEP VEIN THROMBOSIS AND PULMONARY EMBOLISM IN SPINAL CORD INJURIES IN INDIAN PATIENTS

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Most of the literature from the west on deep vein thrombosis(DVT) and pulmonary embolism(PE) in spinal cord Injury(SCI) report alarmingly high incidence necessitating Thromboprophylaxis.The literature from Indian subcontinent on this subject is scanty and not clear. In a prospective study, we analyzed 72 consecutive hospitalized SCI patients with neural deficit. Forty two of these were subjected to colour doppler using B mode and 30 to Venography. Whereas positive venography was observed in 4 cases, colour Doppler showed VT in 3. Fifteen patients died within three weeks of injury. As no other apparent reason for the death could be justified, PE was considered as cause of death as suggested by their clinical course. No thromboprophylaxis was used in our patients. We conclude that in Indian patients, it is difficult to diagnose DVT by clinical examination. Conventional Venography and colour Doppler show much lower incidence; possibly because of practice of massage and passive exercises by ever willing family members, racial differences and non availability of latest technologies at all centres. Still the high incidence of sudden death possibly due to undiagnosed and unsuspected PE is as high as reported in the west, thus the thromboprophylaxis in Indian patients too, can be recommended.

SURGICAL REHABILITATION OF HAND OF A TETRAPLEGIC PATIENT – A CASE PRESENTATION

Dr. B.D. Athani, Director,
All Indian Institute of Physical Medicine & Rehabilitation, Mumbai

NEW PRESCRIPTION CRITERIA IN ORTHOTIC MANAGEMENT OF RHEUMATOID ARTHRITIS

Ms. Poonam Rani
Orthotic Department, ISIC, New Delhi

The idea of presenting this article to make a person efficient to do their daily activity without any obstruction with in a splint in a rheumatoid arthritis patient. R.A. is autoimmune disease. Rheumatoid Arthritis can attack any synovial joint in the body, it has the greatest affinity for the small joints of the hand, wrist, and foot except the distal interphalangeal joints. Patient with RA. have deformity in hand and for that splinting is being recommended. Earlier splint use to cover the whole hand, which can't allow any movement of in hand that's why patient can't use in daytime. Sometimes cases received at ISIC, need splint or ulnar deviation control. This leads to change in prescription criteria and work on new design. splint can correct almost 60-70% deviation of mcp jt without obstructing his daily activity.

UROLOGICAL COMPLICATIONS AFTER SPINAL CORD INJURY

Dr. Roop Singh
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Urological complications observed in a sample of 300 patients with spinal cord injury over a period of 8 years and their possible remedial measures will be displayed in a poster form.

SEXUALITY, LOVABILITY AND INTIMACY AFTER SCI IN RELATION TO QUALITY OF LIFE: AN IMPORTANT DOMAIN OF OCCUPATIONAL THERAPY

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Sensuality and sexuality are aspects of everyone's Activities of Daily living and hence, directly related to the quality of each person's life, self-esteem, and adjustment to disability. Thus, it is very much in domain of occupational therapy.

OBJECTIVE: The purpose is to study the quality and the quantity of sexuality-related services and the efficacy of sexual rehabilitation from occupational therapy point of view.

LITERATURE REVIEW/ RETROSPECTIVE ANALYSIS: A review of literature and previous studies demonstrated a high priority concern for sexuality counseling, the strengths and limitations of occupational therapy in this role, the need for a sex-related role, the need for education, counseling about positions according

to the specific problems of patients.

METHOD: The paper consists of the role of occupational therapists, the appropriate time and method of approach. It also contains the ideal intervention strategies and the positions based on the feedback from SCI persons based on which a prospective could be designed.

RESULTS: The most pleasurable positions depend on the sexual preference, the level of injury and mobility. Each position has certain advantages in terms of comfort, convenience and type of stimulation. Suggesting a wide variety of sexual practices, sexual expressions and expression of sensuality are possible, but this is an individual decision and requires experimentation and practice. The client needs the opportunity to explore his or her needs and acceptable options to meet those needs. Education, counseling and activity analysis can be used to solve many sexual problems confronted by SCI patients.

CONCLUSION Occupational therapist is one of the members of rehabilitation team who has something important to offer in rehabilitating the client in area of sexuality and sensuality and thus improving the overall quality of life.

CHANGING A MEDIUM CAN BRING CHANGES IN THE LIVES OF PATIENTS: HYDROTHERAPY APPROACH

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OBJECTIVE-This paper throws light on the effects of Hydrotherapy in different types of cases with a focus on role of hydrotherapy in rehabilitation of spinal injury patients during my clinical experience in Indian Spinal Injuries Centre. DESIGN-Hydrotherapy, the treatment inside a pool is an attempt to bring difference in the lives of the patient suffering from spinal injuries, stroke, low backache, arthritis, sport injuries, post-fracture stiffness and other orthopedic and neurological problems. The concept of Hydrotherapy, an "adaptation" to a new environment –WATER, is an upcoming approach, not much talked about therapy, in India in the field of Rehabilitation. The focus is towards the difference, which can be brought about in spinal injury patients in comparison to the treatment given outside water i.e. Conventional therapies-occupational and Physiotherapy. SUBJECTS-The study comprises of 250 patients with different ailments including 20 Spinal injury patients. METHODOLOGY- Patients with Spinal Cord injury were given hydrotherapy and the effectiveness of hydrotherapy was analyzed in comparison to the other modes of therapy- Physical and occupational therapy in our department of rehabilitation. RESULTS- indicated significant improvement in patients. With the application of Hydrotherapy principles, we get the results like

- relaxation of muscles
- decrease in spasticity
- improvement in the residual movements
- improvement in the strength of muscles
- improvement in the vital capacity with respiratory training
- promotion of gross movements
- re-education of gait

Also categorization of the effects of hydrotherapy and the conventional therapy was done to emphasize the role of Hydrotherapy. CONCLUSION-Thus, it can be concluded that Hydrotherapy is an effective mode of treatment in Spinal cord injury patients and other conditions.

ROLE OF NEURO SURGEON IN THE MANGEMENT OF SPINAL INJURED PERSONS

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Chennai

Spinal injuries are best managed by multidisciplinary approach. This paper will deal with the role of Neurosurgeon in the management of Spinal Injury.

He/she has specific tasks to perform for a successful management of spinal injury at the following stages.

1. Assessment.
2. Investigation.
3. Treatment- surgical/non-surgical.
4. Rehabilitation.
5. Follow up.

Assessment: Vertebral level and neurological level do not correspond and it is the responsibility of the surgical neurologist to precisely record the exact diagnosis.

Investigation: Surgical neurologist has to decide on the exact level of radiograph and imaging. Further sensory evolved potentials study will guide in the management.

Treatment; The treatment is essentially physiotherapy, nursing care and surgery when indicated and rehabilitation. The spinal injured patient will get the best benefit when the surgical neurologist is part of the surgical team when decompression is planned.

Rehabilitation: During the stage of rehabilitation also the neurosurgical services may be required especially when the hyper tonus is interfering with ambulation.

Follow up: At the time of review the surgical neurologist has to precisely assess the neurological status and plan for the rehabilitation.

This paper will deal in detail about the role of Surgical Neurologist in the management of spinal Injuries.

INTRORDUCTION: Spinal injuries are best managed by multi disciplinary approach with either the Orthopaedic Surgeon or the Neuro Surgeon or Spinal Trauma Surgeon as the coordinator.

In this paper Neuro Surgeons role in assisting the coordinating Orthopaedic Surgeons is enumerated. Neuro Surgeons role is at multiple stages.

EMERGENCY MANAGEMENT: In the emergency room associated brain injury is excluded by clinical examination and if indicated by CT Brain. Adequate Air way is ensured. Priority of treatment is decided.

ASSESSMENT: A meticulous Neurological examination is conducted to evaluate the involvement of neural elements. Motor level, Sensory level, autonomic level are correlated with skeletal level of the lesion. Skeletal level may not correspond to the neurological level at lower dorsal and lumbar regions.

Further a clear mental picture of the tracts is essential to accurately record the initial neurological involvement.

Lamination in the tracts and vascular supply to the cord may pose discrepancy between the skeletal level and the neurological level.

Surgical Neurologist who is familiar with the Neuro anatomy and Neurophysiology of the spinal card is best suited to assist the Orthopeadic surgeon in the decision on investigations.

Brain Stem Sensory Evoked Potential examination is a good tool to differentiate complete from incomplete cord injury

Surgical Neurologist is also responsible for monitoring of the neurological progress of the patient. Documentation of the progress is very essential.

INVESTIGATIONS : In a developing country as ours it is essential that only the necessary investigations are carried out. The Clinical Neurological examinations guides regarding the investigations required . X rays are still the best and less expensive means of assessing the skeletal injury. However if the X rays do not reveal any skeletal injury, CT Scan may reveal the skeletal damage.

If surgery is contemplated the exact picture of skeletal injury is absolutely essential for planning.

TREATMENT: The management of the patient may be surgical or conservative. In both the Neuro Surgeon plays an important role.

Decision on surgery or not depends on the individual surgeons views. It ranges from emergency surgery within six hours after injury to absolutely conservative management.

Decompression and stabilization are required whenever there is a definite evidence of compromise on the neural elements. The Neuro Surgeon and the Orthopaedic Surgeon should coordinate while performing surgery. The ideal will be the Neuro Surgeon tackling neural part of the surgery as he is familiar with the neural elements and the orthopaedic surgeon may take over the stabilization process.

In these days of sub sub speciality a spinal trauma surgeon may be capable of tackling the spinal cord injured person.

But in a developing country like ours the patient should get the benefit of the best of the Neuro and Ortho Surgeons.

REHABILITATION: Unfortunately this aspect of the patient is neglected because of the enormous work load of Neuro and Ortho Surgeons. But Rehabilitation is most important to the patient. We may to have involve a Physiatrist at this stage though from the beginning the goal is rehabilitation and the objective is to prepare the patient to lead a normal independent life.

Along with the active treatment the following are important from patient's point of view.

1. Ambulation
2. Independence
3. Bladder and Bowl rehabilitation
4. Sexual rehabilitation
5. Management of flexor spasms, if any
6. Pressure sores, if any

Bio feed back, yoga therapy are some of the adjuvant for total rehabilitation of spinal injured persons.

FOLLOW UP: This is another neglected part of the management of spinal injured. When we accept the responsibility of managing a spinal injured person we will be failing in our duty if we do not follow them up.

Follow up is useful not only to the patient but also to the clinician. "Re-search" on the management of spinal injured will help to better the knowledge of the surgeon and life of the patient.

I would like to conclude by conveying to you the services which some of the spinal injured are doing in our country.

Sri Ashok Hans of Bhuvaneshwar, a quadriplegic since 20 years had to face many problems before he could stabilize himself. So he wants to help other spinal injured. He has established a service where after acute care the spinal injured are given guidance. He emphasizes on prevention and he conducts workshops for ambulance staff, public, Red Cross Workers, para medical workers, nurses and doctors from primary health centres. He stresses on the importance of the management at the 'Golden Hour" and there after. Total care is given to each spinal injured at the Shantha Memorial Rehabilitation Centre. Even if one person is totally cared for, it is worthwhile.

Sri Ramakrishnan, a Trainee Army Officer and an Engineer was injured while doing exercise. He fell down and sustained cervical cord injury. He has established a centre for service to Polio children. Polio children are given institutional treatment as well as education. Now he is involved in identifying and helping the "disabled" in the community. Further he has presently started a service for spinal injured. He is assisted by Sri Sankara Raman who is bound to wheel chair due to muscle disease. Both of them are doing wonderful rehabilitation service to the community.

Dr. Chelliah is a medical doctor who leads a wheel chair life has an expansive service better than even an able person.

Dr.A.G.Patil, Prof. of Bio Medical Engineering at Bombay- a quad- has fabricated many gad jets which will be of use to other spinal injured persons.

Major Aluwalia of Indian Army, who is also a spinal injured person, is working in the national centre for spinal injured at New Delhi.

These are some brave persons who have taken a positive attitude and are helping other disabled.

Every one involved in the care of spinal injured should take suggestions from the above mentioned role models. What looks as trivial may be of great importance to the able bodied may be of importance to the spinal injured. For example the toilet should be built in such a way that the wheel chair can go in without hindrance.

ASIAN SPINAL CORD INJURY NETWORK – CURRENT STATUS

Stephen Muldoon
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1. INTRODUCTION

This paper has been prepared to give an overview of the current status of the Asian Spinal Cord Network (ASCoN). It describes progress that has been made, challenges that have been faced and it provides suggestions to help strengthen and further develop ASCoN.

2. BACKGROUND

Spinal cord injury continues to be a major cause of disability throughout Asia. It is often seen as a difficult and expensive condition to treat and is, therefore, not prioritized in already overstretched health services and budgets. The result of this is that patients who sustain a spinal cord injury very often develop life threatening complications. If the patient survives they are usually confined to their homes, reliant on immediate family to provide for their basic needs. The prognosis is usually bleak.

Organisations throughout the region are improving, however, that this does not have to be the case and there are now many good examples where appropriate and effective rehabilitation programmes have been developed. Such programmes have enabled thousands of people with spinal injury to return to their families and communities and to live active lives. It had been felt for some time that these organisations and others have much to learn from each other and that this learning can lead to the increase of services for people with spinal cord injury throughout Asia.

It is against this backdrop that ASCoN was established at a conference on spinal injury management held at the Centre for the Rehabilitation of the Paralysed (CRP) in Bangladesh, in November 2001.

ASCoN consists of a group of organisations in the Asia region who have come together to share and learn from each other in all aspects of spinal cord injury management, from initial treatment of the patient to re-integration of the person.

At present there are 47 member organisations throughout 16 countries in Asia. These countries include Afghanistan, Bangladesh, Bhutan, Cambodia, India, Indonesia, Japan, Korea, Laos, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, and Vietnam. Membership is representative of a broad spectrum of organisations. At one end of the scale there are member organisations that have been established for many years, while at the other end of the scale there are members who have just begun establishing services within their respective countries. New members continue to join.

3. METHODOLOGY

Both the authors, through their organisation John Grooms Overseas, have been facilitating and supporting the development of the Network since its formation in 2001. Therefore much of the information used in this paper was collected by the authors during the course of their work. For example information was collected

- During the annual ASCoN conferences;
- From each Annual General Meeting;
- When compiling the ASCoN Newsletters;
- Through correspondence to and from members;
- Through reports on exchange visits;
- Through questionnaires sent to each member in September 2003 asking for their views on the network and suggestions for its ongoing development;
- Through direct input for capacity building at spinal injury centres by JGO staff.

4. DISCUSSION

ASCoN consists of a group of organisations in the Asia region who have come together to share and learn from each other in all aspects of spinal cord injury management, from initial treatment of the patient to re-integration of the person. The activities of ASCoN can be categorised under the following headings:

- Co-Ordination and Networking
- Newsletter
- Exchange Visits
- Annual Regional Conference and General Meeting
- Promotion and Fundraising
- Capacity Building through JGO Direct Input

5. ACTIVITIES

5.1 Co-Ordination and Networking

Progress

Initially ASCoN was co-ordinated by CRP and JGO. As the Network has grown it was decided at this year's Annual General Meeting that an executive committee should be established with the responsibility of ensuring the objectives and activities of ASCoN are further developed and that the network sustains in the long-term.

The executive committee is made up of representatives from Hope Hospital in India, CRP in Bangladesh, Yangon General Hospital in Myanmar, Dept of Rehab Medicine, University of Chiang Mai in Thailand, Fatmawati General Hospital in Indonesia, Handicap International in Vietnam, SIRC in Nepal and JGO in Sri Lanka.

Maggie Muldoon of JGO was requested and agreed to act as Honorary Secretary to the Network. As such JGO continues to provide a central facilitation function as well as supporting the other activities of ASCoN.

ASCoN has begun the process of becoming an affiliated body of the International Spinal Cord Society (ISCoS). It is hoped that in one sense this will lead to increased opportunities for the further development of members and on the other hand it will help others learn about SCI management in the Asian context.

The network has been featured in an article in the Asia Pacific Disability Rehabilitation Journal (Vol 14. No. 2, 2003) entitled Regional Spinal Injury Network – Initial Experience, (2001-2002), by Maggie Muldoon.

Challenges

For effective co-ordination and networking it is essential that members keep ASCoN informed of happenings within their organisations. It has been difficult at times to keep a flow of information going as members have been slow to provide information from their respective organisations. As the network has grown in size the amount of work relating to implementation of the activities and administration has also grown. This has sometimes proved to be difficult as the work of the Honorary Secretary has to be balanced with her other responsibilities within JGO.

One of ASCoN's strengths has been its ability to thrive with very limited resources and enthusiasm and commitment of the members. While this positive factor should not be lost it is also necessary to secure funding to help ASCoN reach its full potential and to cover its running costs and increase coverage of its activities outlined below.

5.2 Newsletter

Progress

A newsletter is circulated electronically (by email) to all members on a quarterly basis. Examples

of content include scientific papers, case studies of good practice, reports on benefits of exchange visits, organisational profiles and useful information. At present the Newsletter is distributed to all organisations who are members of the Network in 16 regional countries. It continues to provide a forum to share ideas and learn from the approaches adopted by different centres. The Newsletter is compiled, edited and distributed by the Honorary Secretary. The Newsletter was re-formatted recently following feedback from members and new items have been added, for example, a section on useful websites.

Challenges

The main challenge has been the difficulty in getting member organisations to submit articles for inclusion. The Newsletter and the Network will only be as effective and useful as each member makes it.

5.3 Exchange Visits

Progress

Staff from member organisations have begun to visit each other's centres to learn more about the different approaches to Spinal Cord Injury Management in Asia. Last year eight exchange visits took place. Exchange visits are proving to be a very practical and useful method of sharing ideas and skills. They have been found to be particularly useful for newly established organisations to learn from organisations that have been around for sometime, for example when SIRC, Nepal visited CRP, Bangladesh. It has also been found that exchanges involving teams are of greater value particularly when the team returns to their own workplace and begins to put their learning into practice.

Members sending their staff and students on exchange visits and placements have been raising funds to cover travel related costs while members hosting staff and students have been providing training opportunities and accommodation. Benefits have been noted for both parties. Those who have visited other centres have been able to transfer their knowledge learnt into further developing services within their own centres. Those who have hosted people from other organisations and countries believe that the experience has helped their staff to improve their knowledge and teaching capacities.

Challenges

Although the value of exchange visits to both staff and organisations has been realized, one of the main obstacles for members organising exchange visits has been raising funds for travel. This has not been easy when many of the members have limited funds and other areas of priority for which they require funding.

5.4 Annual Regional Conference and General Meeting

Progress

The first Annual ASCoN Conference was hosted by CRP in Bangladesh, and then by ISIC in India. The most recent annual ASCoN conference was held at the University of Chiang-Mai in Thailand in November 2003. Although the conference in its own right is valuable, it also has the added value of generating continued enthusiasm for all of ASCoN's other activities. At the most recent conference there were 164 participants from 20 countries in attendance.

The annual conference continues to provide a forum that enables people working in Spinal Cord Injury Management to get together and learn from each other's experiences. As the conference brings together delegates from the region and from the international arena it ensures that the latest international developments can be discussed alongside advances that have been made throughout the region in all aspects of spinal cord injury management. It is also an opportunity for regional members to share their experiences of SCI management in the developing context.

The conference also provides the opportunity for ASCoN to hold its Annual General Meeting. This meeting enables representatives from member organisations to come together and discuss a range of issues relating to the Network. It also provides a forum to make important decisions, such as, for example, where the next annual conference should be held and why.

Challenges

The conference is a strenuous event for those who choose to host it and a strong team effort is essential. One of the greatest challenges for the organiser is raising funds to enable them to host the conference. The Hosting Organisation has to establish specific fundraising initiatives to cover the costs and through the generous support from many different supporters, all three conferences to date have been a success.

To ease the burden on the organiser it was suggested at the last AGM that the member organisation wishing to attend should themselves plan, budget and raise funds towards the costs

of sending a team to the annual conference.

With regard to the content of the conference it has been acknowledged that much has been learnt with regard to treatment and rehabilitation of spinal cord injury and that these themes should continue in the future also. It has also been suggested however that a stronger focus may need to be given to areas around social and economical integration as it is often after the person goes home that many experience the most serious problems. Also some feel that prevention of spinal cord injury should feature more prominently.

5.5 Capacity Building through direct JGO input

Progress

As well as providing advice and information to ASCoN members, usually through e-mail,

JGO continues to provide short-term capacity building support to a number of ASCoN members each year. The organisations who have received direct input include CRP and SIRC. Input has included supporting the implementation of needs assessments, strategic planning exercises, evaluations and in the development of fundraising strategies.

JGO also has limited funding through the Irish Government which enables us to support the costs of short term and long term expatriate personnel to work alongside local staff. At the present time we do not have the funds to expand this service but we hope to be able to extend this service to a number of other organisations in the future.

Challenges

Whilst JGO would like to extend the short-term capacity building service to other organisations, this needs to be balanced with the availability of funds and time. The authors feel that a feasible way to expand this service would be to facilitate the short-term placement of people with particular skills to another member organisation with a particular need. This of course has implications such as funding and time and more consideration would be needed on how these factors could be overcome.

6. CONCLUSION

ASCoN is proving to be an appropriate and cost effective initiative which is enabling organisations throughout Asia to learn from each other in all aspects of spinal cord injury management. Through its work, ASCoN is putting greater emphasis and focus on a condition that has long been neglected. This is resulting in the development of both services and the people who deliver these services. Through the activities of ASCoN people with spinal injury throughout Asia have a better chance of physical, social and economical integration in their communities.

Like any new initiative lessons are being learnt along the way, but as long as we truly learn from these the Network should grow from strength to strength. Who knows it may become a model for any group of people in any field wishing to share, to learn and to grow within the area of their involvement.

7. SUGGESTIONS FOR FUTURE DEVELOPMENT

- Complete the process of affiliation to ISCOS.
- Member Organisations should agree to submit material and any relevant information to the Network at least once in every quarter. This material can be used for effective co-ordination and for inclusion in the Newsletter.
- Funds should be secured to enable ASCoN to reach its full potential, cover its costs and increase the coverage of its activities.
- Exchange visits between member organisations should be increased.
- Where possible, teams should be encouraged to participate in exchange visits, rather than individuals.
- Member organisations wishing to organise exchange visits and/or attend the Annual Conference should plan, budget and raise funds towards the costs of these activities.
- At the Annual Conference a stronger focus may need to be given to areas around social and economical integration and prevention of spinal cord injury.
- Expand, if funds allow, short-term placements of people with specific skills to organisations with specific needs.
- Develop a database of personnel willing to participate in short-term placements.
- Develop a database of organisations that have identified specific needs.
- Develop a monitoring and evaluation mechanism within ASCoN and use this as a way of strengthening the Network.

PROTOCOL OF PEER COUNSELLING AT ISIC

Mr. Shivjeet Singh
Peer Counsellor, ISIC, New Delhi

SPECIAL NUTRITION REQUIREMENTS OF THE SPINAL INJURED

Ms. Shelly Batra, Dietician
ISIC, New Delhi

Session – II

GOALS, TIMING AND METHODS FOR SURGICAL TREATMENT OF THE VERTEBRAL INJURY IN SCI

Patrick J. Kluger
NSIC Stokemandeville

1. **Introduction :** Only about 30% of all surgically treated traumatic lesions to the vertebral column cause a substantial damage to the spinal cord or to the cauda equina. In these cases, specific considerations must be made in timing and in selection of surgical methods in order to achieve the best possible functional outcome, and to allow the early start of a specific rehabilitation programme.
2. **Fundamentals**
   - 2.1. There is no clinical evidence, and no clinical evidence can be expected in the foreseeable future, that surgical treatment of a spinal injury with SCI would, generally, improve the neurological outcome. On the other hand, no evidence shows surgery as statistically deteriorating the neurological outcome of SCI. Previous studies, showing adverse effects of surgical treatment in SCI, are not valid any more, as they investigated outcome after surgical methods which are long since obsolete, such as laminectomy without fixation.
   - 2.2. Results from experimental animal studies suggest that early decompression in incomplete lesions enhance neurological recovery. A significant relationship was found between the extent of recovery and the duration of cord compression, but the time windows of only minutes up to a few hours, where the removal of encroaching material was found to be beneficial, is rarely applicable in clinical practice.
   - 2.3. In initially complete lesions, the chance of substantial neurologic recovery is extremely low, but a chance of recovery can only be fully excluded if an anatomical trans-section of the cord is proven. MRI studies can not demonstrate complete trans-sections in all cases with full certainty. Because a full neurologic assessment is not possible at the moment of injury, some of the cases appearing complete at the time of admission, may have been progressive to completeness since the accident.
   - 2.4. Apart from cases with complete trans-section of the cord, the neurological prognosis of a transverse lesion is not precisely predictable, and, in the acute phase, the neural deficit of every individual case must be understood as persistent, i.e. the concept of treatment must not rely on neurological recovery.
3. **Timing**
   - 3.1. As already pointed out, the hope of an improved neurologic outcome can hardly dictate immediate surgical intervention. There is one exemption largely accepted:
     The progressive paralysis with findings indicating a persistent compression or stretching of the spinal cord by fragments, by displacement, or by haematoma.
     The neurological deterioration is a proof of the insufficiency of the conservative means of treatment and immediate surgical action is required.
   - 3.2. Vice versa, an ongoing neurological improvement should, when possible, postpone the surgical intervention. The surgical procedure carries the theoretical risk of causing a local oedema, which could be responsible for a halt in the process of improvement, post-operatively.
   - 3.3. If there is a plateau in the neurological deficit with continuous compression or stretching of the neural structures, and once the decision for surgery has been made in principle, the fundamentals above should be considered. In doing so, the question to be answered, on timing, will be:
     "What are the reasons for postponing the intervention?" rather than: "Why operating in urgency?"
   - 3.4. The more there is a persisting encroachment of the spinal canal, and the better the chance for further neurological recovery is (i.e. in incomplete SCI, and where sacral sparing is present), the more difficult it will be to find and accept reasons for postponing the intervention.
   - 3.5. Apart from these views on the neurological situation, general aspects direct the timing for

surgery.

3.5.1. Unstable spinal injuries carry the risk of further neural damage during transportation, nursing, or other surgical procedures. An unstable spinal injury in poly-traumatised patients or in patients with low compliance by intoxication, by age, or by mental disorders, should be stabilised with high priority.

3.5.2. In every severe injury to the thoracic spine, a lung contusion must be anticipated, and an ARDS can develop, usually after 48 to 72 hours. The spine being stabilised before long-term ventilation starts, and before positioning and pulmonary physiotherapy is of vital importance, has a substantial impact on the patient's survival chance.

3.5.3. After more than 10 days, correction of traumatic deformities become increasingly difficult, and more invasive methods must be used. Therefore, surgical reduction and stabilisation should be undertaken within the first week after injury, wherever possible and whenever indicated.

3.5.4. In staged procedures (see below, 4.7.3.2, -3) after initial fixation, the secondary anterior bone fusion should be done within 6 weeks at the latest. The extrinsic stability provided by spinal implants lasts for 6-8 months, and it is limited by fatigue failure of the implant itself, or by its loosening in the bone. In patients with poor bone quality, or with the exertion of unusual high loads on the immobilising construct (e.g. ankylosing spondylitis), an even earlier loss of the primary stability must be expected.

The bony reconstruction must happen early enough for the accomplishment of the graft's consolidation, before the stabilising implant's life-span is exceeded.

4. Methods

Out of the wide scale of procedures in spine surgery, versatile and efficient methods must be selected for the acute treatment, and a uniform protocol should be established, according to the type and localisation of the injury. The selection of methods must be applicable in the acute phase of an injury, as minimally invasive as possible, and the methods have to be effective and fast in achieving the goals of anatomical re-alignment, including decompression of the spinal canal, and fixation. Due to the possible need of emergency interventions, every surgeon on call in the unit must be able to perform these procedures. Therefore, some methods, which are used only in small numbers, or only by singular surgeons of the team, are less preferable, i.e. endoscopic methods.

SCI patients have even greater demands on certain qualities in the surgical treatment of their vertebral injury, than ambulatory ones:

4.1. A high level of primary stability must be achieved. The rehabilitation programme should start as early as possible, and there should be no restrictions, for instance in sitting, which some fixation methods of the lower lumbar spine do not allow for several weeks. Without sitting, the paraplegic patient would remain bed-bound, and he could not become independent in managing his paralysed bladder and bowels, nor could he learn to dress or undress, or to clean the lower parts of the body.

4.2. Additional external immobilisation by an orthosis should be avoided, wherever possible. Halo-vests, full contact body braces and, even worse, casts, carry a high risk of pressure sores in SCI patients and they hinder seriously the rehabilitation progress. Solely a soft or a stiff cervical collar may be acceptable for some weeks if this helps to avoid an additional posterior approach in anteriorly fixed dislocation injuries to the cervical spines.

4.3. An anatomical alignment of the spine, without loss of correction, is paramount in SCI patients, especially in the cervical and in the lumbar spine. The mechanisms for spontaneous compensation of misalignments are less available to paralysed patients. First, the muscle control for active compensating efforts is impaired, but there are other specific aspects, too:
A compensating hyper-lordosis of the cervical spine locks rotational movements of crucial importance to tetraplegics. Wheelchair-users cannot over-extend their hips in order to compensate a kyphotic deformity in the thoraco-lumbar or lumbar region.
In Good Practice, no segmental loss of lordosis should occur in the cervical and in the lumbar spine, and in the thoracic and in the thoraco-lumbar region acceptable degrees of post-traumatic deformity do not exceed 35 and 20 degrees COBB, respectively.

4.4. The preservation of motion segments is of utmost importance in SCI patients. The sacrifice of mobile segments by long instrumentations cannot be compensated by an SCI patient, as by an ambulatory one. To put on his or her trousers, socks and shoes for instance, the SCI patient has to extremely bend forward, whereas the ambulatory patient just lifts and bends his or her leg. If a wheelchair user tilts backwards in his or her chair, he/she needs to rotate quickly and extensively in his or her thoracic spine, to prevent a fall on his/her back or head. This does not need consideration in ambulatory patients, where multilevel fixations of the thoracic spine may be well

tolerated. In the cervical spine, the preservation of as many mobile segments as possible, in an optimal alignment, is an issue of crucial importance in SCI patients. Apart from the cervical spine, the tetraplegic has not much to move voluntarily, and the spine's mobility is largely utilised by these patients: for balance in the chair, for operating mouth sticks, for the use of devices for environmental control, and so on.

4.5. The spinal surgery in the acute phase after SCI must usually explore the spinal canal for decompression, and for micro-surgical treatment of damaged neural tissues, such as suturing of dural tears and repositioning of prolapsed filaments. In the thoracic and in the lumbar spine, both tasks together can only be fulfilled via posterior approaches, as the vast majority of dural tears occur on the posterior aspect of the cord. In the cervical region, due to the anatomy of the vertebral artery, reduction or removal of vertebral body fragments compressing the cord from the front cannot be performed via a posterior approach.

4.6. The closed reduction of traumatic mis-alignments is routinely possible in the cervical, less frequent in the lumbar, and rarely possible in the thoracic spine. Therefore, posterior exposure for achievement of an anatomical reduction of major displacements is rarely needed in the cervical spine, but frequently in the lumbar and nearly always in the thoracic spine.

4.7. In the following, a list of methods (pre-op immobilisation / recommended procedure / post-op immobilisation) is given for the different injuries of the vertebral column, which have evolved to meet the specific demands in SCI patients, as mentioned above, over the last 20 years. The listed methods may be used as a framework for good practice, when surgical treatment of the underlying vertebral injury in SCI patients is considered in the acute phase.

Type of injury	Pre-surgical care	Method of surgery	Post-surgical care
4.7.1 Injuries C0 – T2			
4.7.1.1 Fractures of occipital condyles / occipito-cervical disruptions in adults:	Skull traction (in compressive displacements only), SOMI brace (Minerva orthosis).	Fusion and instrumentation Occiput-C1. If Jefferson fracture concomitant: Fusion C0-C2 (Magerl screws C1-2).	No orthosis
4.7.1.2 C1 Jefferson fractures:	Skull traction	Clamp Fixation with lateral mass screws and connecting rod	No orthosis ./. soft collar 4 weeks
4.7.1.3 C2 - Dens fractures Anderson II	Philadelphia collar ./. SOMI brace	1 – 2 Boehler screws	1 screw: Philadelphia collar ./. SOMI brace 4 weeks; 2 screws: No orthosis
4.7.1.4 C2 - Dens fractures Anderson 3	Skull traction	Anterior fixation Mini – T-plate ./. posterior fusion C1-2 (Magerl screws)	T-plate: Philadelphia collar 4 wks, C1-2 fusion: No orthosis
4.7.1.5 Burst- and wedge fractures C2 to T2 (AO classification A and B)	Skull traction	Anterior decompression (discectomy(ies) / + corpectomy) and fusion with autogenic graft and plate fixation	AO A: No orthosis, AO B: Soft collar / Philadelphia collar 4-6 wks

4.7.1.6 Fracture dislocations C3 to T1 (AO classification C)	Closed reduction by skull traction (AO C in T1-2 rarely reducible by skull traction)	If reduction successful: anterior decompression (s. above) and interbody fusion with autogenic graft and plate fixation. If attempt of closed reduction fails: posterior open reduction, posterior tension band fixation, anterior decompression and interbody fusion with plate fixation in same anaesthesia	Solely anterior fixations: Philadelphia collar 4-6 wks, Posterior-anterior fixations: No orthosis.
4.7.2 Special cases cervical spine			
4.7.2.1 Fractures in ankylosing spondylitis (Bechterew-Struempell-Marie)	In situ immobilisation with cushions, head support; skull traction extremely dangerous!	Posterior + anterior instrumentation, if possible in same anaesthesia, always posterior first with V-shaped interlaminar resection, to allow correction of disease-related deformity and to make anterior approach accessible	SOMI-brace 4 weeks
4.7.2.2 Fractures through the base of cervical pedicles and through lamina (fracture en séparation, f.e.s.)	Skull traction, preferably by Halo / Trippi-Wells, to control rotation	If f.e.s is bilateral, anterior interbody fusion with plate fixation of both affected (dislocated) segments. In cases of unilateral f.e.s., generally only one segment is dislocated and may be fused.	No orthosis in 2-segmental fusion, Philadelphia Collar 6 weeks in single level fusion
4.7.3 Injuries to the trunk spine (T2 – S1)			
4.7.3.1 Injuries T2 to T5 (AO A,B,C)	Postural reduction	Posterior open reduction, decompression via mini-costo-transversectomy, and fixation with Fixateur Interne (pedicle screws 1 above, 1 below injured mobile segment(s)). Interbody fusion of injured mobile segment(s) with autogenic graft via mini – costo-transversectomy. In children / patients with pedicle diameter less 4mm: hook fixation (2 above, 2 below), bony fusion is restricted to injured motion segment(s). If non-fused motion segments are fixed by instrumentation, implant removal is mandatory	No orthosis

4.7.3.2 Injuries T5 to L2 (AO A,B,C)	Postural reduction	Posterior open reduction and fixation with Fixateur Interne (pedicle screws 1 above, 1 below injured mobile segment(s)), decompression via mini – costo-transversectomy (T5-T11) or via inter-laminotomy / laminectomy (T12 – L2), secondary (0-6 weeks) interbody fusion via intercostal mini-thoracotomy (endoscopically optional), if post-op imaging leads to anticipation of late loss of correction with non-acceptable outcome. If non-fused motion segments are fixed by instrumentation, implant removal is mandatory	No orthosis
4.7.3.3 Injuries to L2 – L5 (AO A,B,C)	Postural reduction	Posterior open reduction and fixation with Fixateur Interne (pedicle screws 1 above, 1 below), decompression via inter-laminotomy / laminectomy, secondary (0-6 weeks) non-instrumented interbody fusion via retro-peritoneal minimal invasive approach (Mini – ALIF), if post-op imaging leads to anticipation of late loss of correction with non-acceptable outcome. If non-fused motion segments are fixed by instrumentation, implant removal is mandatory.	No orthosis
4.7.4 Special cases trunk spine			
4.7.4.1 Chance fractures	Postural reduction	Posterior open reduction and fixation with Fixateur interne (Pedicle screw 1 above, one below), in children or patients with pedicle diameter less 4mm: compressive hook fixation (1 above, 1 below). No fusion. Implant removal mandatory	Contact brace, if hook fixation is used. No orthosis after screw fixation
4.7.4.2 Fractures in ankylosing spondylitis	In situ immobilisation with cushions, no postural reduction!	Posterior open reduction with corrective interlaminar resection and fixation with Fixateur Interne (Pedicle screws 2+ above, 2+ below), anterior grafting and additional screw-rod instrumentation as a staged procedure. No mobilisation between stages.	No orthosis

4.7.4.3 Sacral fractures	Bedrest, no postural reduction.	Posterior open decompression and revision of sacral roots, no forced reduction. Fixation with Fixateur Interne L5 to Ileum, with cross-link. Onlay grafting on Os sacrum. Implant removal mandatory.	No orthosis

Session – V
Complications in Spinal Instrumentation

"POSTERIOR FIXATION IN CRANIO VERTEBRAL JUNCTION ANAMALIES – EVOLUTION FROM STEEL TO TITANIUM CONSTRUCTS"

Dr. P. Sarat Chandra
AIIMS, New Delhi

"IMAGE GUIDANCE IN SPINAL INSTRUMENTATION"

Dr. Ashish Suri
AIIMS, New Delhi

COMPLICATIONS IN ANTERIOR LOWER CERVICAL SPINE INSTRUMENTATION

Dr. Kamaljeet S. Paul
Neurosurgeon, Wisconsin, USA

"SUBLAMINAR WIRING - THE ISSUE OF NEUROLOGICAL SAFETY"

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Objectives: Sublaminar wiring (SLW) is a well-known, simplistic and universal method of attaining spinal fixation in combination with other implants, which is often maligned as a 'neurologically hazardous' technique. We present our series of 3353 sublaminar wires used in 256 patients, with gratifying results, and insignificant neurological complication rates.

Design: This paper studies the incidence of neurological complications in the use of sublaminar wires.

We retrospectively studied our series of 256 cases in which SLW was used, in the last 9 years at our clinic. Various indications included infection, fracture, tumors and deformities.

Subjects: We retrospectively studied 3353 sublaminar wires, used in our series of 256 patients. Follow up period ranged from 6 months to 8 years, though it is not as critical in this study as in many others, as most neurological complications of sub laminar wiring occur during surgery itself. The etiological break up of these cases is as tabulated.

- Infection - 87 cases
- Fracture - 33 cases
- Tumour - 47 cases
- Deformity - 75 cases
- Cervical Myelopathy – 14 cases

Outcome Measures:

The following criteria were evaluated post operatively;

1. Major cord related neurological problems post op.
2. Wire related radicular complications
3. Neurological recovery after surgery.

Results: Of the 256 cases operated using SLW technique, no patient had any major wire related neurological reversals.

Two of the 256 patients developed postoperative neurological symptoms, which could be caused by the presence of the intra canal wires in the form of transient, radicular paraesthesiae, which recovered eventually.

87 of the 91 patients with pre operative partial neurological deficit (90%) recovered completely after surgery. 7 out of the 18 (39%) who had total paraplegia pre op, showed neurological recovery.

Conclusions: Sublaminar wiring is an extremely useful technique of spinal fixation, and must be in the armamentarium of every spine surgeon. It is a safe procedure, if done using the correct principles and techniques, in the correct indications.

"PERILS AND PITFALLS OF SPINAL INSTRUMENTATION"

Dr. V. T. Ingalhalikar
Consultant & Surgeon for Spinal Affections, Thane, Maharashtra

Session - VI - Conference Room
Spinal Injury Health in India

"SPINAL INJURY SCENARIO IN INDIA"

Dr. A.K. Mukherjee
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The Rehabilitation programme for spinal injury patients is of recent origin in India. This programme got the momentum in early 70's and subsequently many specialized management centers came up in various parts of India. The profile of a spinal injury patient gives a clear reflection of socio-economic change, demographic pattern and lifestyle practice in any country. Although there is no accurate information about the magnitude and the type of the spinal injury patient in India, the hospital based available records clearly reflect certain important issues related to Rehabilitation programme. India with her growing economy is going to face certain unique challenges in future. Within the next two decades the number and serious injuries in spine will grow and quantum of disability load in Health Services will also increase significantly.

As most of the affected spinal injury patients today in India are illiterate rural male, the economic burden for the society multiplies continuously with the increase of number of spinal injury patient. With privatization, the Government's role will accordingly gets minimized and any treatment programme of patient needs to be supported either by an individual or by the family and not primarily through any Government sector.

Although these patients in future will be looked after with better programme the quality programme in India will still lag behind the quality programme of developed countries. It will be a challenging task in bridging the gaps between the need and the availability of the resources during the next two decades in India.

EPIDEMIOLOGY OF SPINAL CORD INJURIES IN RAJASTHAN

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EPIDEMIOLOGY OF SPINAL CORD INJURIES IN BIHAR

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Session - VII - Auditorium
COMPLICATIONS OF CERVICAL SPINE SURGERY

COMPLICATIONS OF UPPER CERVICAL SPINE SURGERY

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COMPLICATIONS OF ANTERIOR LOWER CERVICAL SPINE SURGERY

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The cervical spine has been the focus of many surgical approaches in clinical practice. Posterior cervical spine surgery was described before 1950's. The anterior disc surgery was described in 1950's, the cervical spine plating procedures was defined in 1970's and modernised in the last two decades. On the other hand, the develeopment of modern posterior cervical spine instrumentation techniques are relatively new. Each approach and method have their own risk and complication. This requires the perfect knowledge of the normal and pathologic anatomy of the cervical spine, biomechanics of the cervical spine, and adequate preoperative

radiological work – up and an adequate intraoperative fluoroscopy. The complications of subaxial ventral cervical spine surgery include dysphagia, CSF leaks, esophageal injuries, graft and plate complications, infections, neurological injuries, vertebral artery injuries, vocal cord paralysis, respiratory and airway complications, and a variety of other miscellaneous complications. Table 1 list these complications.

1. Systematic and/or anesthesia related complications
2. Surgical procedure related complications
   - I. Neural injury
   - II. Vascular injury
   - III. Esophagus injury
   - IV. Instrument – graft related problems
   - V. Postoperative hematoma
   - VI. Dural tear
   - VII. Infection
   - VIII. Donor – site complication
3. Closed reduction related complications

Table 1: The list of ventral subaxial cervical spine complications

1. Systematic and/or anesthesia related complications

   The most important complication in this issue include hypotension, respiratory and metabolic injury after surgery in spinal cord injured cases. On the other hand, intubation in patients with severe cervical spondylotic myelopaty may carry risk of spinal cord ischemia.

   Respiratory and airway complications: Incidence is not high. Obesity, Lung disorders, multiple level corpectomy, long lasting procedures are candidates of airway problem.

2. Surgical procedure related complications

   Both anterior and posterior approaches to the cervical spine carry surgical risk. However, the rate of surgical complication is higher with the anterior cervical spine approach.

2. I: Neural injury: Both the spinal cord and nerves may be injured during anterior cervical spine surgery. In cases with almost compressed spinal cord, inadequate decompression techniques using high speed drill may cause spinal cord injury. Most of these decompressions occur during osteophytectomy. The spinal cord injury was reported 0.4-0.5% in CSRS survey. The use of magnification will reduce the incidence of this complication.

   Nerve injury include peripheral nerve injuries to the recurrent laryngeal nerve, the superior laryngeal nerve, recurrent facial nerve, and cervical sympathetic trunk.

   Recurrent laryngeal nerve injury: RLN injury is the most common type of nerve injury. Its course is much less predictable on the right side, some authors recommended a left-sided approach to the cervical spine to avoid injuries to the recurrent laryngeal nerve. Vocal cord paresis occurs in 0.07-11% of cases. Clinically, it presents with horseness, and diagnosis is performed using laryngoscopy. Treatment modalities include laryngoplasty, and aritenoid adduction. Most of the cases of dysphonia improve within one year. The failure of improvement requires surgery. A bilateral vocal cord paresis requires tracheostomy.

   Other nerve injuries: During the surgical procedure above the C3 level, great care should be taken when using electrocautery to avoid injury to the recurrent facial nerve. The injury to the superior laryngeal nerve leads to the loss of cough reflex. Injury to the cervical sympathetic trunk (1-3%) results in transient or permanent Horner's syndrome.

   Transverse myelitis due to the use of monopolar cautery on the PLL, and C5 injury due to anterior or posterior shift of the spinal cord after decompression are among the rare cervical spine surgery complications.

2. II: Vascular injury: Vascular injury to the carotid artery is rare and preventable by the using of wide-bladed retractors. The sliding of high speed drill in the first step of corpectomy has the risk of carotid artery injury. The vertebral artery injury may occur during the corpectomy for cervical spine tumor and resection of uncovertebral osteophytes by drill in less than 1% of cases (0.6%). The occurence of this complication may be prevented by careful evaluation of the transverse foramen in preoperative CT, a careful orientation of midline and awareness regarding the spatial relationship between the medial borders of the longus colli muscle and the vertebral artery location. The VA injury can be diagnosed by seeing the fresh blood in the lateral surface of corpectomy. It can be controlled by direct repair, ligation (clip or suture, or electrocoagulation), or coil embolization. Such a complication may result in neurologic deficit.

2. III: Esophagus injury: Its incidence is less than 0.5%. The esophagus injury is one of the most devastating complications of the ventral cervical spine surgery. This has been reported with the use of pointed, self- retaining retractors and the use of power drills or burs. It is imperative that the esophagus be protected with blunt, wide-bladed retractors that insures adequate visualisation and a safe operative field. Power tools must be handled carefully with care given to the avoidance of soft tissue. If an esophageal tear be recognized, primary repair, nasogastric tube decompression, wound drainage, and antibiotherapy are recommended.

It can be diagnosed intraoperatively by direct inspection, or after giving a special solution to the hypopharinx or postoperatively. Cases with postoperative odinophagy, dysphagia need to be monitored closely.

The treatment include surgical repair (primary, or using sternocleidomastoid flap), diversion of gastric pathway (nazogastric tube, or gastrostomy), and broad spectrum antibiotics. In timely diagnosed cases, the prognosis is good.

On the other hand, retraction related dysphagia may complicate the postoperative course. Transient dysphagia occurs in 51%, and permanent dysphagia occurs in 12-15% of cases.

2. IV: Instrument - graft related problems: Such complications occur in up to 50% of cases. Anterior cervical plates are used in reduced cervical deformity. A reduction is not expected from the cervical plates. Therefore, one need to reduct the deformity before grafting and plating. Cervical plates placed onto an unreduced spinal deformity will only complicate the later treatment of such a problem. Graft related problems include graft displacement into either the spinal canal or outside, the telescoping of the graft, compression of the graft, and graft fracture. The prevention of graft displacement requires a careful graft placement in an appropriate size into appropriate position. Graft telescoping is a condition seen in degenerative spine, in which the graft density is higher than the patient's bone density. Graft compression may occur in cases of disc herniation fused with allograft iliac crest.

   Both the graft compression and telescoping may complicate the plate and screw system. The prevention of telescoping requires the use of dynamic plates in degenerative spines. Other instrument related complications include plate fracture, screw frcture, screw pull-out, plate-screw kick-out, screw cut - out, and screw malposition, plate-screw missing, and oral extrusion of the screw. All these complications can be avoided by the use of intraoperative fluoroscopy. The countouring of the plate before the fixation is the main principle of the plating procedure. On the other hand, the addition of a posterior stabilization in case of three or more level corpectomy decrease the rate of graft - plate complication. In cases with minimal screw or graft pullout (< 5 mm) surgery is not necessary.

2. V: Postoperative hematom: The occurence of postoperative hematoma is extremely rare. However, it may occur after both anterior or posterior surgery. The main causes include insufficient hemostasis and coagulation defect. A minimal nonsymptomatic hematoma does not require any intervention.

2. VI: Dural tear: Dural tears occur in 0.4 % of cases. Dural tears are commonly experienced during resection of ossified posterior longitudinal ligament and in cases of traumatic cervical spine injuries, so that the CSF leakage is inevitable in some cases with OPLL. Headache and nausea are the main symptoms. The direct repair is the best option. However, using a fascia and lumbar drainage may also stop the leakage. Dural injury may also result in pseudomeningocele.

2. VII: Infection: Infection occur in 0-5% of cervical spine operated cases. The rate of infection is higher in instrumented cases, and in cases with risk factors such as diabetes mellitus, and chronic renal failure. Aseptic technique, wound irrigation, prophylactic antibiotics are the main preventive measures. Fever, purulent leakage, leucocytosis, increased rate of sedimentation, MRI may help diagnosis. A postoperative infection can be treated by drainage, irrigation, debridement, and parenteral antibiotics. Implant removal and surgical reconstruction are other options for serious cases.

   One of the serious complication of cervical spine surgery is mediastinitis. The case of mediastinitis presents with sternal pain, tachycardia, and subcutaneous emphysema.

   Prognosis in superficial and non-complicated deep infections, as well as in timely diagnosed spondylodiscitis is good; The neurological deficit with epidural abscesses may be permanent. Mediastinitis may be fatal

2. VIII: Donor site complications: Donor site complications include hematoma, iliac bone fracture, superficial femoral nerve injury, permanent pain, superior gluteal arter injury, ureter injury, sacroiliac joint injury, and superior cluneal nerve injury.

3. Closed reduction related complications:

Closed reduction of the cervical spine may cause neurological, vascular, and infectious complications.

The traction or over-traction of dislocated cervical spine may result in neurological compromise. Traction may lead to the additional tissue disruption and ischemia of already injured neural fibers. The prevention of overdistraction of the spinal elements may be ensured by graded low-weight force application.

The incidence of disc herniation after closed reduction of the dislocated cervical spine has been reported to be anywhere from 9% to 77%. Such an acut herniation may result in neurological deteriation. The likelihood of occurence of traction-related disc herniation in cases of cervical spine injury dictates the routine use of MRI in preoperative work - up of these cases.

Disruption or spasm of extracranial vertebral artery is another possible complication of closed cervical spine reduction. The rarity of this complication may be attributed to the rich anastomosis between the basilar artery and anterior cerebral circulation.

An exteremely rare and dangerous complication associated with closed reduction is the perforation of the cranium, resulting in intracranial hematoma or abscess.

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COMPLICATIONS OF POSTERIOR LOWER CERVICAL SPINE SURGERY

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AVOIDING COMPLICATIONS IN SUBAXIAL CERVICAL SPINE TRAUMA – CIRCUMFERENTIAL SURGERY FOR COMPLEX INJURIES

Prof. Mehmet Zileli
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Session-VIII- Auditorium
Complications of Spinal Tumor Surgery

COMPLICATIONS OF INTRADURAL SPINAL TUMOR SURGERY

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COMPLICATIONS OF OTHER (NON INTRADURAL) SPINAL TUMOR SURGERY

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Session – IX - Conference Room
Complications During Acute Management of Spinal Injured

PREVENTION OF COMPLICATION AT THE SITE OF ACCIDENT AND DURING EVACUATION TO THE HOSPITAL

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RESPIRATORY COMPLICATIONS IN THE SPINAL INJURED – PREVENTION AND MANAGEMENT

Dr. Douglas Brown
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The severity of respiratory compromise after SCI depends upon the level of injury. Complete lesions at C2 and above lead to paralysis of all respiratory muscles. Such patients are ventilator dependant if they survive the initial injury. With lower levels, gradually more muscles are activated. Thus, lesions between C5 & C8 have paralysis of abdominal, intercostal, parasternal and scalene muscles, but functional diaphragm, trapezii & sternocleidomastoid muscles as well as the clavicular head of pectoralis major. The lower the thoracic lesion, the more intercostal muscles and then abdominal muscles are spared.

Additionally, in the acute complete lesion the flaccid paralysis of spinal shock results in further mechanical workload as the intercostals are sucked in with diaphragmatic decent, making inspiration very inefficient. This, and the loss of the ability to cough, are the main reasons for the development of respiratory failure after acute spinal cord injury.

For acute quadriplegic patients, there is an immediate loss of vital capacity, often to 1.5L and even below 1L. The workload thus generated can lead to respiratory failure from muscle fatigue. It indicates large areas of atelectasis which themselves contribute to poor oxygenation of the blood.

Inability to generate increased intra-abdominal pressure needed for an effective cough leads to retention of bronchial secretions, particularly in smokers, and this leads to pulmonary infection and respiratory failure. Mucus plugging can cause acute oxygen desaturation of the blood.

Acute management therefore requires intensive physiotherapy, nasal oxygen, positive pressure inspiration. In many cases the patient will require intubation and volume ventilation as well as physiotherapy and antibiotics. The need for intubation, either endotracheal or via tracheostomy, is usually the result of diaphragmatic tiring, mucus plugging, atelectasis and the development of pneumonia.

Return of muscle tone in the second week after injury leads to stiffening of the chest wall and more efficient inspiration. During this time the diaphragm also becomes stronger. Respiratory failure or the prospect of it recedes. The patient may be weaned from the ventilator and managed with physiotherapy, which includes positive pressure ventilation, oxygen and antibiotics.

Recent work in our service has shown that acute quadriplegic patients also develop obstructive sleep apnoea during the first month after injury, such that 60% at one month have sleep disordered breathing (SDB). At three months this rises to 80% and this is maintained during the first year of injury.

With the passage of time, chronic changes take place. The chest walls stiffens and eventually there may develop ankylosis of the rib cage. Atelectasis becomes permanent with loss of functional reserve. Unopposed vagal activity may contribute to bronchial constriction.

Aspiration pneumonia is a risk in the acute/subacute phase and makes the decision to remove the tracheostomy tube difficult. This is because in the quadriplegic patient, an incompetent swallow mechanism can initially be due to the injury and neck surgery, but later to the tracheostomy tube itself. We have a tracheostomy team and a strict set of criteria to assist us to make the decision to decannulate a patient.

Early use of the Bird positive pressure ventilator along with physiotherapy may not be enough to prevent pulmonary complications. Early use of CPAP or BiPAP by facial mask may prevent the need for tracheostomy from a respiratory point of view, but may not prevent aspiration during the acute phase. Therefore a nasogastric tube is essential to drain the stomach as a vital part of early acute management until bowel sounds are established.

Acute respiratory failure can occur from a pulmonary embolus (PE). Death from PE is reported in some studies to occur in 2-4% of acute patients. A prophylactic routine is necessary in the form of low molecular weight heparin (enoxaparin 40mg subcutaneously) from admission unless there is a contraindication. This must be stopped in advance of surgery and can be restarted 24hrs later. In the second week it can be changed to anticoagulation with warfarin to achieve an INR of 2.5-3.0.

In addition the patient should have calf stimulators to mimic the normal muscular pump action. External pneumatic compression or pressure grading stockings can be used if calf stimulators are not available.

With these measures the death rate from PE can be reduced to >0.5%. However, I'm reliably told that in many south east Asian countries, P.E.s do not occur and preventative measures are not needed. This situation only applies in children amongst other populations.

Patients with lesions at the C0 – C4 may be ventilator dependent for life. With good care their life expectancy is many years provided they survive the first few years of adjustment. Those with this level of lesion, who are incomplete, may deteriorate during the night and require night nasal CPAP or BiPAP to prevent hypoxia and hypercapnia.

Quadriplegics in general have a greatly increased incidence of SDB, reportedly 27-55%. Whether this is a reflection of the situation in the first year or whether the time course is one of improvement followed by later decompensation due to aging and obesity, is not yet known. One must be attune to the possibility when reviewing these people each year. Sleep studies make the diagnosis and treatment by CPAP or BiPAP.

Complications are greatly increased in smokers. Chronic SCI patients should be actively discouraged from this health hazard.

With good respiratory care, respiratory complications in the acute phase and long term can be greatly minimized and the patient, even those ventilator dependent, can lead happy, healthy lives.

GASTROINTESTINAL COMPLICATIONS IN SPINAL INJURED

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METABOLIC MANAGEMENT IN THE ACUTE SPINAL INJURED WITH A VIEW TO REDUCE COMPLICATIONS

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COMPLICATIONS IN THE DEVELOPMENT OF HAND FUNCTION WITH TETRAPLEGICS

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The upper extremities are very important for the human being to be able to perform various kinds of activities. Especially the hand with its great variety of well - coordinated movements is the special privilege of human.

People with a spinal cord lesion are more than others dependent on their upper limbs.

In 1976, Hanson and Franklin asked a survey of 74 persons with various levels of tetraplegia to choose the function which they would prefer above all others if they could have one function restored. The list of choices included sexual function, bowel and bladder function, walking ability and the use of arms and hands.

The most frequent choice (75 %) was arm-hand function.

Later, in 1988 Murphy and Chuinard stated that the greatest potential improvement lies in the proper rehabilitation of the upper limbs because the tetraplegic patient is so dependent on them for all activities of daily living.

So the ability to use ones hands can be the key to more independence for the tetraplegic person and almost each single muscle which is reinnervated increases this patients possibilities in activity.

The main focus in rehabilitation is compensation of function loss, using those parts of the sensorimotor system which are still intact. So for example, in the case of a C6/7 spinal cord lesion a tenodesis grip can be performed, if voluntary wrist extension is possible.

The conservative management is starting just from the first days after injury with hand and arm positioning, passive movement and active training of the reinnervated muscles.

In addition to the conservative treatment as a basic, there exist some methods of surgical reconstruction which can help the tetraplegic to regain an increased level of arm and hand function.

Surgical restoration is not indicated in every patient. It has to be decided individually as there have to be some preconditions fulfilled like no severe spasticity, no contractures, full attention and cooperation of the patient and it should not be performed in the acute phase of SCI.

I'm now going to talk about the conservative management of tetraplegic hands and the complications and problems which can occur and influence the therapy and the outcome.

I won't present you a scientific study, more I will discuss with you the literature findings and my own experiences from many years working with patients in one of the biggest SCI departements of Germany.

At the beginning I want to give a short survey of the main goals in conservative management of tetraplegic hands. Maintenance of a functional hand posture, prevention of contractures and maintenance of passive movement are in both cases important - in a C6/7 complete lesion and in an incomplete cervical lesion with innervated hand muscles.

C6 and C7 tetraplegics with a complete motory lesion have paralysis of finger and thumb muscles, but retain voluntary control of wrist extension. With this they will be able to perform a tenodesis grip. The tenodesis grip is a mechanism of hand opening and closing that arises from passive forces developed by the extrinsic muscles of the fingers and thumb during wrist extension and flexion. That means wrist extension produces finger flexion and wrist flexion produces finger extension.

Even if the C6 paralysed patient has no active wrist flexion he will benefit from this grip because gravity can assist him for hand opening.

In order to develop this way of grasping, a shortening of the finger flexor muscles (FDS , FDP and FPL) is encouraged. The method to reach this is to place the hand in a fist-like position with 30°- 45° wrist extension, 90° flexion in the MCP-joints, 90° flexion in the PIP-joints and 0° flexion in the DIP-joints. The thumb should be placed at the radial side of the index finger in a key pinch-position, the web space should be maintained.

The treatment of choice is taping, with the wrist supported. This positioning should be started just in the first days after injury over several hours a day and/or overnight, interrupted with sufficient passive movement done by the therapist to prevent contracture. So the hand is prepared for the active training program.

A C6/7 tetraplegic hand with a well developed tenodesis grip should be able to perform a lateral pinch grip (key pinch), a palmar grip, a weaving grip, an interdigital grip, a two hand hold and different types of pre-grip preparation. Of course the forces produced are quite minimal and the grip strength cannot be measured with common grip strength assessment tools like the jamar dynamometer or the pinch meter. But patients can often do a variety of daily living activities.

Patients with an incomplete cervical lesion are splinted in a contracture preventive position. We use the IPP (Intrinsic Plus Position) with 30° wrist extension, 80-90° MCP flexion and 0° flexion in PIP and DIP joints, the thumb in an abducted position.

This splinting combined with passive movement and increasing active training prevents tightening of soft tissues, overstretching, contractures and deformity of the joints and helps to preserve the architecture of the hand.

To come now to complications concerning hand rehabilitation: First I want to start with aspects or problems which may influence the functional outcome of a hand, but which are not a complication caused by the spinal cord injury by itself.

Practical work shows that the individual constitution and shape of a hand can influence the conservative rehabilitation potential, for example length and thickness of fingers, its relation to each other, tightness of soft tissues or joint-mobility in general. So the shorter the thumb in relation to the index finger, the more flexion will be required to ensure the desired point of contact between the two digits.

A hand of a hard working man like a bricklayer or a farmer looks different to the hand of a pianist or a surgeon and their joint mobility and functional potential concerning fine motor-control can vary.

Hands who have already had previous injuries like amputation of fingers, fractures or injuries with resting impairment like pain or joint contractures and overstretching of the capsular-ligament structures can be more problematic in effective training.

Overstretching of capsule and ligaments is often seen in the MCP-joint of the thumb: one reason are in our country skiing accidents where in the case of a fall the thumb can stay hanging in the loop of the ski-stick. So important stabilising structures can be overstretched.

In case of a C6/7 patient this has the result that the thumb cannot meet the index finger with wrist extension. The most important tenodesis grip – the key pinch – can then either not be performed or only very light and handy objects can be grasped, using additional gravity by turning the forearm to a neutral position.

Other illnesses which may influence the rehabilitation in a negative sense can be existing Dupuytren's contraction, arthritis and osteoarthrosis. The potential of functional outcome can be limited in those cases.

Complications with direct relation to spinal cord injury are oedemas , hypersensibility, pain, spasticity and hypertonus.

Oedemas in complete paralysed hands make the positioning in the fist like way, which is needed for the tenodesis grip as described before, difficult or impossible. If the fingers are in an extended position over a longer time, the shortening of the finger flexor muscles is interrupted and the resulting tenodesis grip will be quite weak.

With incomplete lesions, oedemas of the hand handicap active movement which could already be done by the patient.

Reducing or minimizing the oedema is necessary and basicely for further-on rehabilitation.

Some opportunities to enforce this are for example avoidance of a 'hanging' position of arms and hands – they should lie in an elevated position to support the circulation and flowing off of the lymph.

Manuel lymphdrainage can also be effective, if necessary combined with compression gloves or bandaging. Further interventions can be cold applications, brushing, passive and active movement to prevent stiffness and contractures.

People with spinal cord lesion often have impaired sensibility which influences the quality of grasping in general. Reduced or loss of sensation can be partially compensated with visual control. Patients who complain of hypersensibility which often changes to pain when their hands are touched, are more problematic. They often don't tolerate positioning methods and avoid active movement and manipulating with their hands.

This does affect grasping and the level of activity of patients. Treatment of choice are medicinal interventions – sometimes physical methods can also have an effect.

Spasticity and hypertonus are further complications which can cause significant disability in affected patients. If this disorder of muscle tone resulting from the injury of the central nervous system occurs at the upper extremities it affects grasping, usually in a negative way.

Spasticity can make positioning of the hands in itself more difficult because of the higher risk of getting pressure sores. To avoid them, splints have to be fit on in an optimal way and padded at the endangered spots if necessary.

In relation with encouraging the tenodesis grip in C6/7 lesion, spasticity impairs the outcome: higher tone of the finger extensor muscles hinders the desired shortening of the flexor muscles, and the tenodesis grip will be weak, or even worse, a claw deformity will be the result.

In the opposite case, higher tone of the finger flexor muscles makes it impossible to open the hand, which is also a bad precondition for grasping in an efficient way.

Patients with a lesion at the level C5 /6 sometimes develop a persistent hypertonus in the biceps together with supination of the forearm. Patients with incomplete cervical lesions sometimes develop a high wrist flexor tone. In both cases grasping is impaired or even impossible.

Reducing spasticity and hypertonus is important to maintain the level of rehabilitation potential. Common treatment methods are for example physiotherapeutic interventions like stretching, positioning with individual splints, active and passive movement and from the doctors' side, oral medical treatment or in special cases botulinum toxin injection.

Complications in Spinal Cord Injury cannot always be avoided. Although the complication mentioned above are not live-threatening, they are severe for the functional outcome of a tetraplegic hand.

In order to keep their negative impacts low, each member of the interdisciplinary rehabilitation team is required to do the best.

Concerning the development of hand function it is necessary to exploit any potential available because being able to grasp or not is the most decisive point for any tetraplegic patient.

COMPLICATIONS RELATED TO PHYSICAL REHABILITATION OF SPINAL INJURED AND MANAGEMENT

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Physiotherapy is an important part of rehabilitation programme following spinal cord injury. A spinal cord injury is considered to be one of the most devastating conditions that can result following trauma. This devastating condition brings a family of complications along with it which are also as devastatating as the injury itself. These complications are problematic not only for the patient but for the therapist also. That is why it is rightly said –***PREVENTION IS BETTER THAN CURE.***

List of common complications

1. Spasticity

2. Respiratory complications
3. OEDEMA/Deep Vein Thrombosis (DVT)/pulmonary embolism
4. Pain
5. Contractures
6. Degenerative joint disease.
7. Osteoporosis
8. Spinal Deformities
9. Associated Injuries.

PAIN

Types of Pain-

1. Pain due to musculoskeletal contractures and articular structures
2. Neurogenic pain
3. Referred pain

TREATMENT

- Gentle handling of patient's limbs
- Carefully positioning
- Hydrotherapy
- Contrast bath
- TENS
- Passive mobilization

Treatment of Pain and Inflammation

Heat Therapy(if sensation is intact, under supervision): Heat increases blood flow and the manipulability of connective tissue. It decreases joint stiffness, pain, and muscle spasms.

Cold Therapy (Cryotherapy): Application of cold may help relieve muscle spasm cold may be applied using an ice bag, a cold pack, or fluids (such as ethyl chloride) that cool by evaporation. The spread of cold on the skin depends on the skin's thickness, the thickness of underlying fat and muscle, the water content of the tissue, and the rate of blood flow. The therapist takes care to avoid tissue damage and abnormally low body temperature (hypothermia).

Electrical Stimulation: Muscles that lack proper nerve function can be stimulated electrically to help prevent muscle wasting (atrophy) and spasticity.

Massage: Massage may relieve pain, reduce swelling, and help mobilize contracted tissues.

Hydrotherapy: is found to be effective in many cases.

CONTRACTURES

Contracture:- Contractures introduce delays and difficulties into the patient's programme of rehabilitation. It is the direct responsibility of the therapist to prevent their occurrence.

Causes of contractures

- Incorrect positioning in bed or incorrect posture in the wheelchair
- Inadequate physiotherapy
- Spasticity

Prevention-

- correct positioning
- maintenance exercises
- splinting

Conservative treatment of established contractures

Manual Techniques

- Passive movements
- Prolonged passive stretching- can be given for flexion contractures of the hips and knees and adduction contractures of the hips by strapping the limbs in the corrected position.in bed the corrective position is maintained by using pillows and padded strap. Some healthcare professionals may use some form of heat prior to the stretching and mobilization
- Joint mobilization
- Active exercises- where the muscle group are innervated, hold – relax techniques are used to obtain relaxation of the contracted muscle groups, and resistance is always given to the antagonist.

- Splinting- To avoid excessive pressure it is advantage to make serial splint and not try to obtain maximum correction initially. The contracture s involve more than one joint. In this case maximum correction is obtained firstly in the joint principally controlled by the major muscle involved. E.g. where the elbow, wrist and fingers are flexed, biceps is the major muscle and maximum correction is given at the elbow joint.
- Passive and active exercises in a hydropool – the hot water aids relaxation, and is especially beneficial if there is severe spasticity
- Ice therapy and ultrasound – are used as and where suitable.

"Constant attack" is the motto for dealing with contractures. Treatment needs to be carried out several times a day using a variety of methods. For example, hip and knee flexion contractures have been successfully treated by giving daily passive movements, passive stretching on the plinth.

Mechanical techniques

Devices known as continuous passive motion machines are very popular, especially following surgery of joints. Continuous passive motion machines (CPM) are specifically adjusted to each individual's need. This method is administered within the first 24-72 hours after the injury or surgery. The joint is mechanically moved through the patient's tolerable motion. **CPM** machines have been proved to accelerate the return motion process, allowing patients more function in less time.

ARM and LEG EXERCISER (passive and active)-MOTOmed

Reduces tone, improves circulation, maintenance of ROM, reduces Oedema

Casting or splinting

Casting or splinting techniques are used to provide a constant stretch to the soft tissues surrounding a joint. It is most effective when used to increase motion of a joint from prolonged immobilization. It is also popular for treating contractures resulting from an increase in muscle tone from nerve injury. After an initial holding cast is applied for 7-10 days, a series of positional casts are applied at weekly intervals. Before the application of each new cast, the joint is moved as much as can be tolerated by the patient, and measured by a goniometer. When as much motion as possible is obtained after stretching, another final cast is applied to maintain the newly acquired motion.

Para- articular /hetrotropicOssification

Rehabilitation Program:

Heterotopic ossification is a condition not well understood that occurs in acute spinal cord injury and consists of the laying down of bone outside the normal skeleton, usually occurring at large joints such as the hips or knees. The primary problem with Heterotopic ossification, or HO, is the risk for joint stiffening and fusion. Should the hip or knee become fused in a certain position, a surgical release is necessary to allow range of motion to occur. Unfortunately, it takes between 12 and 18 months for Heterotopic bone to mature once it has developed. Activities that are used to prevent the development of HO include range of motion programs and other functional activities that move the joints within a functional range. Currently treatment is limited with the exception of preventing the joint fusion (termed ankylosis).

CURRENT PHYSIOTHERAPY

- In the initial stage when the joint feels 'spongy' and the area may be red and swollen, passive movements to that joint are discontinued until the inflammation has subsided. This will take approximately a week; passive movements are then recommended. The limb is moved slowly and carefully two or three times only, through as full a range as possible. No forced movements are given, but every effort is made to maintain the range.
- After approximately 4-8 weeks, the passive movements and general activity are increased and careful effort is made to increase the joint range.
- It is thought that *vigorous* passive movements given to the patients with acute lesions may result in small haemorrhages in muscle and connective tissue and that this may be a contributory factor in the formation of the para-articular ossification
- Occupational Therapy: **The occupational therapist (OT) works on activities of daily living (ADL) and functional transfers to compensate for lost ROM due to HO. Both the OT and PT work on customizing seating systems to minimize pressure over heterotopic ossification bony prominences.**

SPASTICITY

The increased muscular tension leads to an uneven distribution of pressure on joint cartilage. This may result in destruction of cartilage, capsular contractures or partial dislocations of varying degree.

TREATMENT OF ESTABLISHED SPASTICITY

Physiotherapy:

Passive movements:

These are always given to maintain mobility in all structures.

Prolonged passive stretching:

The stretch may be given manually, or by utilizing one of the stretch positions as for contractures, or in the standing position.

Hydrotherapy

Passive movements and swimming exercises in a heated pool reduce spasticity in 90% of patients.

Reflex inhibiting postures

These may be useful to reduce spasticity or maintain relaxation during treatment. The position adopted in bed can be used to reduce spasticity. For example, sleeping prone for 3 or 4 hours reduces flexor spasticity in the lower limbs.

Standing and walking

Weight-bearing reduces spasticity. However, in some severely spastic cases the standing position may be impossible without first reducing the spasticity by some other means, e.g. passive movements, a passive stretch, hydrotherapy.

Ice Therapy

Immersion in ice is useful for reducing spasticity in the extremities. Ice towels are effective where the spasticity is associated with contracture but have not proved valuable in treating the large muscle groups for spasticity alone.

ARM and LEG EXERCISER (passive and active)-MOTOmed

Reduces tone, improves circulation, maintenance of ROM, reduces Oedema

If excessive spasticity develops, passive and active movements, stretches and mobilizations may have to be modified and / or increased. Special positioning to break a dominant pattern may be indicated (hip flicks, frog position). The degree of spasticity should be monitored and communicated to the other members of the team.

The best way to manage or reduce excessive spasms is to perform a daily range of motion exercise program.

Avoiding situations such as bladder infections, skin breakdowns, or injuries to the feet and legs will also reduce spasticity.

Tilt table standing for reducing spasticity after spinal cord injury is an effective method.

Treatments may include:

Stretching

Stretching forms the basis of spasticity treatment. Stretching helps to maintain the full range of motion of a joint, and helps prevent contracture or permanent muscle shortening. To be effective, the prescribed stretching routine must be done regularly, usually once or twice a day.

Strengtheningoften leads to loss of strength in both the spastic muscles and surrounding ones. Strengthening exercises are aimed at restoring the proper level of strength to affected muscles, so that as tone is reduced through other treatments, the affected limb can be used to its fullest potential.

Orthoses & casts

The short term application (30 min) of high-frequency **EAP** (100 Hz) produced an immediate antispastic effect in contrast to the low-frequency **EAP** (2 Hz). After application of high-frequency **EAP** (2 times/d, 30 min/time) for 3 mo, antispastic effect was stable. To keep this antispastic effect, the high-frequency **EAP** must be used permanently. Recent experimental results showed that low and high frequency **EAP** release MEK and dynorphin respectively from the spinal cord in humans. by enhancing the production of dynorphin in CSF, high-frequency **EAP** decrease the excitability of the motor neurons in the anterior horns through the kappa opiate receptors, thus ameliorating the muscle spasticity of spinal origin.

Biofeedback is the use of an electrical monitor that creates a signal—usually a sound—as a spastic muscle relaxes. In this way, the person with spasticity may be able to train himself to reduce muscle tone consciously. There are many researches still going on proving the efficacy of biofeedback in reducing spasticity.

There are some benefits to spasticity. It can serve as a warning mechanism to identify pain or problems in areas where there is no sensation. Many people know when a urinary tract infection is coming on by the increase in muscle spasms. Spasticity also helps to maintain muscle size and bone strength. It does not replace walking, but it does help to some degree in preventing osteoporosis. Spasticity helps maintain circulation in the lefts. It can be used to improve certain functional activities such as performing transfers or walking with braces. For these reasons, treatment is usually started only when spasticity interferes with sleep or limits an individual's functional capacity.

RESPIRATORY COMPLICATIONS

When the spinal cord is damaged, the respiratory muscles with innervation below the level of the lesion become paralysed.

Patients with injuries above T6 will have no abdominal muscles and will therefore have compromised ability or total inability to perform a forced expiration or cough, leading to serious problems clearing secretions (or food, if choking).

Patients with lesion below T6 and patients with incomplete lesions may have minimal impairment of lung function. However, all acute lesions on bedrest are at risk of hypostatic pneumonia and will need prophylactic monitoring

Respiratory problems for patients with lesions above T6

1. Total lung inflation impossible.
2. Inability to cough effectively
3. Mechanical disadvantage for the diaphragm
4. Inability to rotate the work of inspiration

Prophylactic respiratory therapy

Prior to initiating any treatment it is vital that the therapist assesses the patient properly. Frequent re-assessment is necessary

A physical therapist's purpose with respiratory care is to help you breathe easier and to decrease your chance of developing a lung infection such as pneumonia.

Aim of respiratory therapy-

Improve ventilation and gas exchange
Reduce airway obstruction
Promote sputum mobilization and expectoration

Management-

Breathing exercises
Postural drainage
Assisted coughing
Caution when using assisted coughing-
Patients with an acute spinal cord injury may have paralytic ileus, bleeding gastric ulcer,
Or other internal injuries. In these type of cases extreme caution may be taken. Methods using two people should be used.

POSTURAL HYPOTENSION

Postural hypotension, also known as orthostatic hypotension, is a condition which results in a decrease in blood pressure when you sit or stand. This can cause "light-headedness" or "fainting". It occurs more commonly when you are first injured, when you are fatigued, or after any illness. You will have an increased tendency for postural hypotension if your level of injury is at T-6 or above, but it can occur in all spinal cord injured individuals.

After spinal cord injury, the blood vessels do not decrease in size, in response to lowered blood pressure, due to the altered function of the autonomic nervous system. Because of this, blood pools in the pelvic region or legs while you are sitting or sanding.

Postural hypotension usually occurs when you are initially placed in your wheelchair or on the tilt table. To prevent this, wear elastic hose and an abdominal support. It is also helpful to come to a sitting or standing position gradually.

If Postural hypotension occurs while you are in a wheelchair, your attendant should firmly grab the handles of the wheelchair and tilt you backward, until your head and neck are nearly horizontal to the floor. This will increase your blood pressure and the "fainting" will quickly disappear. You should then be gradually returned to a sitting position.

Another problem that may occur as a result of the lowered blood pressure is a decrease in the amount of urine produced by the kidneys. He may notice that there is little or no urine in your urine bag. After he reclines, your leg bag may fill quickly. This is a result of the increase in your blood pressure that occurs when he lie down. Patient is advised to watch the drainage bag closely after changing positions to make sure it does not get too full.

Osteoporosis

Research into the physiology of bone formation and absorption has shown that the mineral metabolism associated with atrophy of the muscular and skeletal systems changes as a result of prolonged bed rest.

TREATMENT OF OSTEOPOROSIS

Physiotherapy

When the patient is in bed, passive movements are given to the paralysed limbs and resisted exercises to the unaffected arms to increase the circulation.

When the patient is up in the wheelchair he is given intensive physiotherapy including long periods of standing and walking (if possible).

The majority of people with SCI develop osteoporosis. Using the legs to provide support in transferring is helpful in increasing the load on the bones, which may reduce or slow down the osteoporotic process. Standing using a standing frame or a standing table also helps prevent weakening of the bones and so does using braces for functional or parallel bar walking. Newer techniques, such as electrical stimulation of the leg muscles, may decrease osteoporosis as well.

Unfortunately, at the present time, there is no way to reverse osteoporosis once it has occurred. The main risk of osteoporosis is fracture. Once the bones become brittle, they fracture easily. An osteoporotic bone takes much longer to heal.

PRESSURE SORES

Skin breakdowns (also termed "decubitus ulcers") are a major complication associated with spinal cord injury. They occur as a result of excessive pressure, primarily over the bones of the buttock (particularly the ischial tuberosities and the trochanters at the hip). Following a spinal cord injury, there are not only changes in muscle tone and sensation, but shifts in the supply of blood to the skin and subcutaneous tissues. Additionally, there is a loss of the normal elastic nature of the tissues underlying the skin. Increased stiffness, vascular alterations and alterations in muscle tone combine to significantly reduce the skin's ability to withstand pressure. It is estimated that the closing "pressure" for skin breakdown is between 40 and 50 millimeters of mercury (about the same amount of pressure as placing a stamp onto an envelope). This complication is combated fairly aggressively through the use of pressure relieving cushions that are either gel based or consist of a number of air bladders to reduce the risk of the person "bottoming out". The cost associated with medical and/or surgical care of a single decubitus ulcer can run very high.

PREVENTION-

Relieve pressure

The patient must be turned every 3 hours day and night to prevent further sores from developing on unaffected areas, and positioning in such a way that no weight is thrown on the sore or sores.

Push ups in wheel chair should be taken for atleast one minute after every 10 min.

PHYSIOTHERAPY

Passive movements

Passive movements are given to the paralysed limbs to improve the circulation and prevent contractures.

If the patient has severe spasticity or if any movement causes violent spasm, all movements are avoided until the scar is healed.

If the lesion is flaccid or the patient has minimum spasticity, it may be possible to commence moving the knees and feet after a week to few days.

Initially very gentle movements only are given. Whilst moving the joints involved, the therapist watches the scar to avoid excessive tension. The range of any movement which looks potentially dangerous is increased with extreme caution to avoid breakdown of the wound.

Massage

Deep finger kneading increases the circulation and improves the elasticity and mobility of the skin and subcutaneous tissues.

Exercises

Pressure consciousness

The patient must be educated, or re-educated, in "pressure consciousness", and have posture, cushion and wheelchair checked at the posture and sitting clinic.

Transfers

In spite of any previous rehabilitation, once the patient is mobile all the transfers are checked to see that due care is taken when lifting And moving the limbs.

LASER therapy

OEDEMA/ DVT

Feet and legs

Due the poor vasomotor control and loss of muscle tone in the legs, some patients get oedema of the feet, ankles and lower legs when they first start sitting out of bed.

To simulate the vasomotor systems, the legs are elevated several times during the day, and if necessary the bed elevated at night. Besides being elevated in the physiotherapy department the patient should be responsible to put his feet up on the chair at appropriate times during the day, for example, at meal times, in the occupational therapy department and while watching television.

Only if this procedure fails to reduce the swelling after 3-4 weeks are elastic stockings supplied. The patient may need to spend 24-48 hours in the bed with the foot of the bed elevated to disperse the oedema before measurements for the stockings can taken.

Hand

Patients with high lesions sometimes develop oedema in the hands. If the oedema is not dispersed, the collagen deposit is changed into fibrous tissue and contractures develop.

Elevation, Passive movements: Forced passive movements are contra-indicated to reduce the oedema.

Treatment is given several times a day taking care to maintain full range of all the nonaffected joints. After an initial period of elevation, Boxing Glove splints may be used if desired to keep the swelling down.

SPINAL DEFORMITIES

DEVELOPMENT OF SPINAL DEFORMITY

When a patient spends a high proportion of time in an abnormal, incorrect posture for functional activities, convenience or comfort, whether in bed or in a wheelchair, deformities develop. Gross scoliosis or pelvic distortion will severely hamper the patient's rehabilitation and may prevent him from attaining complete independence or from functional weight bearing.

Examples:

- **In bed**

  All functional activities – washing, feeding, and writing – may be done with the right hand and the patient will prop himself on his left elbow. This will involve habitual work for the right trunk side flexors. As a result the patient may develop a long C curve to the left.

- **In the wheelchair**

  Constantly working at a desk in lateral flexion and possibly rotation predisposes to the development of a scoliosis.

- **In standing**

  Increased lordosis occurs particularly in children and adolescents with lesions at T7-8 and above.

Flattering of the lumbar curve occurs with the patients with low thoracic lesions T11-L1 due to the imbalance between the innervated abdominal muscles and the paralysed sacrospinalis, illiopsoas and the muscles of the leg.

Increased forward tilt of the pelvis with lordosis develops in patients with lesions below L3 through the over action of illcpsoas and rectus femoris and the loss of innervation of the right.

An increased in a forward tilt of the pelvis is produced by minimal tightness in hip flexor muscles.

PREVENTION AND TREATMENT

1. Correct choice of cushion
2. Fit of the patient in his wheelchair

Treatment

1. Strengthening the weaker or less used muscle groups including the use of functional electrical stimulation and archery where appropriate
2. Streching those muscles tending to shorten

3. Maintaining a passive stretch in the overcorrected position of those muscles tending to shorten.
4. Re-education of posture and regular re-assessment of the efficacy of cushion
5. Corrective sleeping posture
6. Bracing

Corrective sleeping postures

Pillows can be used to support the spine corrected position at night. For example patient with a long 'C' curve to the left should use sufficient pillows under the thorax when lying on his left side to give maximum correction at deformity.

Bracing

A spinal brace may be necessary to support children or adolescent with a bad posture in sitting and standing.

Archery

Archery is an excellent exercise for the back and shoulder girdle muscles.

Surgery

Surgical procedures may be indicted in a few selected cases.

CONCLUSION

Management of the patient with SCI is a complex and challenging task in which continuity of care is critical to achieving the overall goals of rehabilitation. Frequent and open communication among team members, patient and family is vital to maintaining an organized and highly individualized approach to both rehabilitation and re-integration of the into the community.

Thus, it can be concluded that physiotherapy plays an important role in prevention and management of some of the complications related to physical rehabilitation of the spinal injured patients.

Session - XII - Auditorium
COMPLICATIONS OF THORACIC AND THORACOLUMBAR SPINE SURGERY

ANATOMICAL CONSIDERATIONS IN LUMBAR SPINE PEDICLES WITH A VIEW TO PREVENT COMPLICATIONS

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COMPLICATIONS OF THORACIC & THORACOLUMBAR SPINE SURGERY

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There have been numerous advances in technology related to Thoracic & Thoracolumbar Spine Surgery. However not all Spine Surgeries have a successful outcome or are without complications. Careful selection of patients, an accurate diagnosis and choice of an appropriate surgical procedure decrease the chance of complications. However one should be well versed with the various complications which could be associated with Thoracic & Thoracolumbar Spine Surgery. The complications could be divided into intraoperative, immediate postoperative, early and late complications.

Intraoperative complication could be vascular injuries, neurologic injury or intraoperative implant related complications.

Concern has been raised about proximity of great vessels and pleura to anterolateral or laterally placed thoracic pedicle screws. No reports of injury to or erosion of great vessels in such procedures have been reported.

Neurologic complications could be a nerve root injury due to inferiorly placed screws or cauda equina or cord injury due to medially placed screws. The incidence ranges from as low as 1 % to as high as 11% in various series. The incidence in pedicle screw use parallels rates using hooks or wires. Neurologic complications could also be a result of direct injury during the surgery of indirectly due to distraction of the cord as during deformity correction surgery.

Intraoperative implant related complications include pedicle fracture or screw loosening during pedicle fixation. The incidence of screw misplacement is variously reported as 0% - 25% in Scoliosis and 0% - 4.2% in degenerative conditions.

The immediate complications could be due to a surgical error. This could rarely be due to an incorrect diagnosis. Even if the diagnosis is correct, an in appropriate surgical procedure can lead to failure. An in appropriate surgical procedure could be due to wrong indications, wrong approach, inadequate decompression or

inadequate correction of deformity. Surgical error could also be due to surgery at the wrong level or the wrong side. Even though this is fortunately rarer, it is fraught with medico legal complications.

Another immediate complication could be due to a foreign body left in the surgical side. This can lead to nerve root or cord compression. Surplus haemostatic material left in the surgical side could also cause complications. Free fat graft or gel foam placed over the decompressed cord with a view to prevent epidural scarring can also in turn cause compression. In addition it is believed that the gel foam could enhance scar formation.

The early complication includes infection, arachnoiditis, epidural fibrosis, recurrent pathology, stenosis, nerve/root injury and graft migration.

Postoperative infection would include wound infection, Discitis, osteomyelitis and frank abscess. The risk factors include Spinal instrumentation and posterior approach patient age and nutritional status, diabetes, cancer or immuno suppressants. Postoperative infection of the surgical site may manifest itself with systemic signs of fever and localized pain, erythema, swelling, rubor and wound drainage. Laboratory investigations may reveal a normal or increased peripheral white count and elevated sedimentation rate. However it may be pointed out that sedimentation rate may remain elevated upto 6 weeks postoperatively in upto 38% of Spinal Surgery patients. Blood and wound culture should be obtained before starting antibiotic therapy. Operative debridement should be considered for patient with persistent infection despite antibiotic treatment.

Arachnoiditis is an inflammatory response of the arachnoid membrane, resulting in varying degrees of blockage of CSF flow through the sub arachnoid space, nerve root clumping, obliteration of nerve root sheaths and nerve root atrophy. This has increasing been deducted in failed spine surgery. Arachnoiditis can reproduce the patients initial radicular symptoms. Motor deficits are generally rare. Non-operative treatment consists of physical conditioning, detoxifications, antidepressants and epidural steroids. Surgical treatment is generally controversial and reserved for patients with progressive deficit.

Epidural fibrosis is one of the leading causes of failed Spine Surgery. It is especially seen in patients with multiple surgeries. It may manifest few months to years after the surgery. The main differential diagnosis is that of a recurrent disc herniation. A contract enhanced MRI helps to differentiate between the two but is useful generally six weeks postoperatively. The main treatment is prevention. The surgical outcome is generally disappointing.

Recurrent pathology is the most common cause of initial recurrence of symptoms in lumbar discectomy. It may present with radicular symptom on either side, or with myelopathy and may not mimic the initial presentation.

Stenosis may be as a result of progression of preexisting disease, prior inadequate decompression or overgrowth of previous posterior fusion. History and physical examination are similar to those of patients with stenosis but with no history of surgery.

Nerve or Nerve root injury can produce pain through neuralgia or through denervation. The pain often characterized as burning or gnawing in character and is present at rest and exacerbated with activity. Diagnostic imaging is unrevealing. Spinal nerve blocks can screen for patients in whom a micro surgical dorsal root rhizotomy may be beneficial.

Graft Migration can cause significant nerve or cord compression and may require an emergency surgery. Graft in the setting of osteopenia or tumor is especially at risk. The treatment lies in repositioning or replacing the graft.

Late complications include instrumentation failure, instability and pseudarthrosis.

Instrumentation failure commonly occurs in the setting of Pseudarthrosis. The incidence of screw breakage in the lumbar spine varies from 2.6% - 6.0%. Highly comminuted fractures fixed with posterior short segment pedicle instrumentation have a high incidence of failure. Instrumentation failure also includes screw pullout and screw connector disengagements. Harrington rod breakout and sublaminar wire breakage are complications seen with the use of these implants. Low bone mineral density is associated with a higher rate of instrumentation failure. Even though all instrumentation failures may not require reoperation, but all of them do necessitate careful examination. Patients may present with pain from subsequent instability, symptoms of nerve root or spinal cord compression or cosmetic deformity. They may even be asymptomatic. An examination could reveal local muscle spasm, tenderness or deformity. Plain X-rays are generally diagnostic. Indications for reoperation include instability, compression of neural structures, pain and cosmesis.

Instability may result due to injury to ligamentous, muscular or bony structures. It is the third most common cause of failed lumbar disc surgery (18% of failures). The risk factors include younger age, female sex, preoperative disc space widening, degenerative pathology, magnitude of surgery and insufficient para spinal muscle extensor tone and strength due to neurologic injury or myelopathy. The signs & symptoms include back pain without significant radicular component, aching pain aggravated by movement, local muscle spasm or tenderness and restricted or hyper dynamic range of movement. Most often instability is difficult to confirm with diagnostic imaging even though gross instability may be readily apparent. Radiographic findings suggestive of segmental instability include disc space narrowing & traction spurs. If instability is suspected a trial of external bracing may be given. If the patient has significant improvement in pain revision fusion surgery should be considered.

Pseudarthrosis is defined as the documented failure of solid fusion 1 year after surgery. It may result from physiologic deficiencies like calcium homeostasis, metabolic disorders of bone formation, malnutrition, tobacco use, various medications or surgical errors including inadequate decortication, inadequate graft size, shape or material, inadequate internal fixation or inadequate post operative immobilization. The incidence of pseudarthrosis is variable. The incidence of Pseudarthrosis in scoliosis corrective surgery ranges from 0-19 %. It may manifest with back pain, midline tenderness, limitation of motion and muscle spasms. Plain antroposterior spine X-rays, along with lateral flexion/extension views can confirm the diagnosis in most cases. A success fusion shows a continuous trabecular pattern traversing the grafted segment. Fine cut CT and three dimensional CT reconstructions of fusion site are required when X-rays are ambiguous. The primary indications of revision are instability or intractable pain.

COMPLICATIONS IN ANTERIOR THORACOLUMBAR & THORACIC SPINE SURGERY

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REDUCTION OF COMPLICATION RATE THROUGH SURGICAL MANAGEMENT OF THORACOLUMBAR SPINAL CORD INJURY – THE BANGLADESH EXPERIENCE

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Session - XIII
COMPLICATIONS IN SPINAL DEFORMITY SURGERY

INTRA-OPERATIVE AND IMMEDIATE POST OPERATIVE COMPLICATIONS OF DEFORMITY SURGERY

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Introduction

The management of spinal deformities is a challenge to the spinal surgeon and corrective or reconstructive spinal surgery is a major intervention. There have been significant advances and development of new techniques since last two decades. However, pitfalls and complications while treating spinal deformities are still nightmares of spinal surgeons today. (Table 1)

The terms of "learning curve", "complication" and "mal practice" should be clearly define and separated from each other. While applying the most recent "state of the art" and after taken all the precautions some undue outcome might occur. This is clearly different from learning curve or mal-practice.

Paraplegia resulting from the operative treatment of scoliosis is the complication most feared by surgeon and patient [20]. Neurologic injury stemming from surgical treatment of scoliosis can be direct or indirect.

Preoperative evaluation

Many complications may be prevented by careful preoperative investigation and planning. Congenital scoliosis, neurofibromatosis, skeletal dysplasias and post infectious scoliosis carry higher neurologic risk. Most structural curves seen in adolescents are idiopathic in nature. However, accompanying signs and symptoms should be sought with high degree of suspicion. The preoperative examination should include assessment of gait and through motor, sensory and reflex examinations. Ocular movement pathologies might be related to the pathology in the vicinity of pons; left thoracic curves, absent abdominal reflexes [29] might be related to syringomyelia and Arnold Chiari syndrome; brisk neurologic impairment at the lower extremity, feet deformities, feet size differences, midline dermal sinuses may be the only signs of tethered cord or diastometamyelia syndromes. Though there is some controversy exists, MRI is indicated in patients less than 11 years of age, patients with neck pain and headache, patients with findings of ataxia, weakness, cavus foot, diminished sensation to pain, temperature, light touch or position and those with left thoracic curves[20].

Pain is not usually accompanied with idiopathic scoliosis curves, so painful curves should thoroughly be investigated. Technetium bone scintigraphy is a useful tool in the diagnosis of a painful tumour such as osteoid osteoma. On the contrary pain the almost always present in adult scoliosis. One must be aware of other possible pathology, which may be responsible for back pain, including disk herniation, spondylolysis, spinal stenosis, abdominal aneurism, renal stones and others[3].

Differentiating congenital curves from idiopathic curves carries the utmost importance.

Intraoperative positioning

Nerve injury: Positioning of the patient is important and may cause some problems unless carefully managed. Brachial plexus, ulnar nerve, femoral nerve, lateral femoral cutaneous nerve and peroneal nerve are the nerves that are the most vulnerable ones during the positioning of the patient [6,20,21,24]. Careful padding of the vulnerable sites prevents nerve injury.

Ocular complications: Ocular complications have been considered as rare events and have received little attention. However, during the past few years there have been reports in the literature [8,21]. Direct pressure on the eye, especially as a result of patient malposition in a horseshoe type headrest, has been cited as a factor contributing to visual loss[21]. However, hypertension, smoking, diabetes, and vascular disease appear to increase the risk. Hypotension during the surgery is also an important factor. Patients who experience complete absence of light perception will not have significant improvement in their vision with time[21].

Air embolism: Air embolism is one of the most serious complications associated with all positions where the incision is above the level of the hearth. It is most common in sitting position. Incidence of air embolism in sitting position has been reported as high as 39-58%. [24]

Major vascular injury: Great vessels and their branches lie in close proximity to the spine and are susceptible to injury during spine surgery at any level. Injury may occur either directly while operating in close proximity or indirectly by a probe, rongeur, or screw. The manifestations of major vascular injury may be variable, difficult to recognize, and highly dangerous. Among 106 vascular injuries reviewed by DeSaussure, there was an associated mortality of 47%.[24]

Neurologic complications:

Review of clinical case reports, clinical series and basic science research show that there is risk to the spinal cord while performing corrective surgery for spinal deformity[4,6,18,20,22,25,27,28]. (Table 2, 3). These risks are 1) direct contusion of the cord during exposure, 2) contusion by hooks or wires, 3) distraction by rods or halo traction and 4) reduction of spinal cord blood flow[6,20,22,28]. Various methods of monitoring the patient's neurologic status have been suggested. These include Stagnara wake up test[26], ankle clonus test[9], somatosensory-evoked potentials, motor evoked potentials[20]. The purpose of monitoring is to allow early intervention by the surgeon. Removal of instrumentation has been proposed in the management of intraoperative neurologic deficit. Bridwell in their review of 1090 spinal operations have hypothesised that combined anterior and posterior surgery had higher risk for a neurologic deficit than anterior or posterior only surgery. Hyperkyphosis further posed risk for the spinal cord injury[6]. In his review Winter makes the following recommendations: 1) preoperative evaluation is important, 2) delicate and careful exposure is important to prevent spinal cord from inadvertent contusion, 3) insert hooks, screws, wires with greatest care, 4) never distract excessively, 5) monitor spinal cord while instrumenting or manipulating around spinal cord, 6) remember that hypotension reduces spinal cord flow, 7) these risks are additive[28].

Implant problems

Implant related complications may be encountered intraoperatively or postoperatively. Most of the intraoperative implant related complications are due to improper surgical technique related to the implant used. Lamina fracture, screw canal violations are important complications. Hook dislodgment or implant failure can be an immediate or late postoperative complication. Poor placement of the hook, lamina fracture, excessive distraction, poor contouring of the rod are among the main causes of early hook failure. Neurologic injury following insertion of laminar hook has also been reported[4,25].

Pedicle screws have been in the armamentarium for a long time. Complications related to screw placement have been described in the literature. Growing popularity of the pedicle screws is based on the biomechanical advantages over hooks and their higher stiffness. Liljenqvist, in their study, where they evaluated thoracic pedicle screws, 25% pedicle or vertebral body cortical penetration was encountered.[15,16] In another study, 40% manually placed screws were found misplaced. It is generally accepted that up to 40% of pedicular wall perforations can be observed during pedicle screw insertion. The learning curve for some of the surgeons may be responsible for the similar high pedicular perforation

rate (40%) obtained in the this study[10].

Infections

Postoperative infection, whether a minor superficial dermatitis or a catastrophic deep wound abscess with osteomyelitis, is a dreaded complication following spinal surgery. Reported incidence ranges from 0,7 to 9,3%. Kosay have conducted a study to determine and evaluate the risk factors of postoperative deep wound infections in spinal instrumentation. The study group included 29 deep wound infection cases and age, sex; aetiology matched 92 control cases among 869 cases with spinal instrumentation between 1989 and 2000. Logistic regression analysis revealed that the most important risk factors were staged surgery, preoperative hospitalization more than 4 days, polytrauma, and paraplegia. Duration of urinary catheters, duration of operation (more than 210 minutes) and segments involved were other risk factors in decreasing importance. Body mass index was a risk factor for adult patients. Staged spinal surgery increased risk of infection 6 times, and hospitalization preoperatively more than 4 days increased risk of infection 6 times[11].

Other complications

Superior mesenteric artery syndrome, also known as the cast syndrome results from the compression of duodenum by the superior mesenteric artery. Manifestations range from mild discomfort to paralytic ileus, vomiting and metabolic alkalosis[24].

Spinal surgery has been shown to play an etiologic role in cholelithiasis and acalculous cholecystitis, associated with pancreatitis. Fuller et al has documented an 11% rate of cholelithiasis among children and adolescents who have undergone spine fusion for scoliosis[7].

Pancreatitis has long been recognized as a complication of various abdominal surgeries and more recently as a complication of surgical procedures on sites remote from pancreas[12,13]. Leichter et al reported a 14% incidence of pancreatitis in patients after scoliosis surgery. The only significant differences found between the group with pancreatitis and the nonpancreatitis group was blood loss, days of fasting and presence of gastrointestinal symptoms[13].

Recent clinical studies suggest that the syndrome of inappropriate antidiuretic hormone (SIADH) secretion is a common finding in postoperative spinal fusion patients. The incidence of SIADH in spinal surgery ranges from 5 to 6,9%. The risk is higher in revision surgery and increased blood loss[5,17].

Table 1 List of complications in scoliosis surgery

1. **Intaroperative**
   - 1.1. Anesthesiology related
   - 1.2. Positioning
     - 1.2.1. Peripheral nerve palsy
       - 1.2.1.1. Femoral nerve
       - 1.2.1.2. Peroneal nerve
       - 1.2.1.3. Brachial Plexus
       - 1.2.1.4. Ulnar nerve
     - 1.2.2. Ocular complications
       - 1.2.2.1. Central Retinal Artery occlusion
       - 1.2.2.2. Ischemic Optic Neuropathy
     - 1.2.3. Vascular compression
   - 1.3. Surgical technique
     - 1.3.1. Approach related
       - 1.3.1.1. Pneumothorax
       - 1.3.1.2. Air embolism
       - 1.3.1.3. Wrong level
     - 1.3.2. Implant related
       - 1.3.2.1. lamina fracture
       - 1.3.2.2. Pedicle violation
       - 1.3.2.3. Canal violation
       - 1.3.2.4. Over distraction
     - 1.3.3. Blood loss
     - 1.3.4. Neurologic
       - 1.3.4.1. Paraplegia
2. **Postoperative**
   - 2.1. Early postoperative
     - 2.1.1. neurologic
       - 2.1.1.1. Paraplegia
     - 2.1.2. metabolic
       - 2.1.2.1. Inappropriate ADH syndrome
     - 2.1.3. Bleeding
     - 2.1.4. Infection
     - 2.1.5. Chylothorax
     - 2.1.6. Mesenteric artery syndrome
     - 2.1.7. Remote organ
       - 2.1.7.1. Pancreatitis
       - 2.1.7.2. Gastrointestinal bleeding

2.2. Late postoperative

2.2.1. Infection
2.2.2. Pseudoarthrosis
2.2.3. Implant related
2.2.3.1. rod breakage
2.2.3.2. hook dislocation
2.2.3.3. screw breakage
2.2.4. Cholelithiasis

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Table 2
Complications of scoliosis in pediatric patients
(Adapted and updated from "Complications in spinal surgery. Balderston RA, An HS W.B. Saunders 1991[3])

Author	Year	n	Type	Treatment	Neurologic%	Pseudo%	Implant%	Inf. %	Mortality%
Goldstein	1969	107	Idiop	HR	0,9	3,7	4,7	1,9	0
Harrington	1973	378	Idiop	HR	0	3,3	21,3	0,7	1
Herndon	1987	63	Idiop	HR+sublam	1,6	11	23,8	6,3	0
Lonstein	1987	107	Paraly	HR+/-AF	0,9	17	23,4	5	3
Lovallo	1986	163	Idiop	HR	0	1,8	8	3,4	0
Luque	1982	65	Mixed	Sublam	10,8	3,1	9,2	3,1	0
Thompson	1985	86	Idiop	HR+Sublam	16,3	0	2,3	0	0
Winter	1984	66	Cong	Mixed	0	20	3,0	1,5	4,5
Lenke[14]	1992	95	Idiop	CD	1	1	0	0	0
Alici[2]	1992	755	Idiop	Mixed	0,3	1	2,4	3,9	0
Richards[23]	1994	103	Idiop	TSRH	0	1,9	2,9	9,7 (late)	0
Bridwell[6]	2002	44	Idiop	Wisconsin	0	2,2	2,2	0	0
Liljenqvist[15]	2002	99	Idiop	CD+MPDS	1	?	14	5	0
SRS M&M	1975	3773	All spine	Mixed	0,6				
British Scoliosis Society	1985	1121		459 HR 339 Luque	1,7 4,6				
SRS M&M	1987	805	Scoliosis	Mixed	0,62				
SRS M&M	1993	2031	Scoliosis	Mixed	0,3				
SRS M&M	2003	7328	Scollosis	mixed	0,8			0,9	0,2 (overall)

Table 3
Complications of scoliosis surgery in adult patients
(Adapted from "Complications in spinal surgery. Balderston RA, An HS W.B. Saunders 1991)

Author	Year	n	Neurologic%	Pseudo%	Instrument%	Infection%	Mortality%
Byrd		26	7,7	0	11,5	0	0
Court-Brown		32	0	6,2	12,4	3,1	0
Kostuik		107	0,7	10	10	10	1
Ponder		132	0	17,6	3,7	4,6	2
Sponseller		46	6,5	8,7	10,1	2,2	1
Swank		222	0,5	11	12	8,0	3
Van Dam		91	1,1	15	5	1	0

REVISIONS FOR COMPLICATIONS AFTER SURGERY FOR SPINAL DEFORMITY

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EVOKED POTENTIAL MONITORING IN DEFORMITY SURGERY – ADDRESSING THE SAFETY FACTOR

Prof. Haluk Berk
Professor of Orthopedic Surgery, Member of Executive, Committee of Spine Society of Europe

URINARY TRACT INFECTION: PREVENTION AND MANAGEMENT

Dr. Jean Jacques Wyndaele
Prof. of Urology, University Hospital, Belgium.
President of International Spinal Cord Society Education Committee

Questions about UTI

- Prevalence
- Diagnosis
- Treatment
- Prevention
- Urinary tract infection

Prevalence overall

2.5 episodes per patient per year

Specifying the problems

- At spinal lesion almost all patients have sterile urine (no UTI): in own series 2/100 infected at primary admission
- Infection = result of urinary catheter mostly
- Infection = relates to complications and general prognosis

Stages of Urinary treatment after SCL

- Spinal shock bladder
- After spinal shock regaining of micturition and continence
- Follow-up "lifelong"

Stages of UTI problems in SCL

- Early : Problem of catheterisation
- Late : Problem of neurogenic bladder dysfunction – complications and/or catheterization
- UTI in acute stage
- Depends on type of bladder drainage
- Depends on way this bladder drainage technique is applied
- Depends on defence mechanisms against infection in LUT

Defence mechanisms against UTI

- GAG Layer against bladder mucosa
- Hydrokinetic mechanisms
- Diuresis
- Frequency emptying
- Completeness emptying

Diuresis and UTI

Voiding frequency and bacterial growth

Residual and bacterial growth

Infection risks at admission

- Urinary infections are 40 % of all nosocomial infections
- Most SCL patients need catheter
- Cross infection is frequent (hands!!!)
- Unsuspected infected material (soap, lubricant, door knob..)
- Use of many antibiotics

Infection in different types of bladder drainage in acute stage

- Indwelling transuretral: 5 % per day infected, maximum 14 days sterile

- Cystostomy : maximum sterile 5 – 7 weeks without antibiotics
- Intermittent catheterization: sterile 15 – 20 days without antibiotics and 16 – 55 days with antibiotics

Prevention UTI acute stage

Advantage to use CIC as soon as possible

And meanwhile...

Indwelling catheter and infection prevention

- Care meatus
- Silver coated catheters
- Closed drainage
- Valve in sack
- Distal drain tube
- Broad and long connecting tube

Indwelling catheter prevention of infection

- Closed drainage system
- General hygiëne (hands of carers)
- Use indwelling catheter as short as possible
- Seperate catheterized patients on the ward.

Indwelling catheter and infection prevention:

- Useless Antibacterial installations
- High diuresis and free catheter outflow
- Chronic peroral antibiotics
- Bladder rinse unindicated

Development of resistance

Suprapubic catheter and infection prevention

- Closed drainage system
- Covered punction place
- No unindicated rinse

Intermittent catheterization and infection prevention

- Catheterization 4 - 6 per day
- Antibacterial : be aware of resistance development
- Methenamine hippuraat, nitrofuran, oxolic acid, cotrimoxazole, ...
- Ascorbic acid as adjuvants if prevention is needed
- Start CISC as soon as possible (2 – 3 weeks)

Diagnosis of infection

- Dipstick
- Dipslide
- Microscopy
- Culture

Clinical observation is also very important for diagnosis UTI

- Spontaneous evacuation of urine
- Leakage when moving
- Smelly, cloudy urine
- Calculi evacuated
- Fever and other signs of infection
- Globus *et al*

Rehabilitation period

- CIC
- Tapping
- Crédé
- Indwelling catheter

- External appliances

Prevention of UTI in rehabilitation period

- Corresponds very much to acute phase
- CIC gives also in longterm lower infection rate but infection does occur
- Under CIC prevalence 10,3 per 1000 patient days on IC
- Risk factors: children and high volume in bladder
- UTI Prevalence with other catheters is not seldom higher

Prevention of UTI in rehabilitation phase

- General prevention against nosocomial infections
- Strict antibiotics policy
- Avoid
  - permanent catheter (indwelling, condom)
  - bladder overdistention
  - improper use of material

Prevention of UTI in the longterm

- Very similar to rehabilitation phase but out of hospital
- Bacteria may be different if patient does not leave hospital infected chronically (pyelonephritis, prostatitis or other)
- Drinking enough, emptying regularly, general hygiene.

Intermittent selfcatheterization preventing UTI

- Number catheterization: 5x more infection if 3 cic per day than if 6 cic per day
- Antibiotic prophylaxis: only high risk groups as children, diabetes, reflux, diverticulae. Danger resistance induction!
- Urinary sepsis
- High fever, urinary infection
- Seldom if CIC (< 2%)
- More frequent if indwelling catheter (20 %)
- Dangerous periods: clamping catheter or blocking
- Dangerous periods: change from indwelling to CIC
- Urinary sepsis

Treatment:

- Antibiotics
- Drug against fever
- High diuresis
- Open catheter for continuous outflow urine

Prostatitis

- Acute prostatitis Most probably prevalence underestimated
- Chronic prostatitis: most probably underestimated too
- Diagnosis: clinical, urine-evaluation, Xrays, localisation tests

Prostatitis

- XRays backflow in prostate
- Calculi (restricted diagnostic power)

Localisation tests for recurrent UTI

- Bladder outwash test (Fairley et al 1971)

Locate infection in LUT

- 5 glass test
- Urethritis
- 2 % to 15 % depending on series.
- Relation to type of catheter
- Relation to paraurethral abcess

Goals of neuro-urology after spinal cord lesion

- Low pressure bladder
- Good bladder capacity
- Adequate bladder emptying
- Sufficient urethral resistance
- No infection

Treatment of infection

- Eliminate all material that can prevent cure (stone, catheter, *et al*..)
- Treat what can be cause of recurrence: reflux, residual, bladder overdistention, *et al*
- Oral and parenteral antibiotics: for accurate and effective use during episodes of significant clinical infection

MANAGEMENT OF AUTONOMIC DYSREFLEXIA

Dr. Inder Perkash

Professor Urology, P.V.A. Professor Spinal Cord Injuries and Professor P.M&R Stanford And Director Spinal Cord Injuries Center Palo Alto V.A. Health Care System, USA

ABSTRACT ON MANAGEMENT OF A CONTRACTED BLADDER FOLLOWING SPINAL CORD INJURY

Gurpreet Singh

Consultant urologist, neurourologist, Southport Spinal injury Unit UK

Spinal cord injury in this day and age is a formidable non-fatal injury which causes profound disability. Bladder management remains paramount in reducing mortality and improving morbidity in patients with spinal cord injuries and factors that have recently improved bladder management include better catheters and increased catheter free management, control of infections, early and appropriate urodynamic assessment and proper surgical management of an intrinsically high pressure bladder causing reflux and upper tract changes.

The bladder passes through different stages of recovery. The retention phase is essentially the phase during spinal shock and following on from this you get retention with overflow and then as the bladder recovers depending upon the extent of the injury and the level of the lesion you either get reflux voiding or chronic retention with overflow incontinence, historically called automatic voiding or paralytic incontinence.

As in most things prevention is by far the better way of reducing complications and complications are difficult to manage them. Following a period of catheterisation the bladder undergoes histological changes within 6 weeks of an indwelling catheter; fibrosis leads to loss of compliance in the bladder and permanent histological changes subsequently lead to the bladder losing its vesico elastic properties. Intermittent catheterisation needs instituting at an early stage. Once the bladder has developed histological changes and high pressures; conservative treatment including anticholinergics fail, we then need to retreive a difficult situation. Our experience in injecting botulinum toxin in the bladder is discussed. Our early results in 10 patients shows significant improvement in quality of life and improvement in all urodynamic parameters.

Augmentation cystoplasty is a gold standard in managing a contracted bladder with high pressures. Results in both the neuropaths and the non-neuropaths are excellent with a success rate of over 90%. Problems including bowel problems and long-term cancer risks are discussed. Substitution cystoplasty is instituted once the bladder has lost most of its functional capacity and it's beyond a retrieval situation.

The native urethra is by far the best conduit to facilitate bladder emptying; failing utilization of the native urethra various conduits including appendix and ileum have been used in different forms.

The surgical management of a contracted bladder remains difficult. The important carry home message is; prevent a bladder becoming contracted. Adequate measures need instituting early following injury to stop the bladder becoming a millstone around the patients neck.

OTHER COMPLICATIONS RELATED TO NEUROGENIC BLADDER: PREVENTION AND MANAGEMENT

Dr. S. V. Kotwal

Head of Urology Dept. ISIC, New Delhi

UPPER TRACT COMPLICATIONS: PREVENTION AND MANAGEMENT

Dr. Jean Jacques Wyndaele
Prof. of Urology, University Hospital, Belgium. Secretary of International Spinal Cord Society

Questions about upper tract complications

- Prevalence
- Diagnosis
- Treatment
- Prevention

Types of upper tract problems

- Dilatation
- Stones
- Infection

Goals of neuro-urology after spinal cord lesion

- Low pressure bladder
- Good bladder capacity
- Adequate bladder emptying
- Sufficient urethral resistance
- No infection
- Upper tract problems

History
After World War I: renal failure from upper tract obstruction and/or urosepsis prime cause of moratlity
1961: this mortality 50%
1968 36 %
1973 30.8%
1983 15.3 %

Upper tract dilatation

Control every year at least

Ultrasonography
IVP
Blood test : limitations: unilateral dilatation, much lost before blood level raises
Isotopes DMSA DTPA MAG3 with diuresis provocation
Causes for dilatation

- Vesico-ureteral reflux
- Intramural ureteric obstruction
- Outflow obstruction
- Stones
- Other

Unilateral versus bilateral dilatation

Importance of urodynamic tests: low pressure/high compliance bladder and complete bladder emptying
Treatment
Treat cause if possible
Treat infection
Treat outflow problem
Surgery if needed

- Urinary tract infection (described in previous talk)
- Infection = relates to complications and general prognosis

Treatment of infection

- Eliminate all material that can prevent cure (stone, catheter, *et al.*.)
- Treat what can be cause of recurrence: reflux, residual, bladder overdistention, et al
- Oral and parenteral antibiotics: for accurate and effective use during episodes of significant clinical infection
- Urinary stones
- Urinary calculi after SCL (Spinal Cord Lesion)
- Renal stones : 6 % (general population 2 %)

- 2 / 3 after 2 years post lesion
- No relation with level of lesion
- 80 % discovered on routine Rx
- Rest discovered because of infections
- 4 % radiolucent (10 % general population)

Renal calculi

- More frequent in elder patients

- Complete lesions
- Lesions above D4
- Lesions lower motor
- Right side

Bunts 1958, Comarr et al 1962, Cukier et al 1967

- Rare below L1

- Gardner-parsons 1991

Renal calculus

Pyelum stone

Coral stone

Bladder calculi after SCL

- Bladder stones often eggshell
- Not always visible XRay
- More when treated with indwelling catheter 12 – 70 %
- Less when IC 5 – 20 %

Bladder stones

Metabolism after SC lesion in relation to risk for stone formation

Blood:

- Calcemia normal (seldom dangerous hypercalcemia)
- Phosfate increases first 3 months (Minaire 1979)
- Alc Phosphatase increases (Fear for PAO)

Metabolism after SCL

- Urine
- High levels calciuria from day 2 till month 5 – 8 (Burr 1972): though no load on bone
- Oxalate: normal
- Hydroxyproline : sharp rise early and lowering in next few months
- Uric acid: no big change

Mechanisms of stone formation

- Nucleation (3 complementary theories)
- Crystal growth
- Stone

Mechanisms urinary stone formation

Types of stones

General prevention

- No catheter in bladder
- Avoid introduction of hair with catheter for CIC
- Treat infection (proteus)
- Avoid vesico ureteral reflux and obstruction

General prevention

- High fluid intake
    - goal: diuresis > 2L / 24 hrs.
    - If possible mineral poor water
    - Not recommended: large quantities fruit juice, coffee, tea

- Diet with little salt and protein

More specific prevention

- pH lower (calcium stones) or higher (uric acid stones)
- Specific medication for specific stones

Treatment of stones

- ESWL, percutaneous, surgery, endoscopy
- Bladder stone lithotripsy Stone treatment Dormia basket
- University Antwerp Belgium

Session - XV - Auditorium
POST OPERATIVE INFECTIONS

DIAGNOSIS OF POST – OPERATIVE INFECTIONS OF THE SPINE BY MODERN – IMAGING TECHNIQUES

Dr. Harsh Mahajan
GMR Institute, New Delhi.

PRE-OPERATIVE RISK FACTORS FOR WOUND INFECTIONS

Dr. Daljit Singh
Associate Professor, Deptt. of Neurosurgery, GB Pant Hospital, New Delhi

USE OF ANTIBIOTICS FOR WOUND PROPHYLAXIS IN SPINAL SURGERY

Dr. Ritabh Kumar
Jr. Consultant Orthopaedics, ISIC, New Delhi.

MANAGEMENT OF ADHESIVE ARCHNOIDITIS

Dr. Rana Patir
Consultant Neurosurgeon, Sir Ganga Ram Hospital, New Delhi

MANAGEMENT OF POST-SURGICAL INFECTIONS

Mr. Abhay Rao
Orthopaedic Spinal Surgeon – Leeds, UK

Historically, spinal infections were devastating diseases with high morbidity and mortality rates. With the advent of antibiotic treatment and powerful new diagnostic techniques the prognosis has improved dramatically in the recent years. However, there are still many management pitfalls that needs' to be considered. As the infection affects an elderly group of patients and those who are immuno compromised, the vertebral osteomyelitis may not be diagnosed at an early stage leading undue complications. Successful management of spinal infection includes maintaining a high level of diagnostic accuracy, to avoid delays in diagnosis, using antibiotic therapy as directed by microbiological result and instituting appropriate surgical intervention when indicated.

The epidemiology, etiology and the bacteriology are of similar spectrum to vertebral osteomyelitis in thoracic and cervical spine. The incidence of spondylodiscitis and facet disease is more common in the lumbar spine but epidural abscess formation in the lumbar spine is of lower incidence compared to cervical and thoracic spines. Pain is the commonest clinical presentation but in the lumbar spine in association with pain, patients can present with psoas abscess or abscess pointing through Petit's triangle but not uncommonly patients can present with signs and symptoms of cord compression or nerve root compression. This is less common in lumbar spine infection in comparison.

It is important to remember that on plain radiographs the character features of disc space narrowing does not appear at least two to four weeks following the onset of infection. A definite diagnosis both from the point of view of infection and also from the point of view of establishing the organism causing the infection is only possible by biopsy. The pre-requisite of biopsy is that the patient should not have had any antibiotics on an empirical basis and that there should be adequate imaging available to access the biopsy needle thereby obtaining the best sample for a microbiological diagnosis.

The goals of treatment are: -

(A) To establish diagnosis

(B) To protect and restore neurological function

(C) Relief of pain

(D) Clearance of infection and prevention of recurrence

(E) Maintain and restore spinal stability.

With regards to the antibiotic treatment it is important to establish sensitivity of the organisms to the appropriate antibiotics before administering adequate dose. The adequacy of dosage of antibiotics should be measured by concentration of antibiotic in the blood. The contentious issue with regards to antibiotic treatment is the duration of treatment. It is said that a minimum of six weeks antibiotics is necessary to clear the infection but it may be necessary to continue the antibiotics up to twelve weeks. The monitoring of the response of infection on antibiotic treatment is based on clinical evidence, inflammatory and/or further imaging.

In the early phase bed rest maybe required but immobilisation with or without arthrosis should be commenced as soon as patients pain levels allow. The arthrosis may need to be worn over a long period of time until spinal stability is established on a radiological basis or the patients pain levels are dramatically reduced in the first six to twelve weeks. Indications for surgical treatments include: -

(1) Open biopsy when all other means of establishing a diagnosis have failed

(2) When a clinically significant abscess is present

(3) In cases of the factor to prolong non-operative treatment

(4) In cases with spinal cord compression causing neurological deficit

(5) In cases of significant deformity and vertebral destruction

In lumbar spine infections with root deficit the final outcome can be satisfactory with or without surgical treatment but patients with spinal cord compression have a better prognosis with surgery. Neurological recovery can be expected as late as five months after the onset of weakness. If only a laminectomy is carried out facet joints should be preserved. However in nearly all cases the spine should be approached anteriorly or by combined anterior and posterior approach. Factors that have been found in increased association with paralysis include increasing age, more cephalic level of infection and a history of diabetes and rheumatoid arthritis. After successful treatment of infection less than 7% of patients have residual neurological deficit. In those who have diabetes it is more than likely that they will have permanent neurological deficit.

We present a prospective series of patients treated for Lumbar Spine Infection at St James's Hospital, Leeds, UK.

Session – XVI - Conference Room
Complications of The Urinary Tract, Complications During Sexuality & Fertility Management And Psychosocial Complications

INCONTINENCE IN SPINAL – CORD INJURY PATIENTS

Mr. Gurpreet Singh
Urologist, UK

COMPLICATIONS ARISING DURING MANAGEMENT OF SEXUALITY IN SPINAL CORD INJURED

Dr. M.A. Salam
Neuro-urologist & Associate Professor, Department of Urology, BSMMU, Bangladesh

COMPLICATIONS ARISING DURING FERTILITY MANAGEMENT OF SPINAL INJURED

Dr. Sanjeev Sharma
UK

The two important aspects of fertility management are semen collection and its eventual use in some form of assisted reproductive technique. Complications are associated with both these aspects.

Assisted ejaculatory techniques commonly employed are vibrostimulation and rectal probe electroejaculation. Significant side-effects of these techniques include autonomic dysreflexia and contractions and spasms of abdominal muscles. These can be avoided or treated with careful, explanation and where needed, the use of nifedipine. Anticipation and preparation for these complications before the treatment is started goes a long way in their management.

Surgical sperm retrieval has been known to be associated with localised pain, bruising and very rarely, infection and haematoma formation. Treatment is with analgesics, antibiotics and good surgical technique.

The complications of assisted reproductive techniques are the same as for non-spinal injury patients and include ectopic pregnancy, multiple pregnancies and ovarian hyperstimulation syndrome (OHSS). These are managed with careful selection of patients and replacement of only two embryos. OHSS is potentially extremely serious and needs much more extensive and careful monitoring.

PSYCHOSOCIAL COMPLICATIONS AFTER SCI

Dr. Stanley Ducharme
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Session – XVII - Auditorium
GRAFT RELATED COMPLICATIONS, BONE GRAFT SUBSTITUTES AND NON FUSION TREATMENT OPTIONS

GRAFT RELATED COMPLICATIONS IN SPINAL SURGERY

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INTRODUCTION

Though bone grafting is a basic technique, its applications are fraught with complications, especially is correct technical principles are not adhered to.

This paper tries to enumerate complications related to bone grafting, and suggest some solutions.

Complications can be related to

1. Poor graft resources
2. Poor grafting technique
3. Post procedure problems
4. Donor site complications

1. Poor graft resources

- Poor donor site
  - Young patient
  - Hypoplastic iliac crest
- Poor recipient bed
  - Geometrically
  - Soft, diseased bones

2. Poor grafting technique

- Improper size and shape of graft
- Ill prepared donor site (aggressive end plate debridement, bone removal, asymmetrical endplates)
- Poor seating of graft / graft not under vertical compression
- Poor instrumetation technique

3. Post procedure problems

- Infection
- Pseudoarthrosis
- Graft slippage
- Graft resorption

4. Donor site complications

- Infection
- Neuro vascular injury
- Fracture
- Hernia
- Chronic pain

Problems during graft insertion

a) Graft height

- Often too tall.... If trimmed , too short !
- Ideally, snug fit
- If too tall.....traction / distraction/ increase slot
- If too short.....stack up/ intramedullary K wire

b) Graft depth

- Too deep....
- Strictly not permissible
- Pre insertion depth measure
- Too proud .....
- Trim pre insertion
- Burr off if well seated

c) Graft fracture

- Out of heavy hammering
- Hammer with broad punch
- Hammer at varying sites
- Ensure perfect size
- May require to re harvest

Post op problems

Graft collapse

- Related to porotic graft / microfractures during insertion / infection
- Causes kyphosis, which may cause canal compromise
- Supplementing with instrumentation may prevent this

Graft dislocation – intra canal

- Most feared complication
- Presents with neurological worsening after initial encouraging recovery
- Presentation can be catastrophic

Comes out of

- Poor graft fit intra op
- Inadequate spinal stability
- Post op factors

Management

- Emergency re-exploration
- Reposition with instrumentation

Graft dislocation – extra canal

- Less dangerous, but can be very problematic
- Asymptomatic
- Dysphagia
- Hoarseness of voice
- Vascular aneurysm
- Esophageal rupture

Pseudarthrosis

- se of spinal instrumentation
- To limit inter-segmental mobility and create a favorable environment for graft incorporation
- To prevent 'collapse'
- To protect the graft (!)

Graft resorption

- Known to occur in cases with frank infection, especially pyogenic
- Cancellous graft more prone
- Also occurs if post op irradiation

Conclusion

- Autograft provides the highest rate of spinal fusion
- Perfect your technique of bone grafting to minimize complications, ...rather than turning away from it to bone graft substitutes, which are exorbitantly priced, and never as good as autografts!
- Reserve graft substitutes for special situations.

BONE MORPHOGENETIC PROTEINS - ROLE IN SPINAL SURGERY

Dr. Julio Gallego
Spinal Surgeon – Memphis, USA

BONE GRAFT SUBSTITUTES

Dr. S. M. Tuli
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NON FUSION TREATMENT OPTIONS OF DEGENERATIVE DISC DISEASE: AN EFFORT TO REDUCE ADJOINING MOTION SEGMENT COMPLICATIONS

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Thirty patients underwent cervical disc replacement from Jan 2002 to Feb 2004 tor cervical disc prolepse with myeloradiculopathy, The age group was 31 to 50 yrs with average age of 40 years. There were 21 (70%) males and 9 (30%) females in this study. Neck pain, brachialgia was the presenting symptoms in all cases, 18 (60%) had radiculopathy and 12 (40%) had myelppathy.

Single level disc prolapse was present in all cases as per Magnetic Resonance Imaging (MR). Four (13%) at C4-C5, 18, (60%) at C5-C6 and 8 (27%) at C6-C7.

The operative approach was anterior from right side using specially designed Bryan's anterior cervical discectomy equipments. Bryan's disc size 15 was used in 8 (27%), sixe 16 was used in 3 (10%), size 17 was used in 18 (60%) patients and size 18 in one (03%) patient.

There was no intraoperative complication. One patient developed hoarseness of voice postoperatively, which recovered in two months. During immediate post-op, 02 months and 06 months follow up the clinical outcome was excellent in 124 (80%) and good in 6 ()20% as per Odom's criteria.

There was demonstrated motion in flexion, extension, and rotation clinically, radiologically during post op and follow up. There was no migration or displacement of device. To conclucle cervical disc replacement for cervical disc replacement for cervical disc prolapse with myeloradiculopathy is a newer concept, which removes the diseased disc, alleviates orachialgia, improves neurological deficit, retains stability and at the same time maintains full neck motion.

CERVICAL DISC REPLACEMENT : AN INDIAN EXPERIENCE

Introduction

Cervical spondylotic myelopathy is the most common cause of cord distortion in patients over 50 years of age. Degenerative changes within the disc osseous and soft tissue structures of the cervical spine cause encroachment and stenos is of the cervical spinal canal. The disc, osteophytes, posterior longitudinal ligament, ligamentum flavim, facet joints and the incovertebral joint all contribute to the stemotic process. The diagnosis of cervical soondylotic myelopathy is primarily based on a thorough history and clinical examination. Comfirmation of spondylotic cervical myelopathy is done by Radiological evaluation and Magnetic resonance imaging (MR) scanning. With extablished and confirmed myeloradiculopathy the best conservative approach probably is a surgical approach.

Anterior cervical mocrodiscectomy (ACD), and fusion (ACDF) has been successful operative methods for cervical sponcylotic myeloradiculopathy due to vervical disc prolapse (1) The evolution of surgical technique in the field of surgery is changing towards procecures like Cardiac, liver transplant and replacement of various joints of the body to reduce patient's disability & morbidity Similarly in the field of Neuro Surgery continuing attempts are made to improve patient management with cervical disc disease with newer surgical techniques with a goal to relieve neck pain & brachialgia, achieve neurological recological recovery, maintain stability, provide ftll neck movements and to assume normal activities early. To achieve this goal ecently reconstruction of a degenerated cervical intervertebral disc with a Neurosurgeon Dr. Vincent Bryan with his research work since 1993 with Spinal dynamics, Inc. Cervical disc replacement not only provides decompression, stabilization like ACDF but als simultaneously protects the adjacent disc levels form abnormal stress associated with fusion (2) and provides full physiological neck motion.

Our institution carried a prospective study to determine if a new functional inter vertebral disc prosthesis (Bryan's Cervical Disc) when implanted accurately, co provide relief from objective neurological symptoms & signs, improve patient functionality, decrease pain, provide long-term stability, and normal range of motion.

Material & Methods

A prospective study was carried out at our institution for thirty patients presented with cervical spondylotic myeloradicuopathy and implanted with Bryan's prosinetic cervical disc during Jan 2002 to Feb 2004.

At admission patients were clinically evaluated and and detailed neurology cal examination was carried out in all cases, Radiological evaluation included Anterior posterior (AP), Lateral Radiographs of cervical spine, and Magnetic Resonance imaging (MRI) in all cases to find out the (a) the level of disc prolapse, (b) thecal & newer

hood compression (c) cord changes. Computerised Tomography (CT) scan was carried out to find out the Bryan's cervical disc size preoperatively.

Skeletally mature young patients above 21 years of age with one or two level cervical disc prolapse were included in this study and patients with unstable spine, osteoporosis and active infection were excluded from this study.

All the cases were operated by anterior cervical approach from right side using the specially designed Bryan's cervical discectomy system. The device and operative techniques are as under :

a) Device Description (Fig. 1)

The Bryan cervical disc prosthesis, manufactured by Spinal Dynamic Corporation, is a cervical intervertebral disc prosthesis, designed to permit motion similar to normal cervical functional spinal unit. The prosthesis is intended to treat stable cervical degenerative disc disease without fusion and thereby provides motion at the treated level.

The device consists of :

i) Polyurethane nucleus.
ii) Tow titanium alloy surfaces (Shells). Bone contacting surtace of each shell includes a titanium porous coating to facilitate bony in growth and long-term stabiligy.
iii) Polyurethane sheath surrounds the nucleus and is attached to the shells, forming a closed compartment.
iv) Titanium alloy seal plugs provides for retention of a lubricant.
v) Anterior stops on each shell are designed to prevent posterior migration of the device.
vi) Prosthesis size – 14, 15, 16, 17 & 18 mm.

b) Operative Technique

i) Initial Discectomy.
ii) Bryan's cervical discectomy instruments utilise a simple gravitational referencing system to establish a virtual axis in the intervertebral disc space that is used to position a milling fixture.
iii) The fixture precisely controls the powered cutting instruments that prepare the vertebral end plates for placement of prosthesis.
iv) The milled vertebral end plates exactly match the geometry implants outer surface.
v) The tight fit of prosthesis provides immedlate AP and lateral stability.

The quality of life results were scored according to modified Odom's criteria and categorized as follows :

ODOM'S CRITERIA

Excellent : Improvement of preoperative symptoms and signs with little deterioration (Not more than 10%).

Good : Improvement of some (70%) preoperative signs and symptoms with some deterioration (not more than 15%).

Fair : Improvement of half (50%) of preoperative signs and symptoms with some deterioration (not more than 25%).

Poor : Improvement less then 50% and significant deterioration (not more than 20%).

Radiographic Results

The radiographic results were assessed by taking AP & lateral radiographs of cervical spine immediate post op and after 06 months to find out the range of motion and device position.

i) Device Position : Device position was measured in lateral radiographs at each follow-up intervals to find out any evidence of anterior/posterior deveice migration.
ii) Range of motion assessments : The range of motion was assessed in the AP & view of Radiograph.

During postoperative period the patients were advised not to use and cervical collar and assume normal activities as soon as the postoperative pain subsided.

Results

Nineteen (65%) patients were in the age group of 31 to 40 yrs and 11 (35%) were in the age group of 41 to 50 yrs. There were 21 (70%) males and 9 (30%) females in this study.

Necl pain and brachialgia was the presenting symptoms in all cases. Features of cervical spondylotic radiculopathy were present in 18 (60%) and myelopathy in 12 (40%) cases.

All the patients had single level cervical disc prolapse as per MRI. Four (13%) at C4-C5, 18 (60%) C5-C6 and 08 (27%) at C6-C7 cervical disc proapse. Anterior cervical discectomy using specially designed Bryan's cervical discectomy apparatus (Fig 2) was carried out for four patients with C4-C5 disc prolapse (Fig. 3), 18 with 15 in 08 (27%), size 16 was used in 3 (10%), size 17 was used in 18 (60%) patients and size 18 in one (03%) patient was implanted. The operative time was 04 hours in first five cases and subsequently 02 to 2½ hours.

There was no intraoperative complication in the form of vascular/esophageal tean. No. intraoperative or postoperative blood transfusion was required.

In the immediate postoperative period one patient with C6-C7 disc replacement developed temporary hoarseness of voce, which improved subsequently.

During immediate post-op, 02 months & 06 months follow up the quality of life results were excellent in 24 (80%) and good ing 06 (20%) cases as per Odom's criteria.

There was demonstrated motion in flexion, extension, and rotation clinically & radiologically during post op and all periods of follow up (Fig. 6). There was no migration or displacement of device in this series post operatively.

Discussion

With extablished cervical spondylotic myaloradiculopathy, the management option is surgical decompression. Cervical spondylotic myelorad culopathy due to anter or thecal/ nerve root compression as demonstrated by MRI, the approach has to be anterior decompression.

Initial description of anterior approach for cervical discectomy always included bony fusion (3) which was popularized, by smith and robinson in 1955 (4) and cloward 1958 (5). The is was advocated to prevent the possibility of late kyphosis from disc space collapse or radiculopathy from foraminal narrowing. Arguments in favour of fusion include the maintenance of disc space height that avoids vertebral settling and minimizes the potential for the development of oraminal stenosis. Also fusion stabilizes the spine and may prevent progressive deterioration due to instabilities. (6) The basis principle is that, the bone grft between the involved interspaces gives inherent stability and allows fusionto occur even in degenerative situations. The anterior cervical decompression and fusion is now videly accepted as a safe and effective treatment modality for cervical disc herniation. Sudies for this procedure have found this to be reproducible, eith a high evel of patient satisfaction (5, 7, 8). There are several factors affecting the fusing rate of anterior graft including the type of graft (6), surgical technique ().

Interbody fusion of the certvical spine following cervical discectomy desides causing restriction of neck movement also accelerates degeneration of adjacent cise leves due to increased stress from fusion ()2, 10. Therefore, reconstruction of a degenerated intervertebral disc with a functional disc prosthesis (Cervical disc replacement), offer the same benefit of decompression & fusion while simultaneously providing full neck motion and thereby protecting the adjacent desc levels the abnormal stress associated with fusion by maintaining physiologica. Motion & kinematics (11).

Excellent to good clinical results are clearly demcnstrated in this stdy for 30 patients receiving the Bryan's total cervical disc prosthesis. There was relief from neck pain, brachialgia, improved patient's quality of life and functionality. It also provided clinical & radiological stability and normal range of cervical motion. Similar results has also been reported by Goffin at all (11) in their study.

To conclude ACD removes the diseased disc & relieves compression but induces deformity and dintability. ACDF corrects the instability but makes the cervical spine riged with encreasing stress at the adjacent intervertebral disc spaces, Cervical disc replacement not only removes the diseased disc, in alleviates brachialgia, improves neurological deficits bu retains stability and maintains full neck motion.

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CERVICAL DISC REPLACEMENT

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Basically the indications for instrumentation of the lower cervical spine (C3-C7) are to provide immediate stability or to enhance stability to the unstable spine.

To access the instability of the spine the three column model was introduced. The anterior column comprises the anterior half of the vertebral body and anterior half of the intervertebral disc as well as the anterior longitudinal ligament, the middle column the posterior half of the vertebral body and intervertebral disc and the posterior longitudinal ligament. The posterior column comprises the lamina, facet joints, spinous process, inter- and supraspinous ligaments. Disruption of elements of two or three columns renders the spine instable and thus is an indication for stabilizing operations. Instability can result from ligamentous injury in the absence of bony fractures. Instability can be caused by trauma, tumor, infection, congenital disease and degenerative disease.

Several motions are possible. The primary motion of flexion-extension is approximately evenly distributed throughout the cervical spine. The total range of motion is 60 to 75 degrees and greatest in the atlanto-occipital region (13 degrees) and next in the C5 to C7 region. Translation is limited to 2 to 3 mm at C1-C2.

Coupled lateral bending and rotation from C2 to C5 is possible to an extent of 10 to 12 degrees decreasing to 4 to 8 degrees below C6.

Instrumentation can be divided in either anterior or posterior instrumentation. In selected cases a 360 degree approach is indicated. Before Smith and Robinson introduced the anterior approach of the cervical spine in 1955 the posterior approach was the technique of choice in cervical spine disorders.

The choice of an anterior or a posterior approach for stabilizing the lower cervical spine depends on: the mechanism and type of the injury, the type of neurological deficit, and the presence of residual cord compression and the preference of the surgeon. An absolute indication for an anterior approach is the presence of anterior compression with preservation of some neurological function below the level of injury. In case of a posterior compression a posterior decompression and stabilization is indicated.

Posterior instrumentation of the lower cervical spine includes interspinous wiring, cervical facet wiring, screw plate fixation (Axis, Synthes, and Summit), screw rod fixation (Summit, Starlock, and Cervifix) and the application of clamps (Hallifax, Apofix).

Interspinous wiring is the oldest technique of stabilization. It cannot be used in cases of fractured spinous processes or laminae. It is especially effective in cases where the bone is to soft to hold screws. It provides little rotational stability.

Although frequently used in the past it is now inferior to lateral mass plating and since it does not provide immediate stability not a technique of first choice.

Lateral mass plates and screws provide immediate stability and they provide greater rotational stability than wiring. The technique is especially suitable in cases of laminar or spinous process fractures. The use of screws and plates or rods should be avoided in patients with osteoporosis, metabolic bone disease or conditions in which the bone is soft. Screw pull out in these conditions is likely to occur.

Anterior instrumentation procedures include anterior screw plate fixation, interbody cage devices and artificial cervical disc.

The use of screw-plate fixation is indicated in case of discectomy or vertebrectomy followed by interbody grafting. Although in these cases immobilization can be achieved by the use of a halo vest a better stability is achieved by the use of a screw plate fixation. Several systems are available: non-constrained cervical plates (Caspar, Acroplate), Rigid or constrained plates (Orion, CSLP) and semi constrained plates (Codman, Atlantis, ABC, Peak, and DOC).

Non constrained systems depend on bicortical screw purchase for stability. There is no linkage between the screws and the plate. Fluoroscopy is essential for safe placement and they are subject to breakout. The trajectory of the screw is at the discretion of the surgeon. Long constructs may fail.

In rigid systems the screws are rigidly locked to the plate. Plates may fail by breakage. The screw trajectory is fixed. These plates are especially suitable in the treatment of trauma. Due to the rigidity of the systems stress shielding of the graft may occur resulting in a non-union.

Semi-constrained systems are hybrid plates. Most of them have a mechanism to prevent screw breakout. These systems are very suitable in the treatment of degenerative disease.

The use of interbody cage devices are a modification to the Clowerd procedure in which a tri cortical bone graft was used. Cages available are composed of titanium, carbon fiber or resorbable material. Although yet widely applied in patients with degenerative disease its effectiveness over a stand alone discectomy has never been proved.

The use of artificial discs is advocated to avoid the adjacent segment disease that may occur after fusion. Although some authors find a rather high prevalence of this complication in other series these findings cannot be reproduced. The efficacy of these prosthesis will have to shown in prospective studies. The first results show them to be as good as cages in patients operated for cervical disc disease.

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LUMBAR DISC REPLACEMENT

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Session - XVIII
MINIMALLY INVASIVE SPINE SURGERY

ENDOSCOPIC MICRODISCECTOMY: A TECHNIQUE TO REDUCE COMPLICATIONS IN DISCECTOMY

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Over the years, Technology has changed the approach to medicine in all spheres. Spinal Surgery has slowly moved towards this and the interest in Minimal Access Spinal Technologies has increased dramatically. The potential benefits of small incisions, limited tissue disruption, enhanced visualization and illumination, shorter hospital stays, and faster recovery times have been the incentive to pursue these technologies. In the case of lumbar discectomy, the primary objective is to decompress the affected nerve root. The objective of the METRXTM System is the same as conventional open surgery -to decompress the nerve root. This is accomplished by applying open surgical techniques through a tubular retractor under microsurgery visualization. In so doing, the METRxTM System combines the reliability of conventional open surgery with the advantages of a minimally invasive technique. The author describes the technique and instrumentation and also results and complications over the last I -year in 60 patients. An attempt to compare results with traditional discectomy is also attempted by the author.

COMPLICATION IN TRANSFORAMINAL ENDOSCOPIC SURGERY

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1. Complications of endoscopic disc surgery

Even though endoscopic surgery of disc has eliminated many of the morbid complications of maximally invasive traditional surgery it still has a few. The complications may be related to the learning curve part, approach that is posterolateral intramuscular and under local anesthetic.

In my experience of more than 4 years I have noted following complications that again are treatable endoscopically.

1. Psoas hematoma: can be related to blunt instrumentation and is manageable conservatively. It is known to resolve naturally.
2. Discitis: due to implantation of skin flora to disc. Can be thought of if postoperative increase in back pain is associated with raised ESR, and positive CRP and failure to respond to antibiotics. It is addressed endoscopically with disc lavage and use of IV antibiotics.
3. Dysaesthesia: use of laser near DRG is known to give excess stimulation of DRG. This is self-limiting and needs only added local steroid instillation and nerve sedatives like carbamazepine.
4. Endoscopic surgery does not have neurological complications, dural tears, wrong levels.

2. Endoscopic treatment of failed disc surgery

Failed surgery is many times due to inability to identify pain generators, residual or untreated lateral canal stenosis, discitis, wrong level surgery, and other neurological complications. It is also widely recognized that backache is a biopsychosocial problem and surgery is effective only in sciatica.

Endoscopic treatment scores over traditional maximally invasive failed surgery being under local anesthetic, tissue sparing approach that essentially is minimally invasive.

AS surgery is under C arm fluoroscopic control level related mistakes are eliminated. As it is under local anesthetic identification of pain generators is possible and better and discography additionally gives more information on disc morphology, annular tears which even an MRI does not. It is not an IMAGE guided decision for surgery as is traditional in multilevel affection.

Endoscopy is done through foramen and so addressing lateral canal stenosis is integral to it, even though there are no set guidelines for identification, diagnosis of foraminal stenosis. Discitis can be easily treated by endoscopy by disc lavage and removal of infected material under local anesthetic. There is no handling or visualization of the nerve roots directly and so morbidity related to this is substantially less.

I would like to emphasize that endoscopic treatment is a different philosophy and needs unbiased assessment.

THORACOSCOPIC AND LAPROSCOPIC SPINAL SURGERY: TECHNIQUES TO REDUCE COMPLICATIONS OF OPEN SURGERY

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Session – XIX - Conference Room
SYMPOSIUM ON FUNCTIONAL ELECTRICAL STIMULATION

AUGMENTED INTENSIVE EXERCISE (AIE) BY ELECTRICAL STIMULATION FOR RECOVERY OF PARETIC ARM IN POST-STROKE HEMIPLEGIC SUBJECTS: A RANDOMIZED CLINICAL TRIAL.

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ABSTRACT

Augmented Intensive Exercise (AIE) aims to promote recovery of the paretic arm in a post-stroke hemiplegic patient. The AIE comprises voluntary movement of the paretic arm in synchrony with electrically assisted hand functions in order to perform typical daily activities.

41 acute post-stroke hemiplegic patients volunteered in the eighteen-month long single blinded Randomized Clinical Trial (RCT). 19 randomly selected patients (Group A) participated in AIE during their acute phase of hemiplegia for three weeks, 30 minutes daily, while the other 22 patients (Groups B) participated in AIE during their chronic phase of hemiplegia (between weeks 52 and 55). Patients from group B were the controls during the first period, while the patients from Group A were the controls during the second part of the study. Control groups followed the same protocol as the AIE groups, yet without the electrical stimulation. Among others, the criterion for inclusion into the RCT was the ability to extend voluntarily the wrist and fingers more than 10 degrees against the gravity. In this paper we present results from 32 patients who completed the study.

The outcome measures of the RCT included the Upper Extremity Function Test - UEFT, the Drawing Test – DT (coordination of elbow and shoulder movements), the Modified Ashworth Scale (MAS) assessing spasticity, and the Motor Activity Log (MAL) questionnaire for upper extremity functions assessing the use out of the clinical environment.

Patients included in AIE in the acute phase relearned functional use of the paretic arm in shorter period compared with the controls. On average patients after AIE in acute phase reached functionality of the paretic arm in less than six weeks, and maintained this near-normal use of the arm throughout the 18 months of the follow-up. The functional gains in all outcome scores were significantly bigger at the end of therapy and at the follow-ups compared to the scores before the treatment. The slopes of the trend lines of the differences in the UEFT and DT scores during the therapy (three weeks) were steeper compared with the slopes of the same trend lines during the follow-up.

INTRODUCTION

Cerebrovascular accident (CVA) is the third leading cause of death in North America and Europe and a major source of disability [1]. About one third of patients die after CVA, a third of CVA patients recover with minimal impairment, and a third of patients have remaining sensory-motor impairment at 12 months [1]. The sensory-motor disability in upper extremities is characterized with spasticity, disuse atrophy, reduced range of movement, reduced grasping strength; hence, eating, drinking, personal hygiene, grooming, and many other daily activities become difficult or even undoable with the paretic arm [2].

Induced concentrated, repetitive functional practice of the paretic limb leads to some recovery of function [3-7]. Several types of electrical therapies claim that they promote the recovery of the paretic arm to some extent [8-19]. In a clinical trial in chronic tetraplegic subjects we found improvement in unassisted functioning of the trained arm after the six months long regular use of the neural prosthesis [20, 21]. This finding suggested a Randomized Clinical Trial (RCT) for analyzing the effects of a therapy that combines electrical stimulation that generates, otherwise compromised grasping and releasing of objects in synchrony with the voluntary repetitive functional arm manipulation in post-stroke hemiplegic patients. This therapy was termed Augments Intensive Exercise (AIE) by Electrical Stimulation. Merletti and colleagues [19] were the first who presented promising results from AIE; yet, effective devices for AIE became available only recently (e.g., BGS [20], Handmaster NMS 1 [22], Compex stimulator [23]). We describe in this paper the results from an 18-months long RCT in post-stroke hemiplegic patients who used the BGS or the prototype of a device ActiGrip CS®1 designed for AIE [24-26].

METHODS

Subjects.

The inclusion criteria for the trial were the following: 1) more than two weeks and less than six months following first CVA ever caused by ischemia or hemorrhagia that was confirmed by magnetic resonance imaging (MRI) or computer tomography (CT), 2) age above 18, 3) able to give informed consent, and 4) being able to understand how to apply electrical stimulation for controlling the grasp, and 5) able to voluntarily extend the paretic wrist more than 10 degrees, and extend the Proximal Inter Phalangeal (PIP) and Meta Carpo Phalangeal (MCP) joints of the thumb and minimum of two other digits more than 10 degrees against gravity. The following exclusion criteria were applied: 1) dependent on care for activities of daily living prior to stroke, 2) severe medical condition in any arm and hand that precludes participation in the study, 3) previous injury, disease, or contracture affecting paretic or non-paretic arm or hand, 4) electrical life support devices (e.g. cardiac pacemaker).

Study design

The study lasted for 78 weeks (18 months). Patients from Group A were assigned to AIE during the first three weeks, and patients from Group B participated in AIE between the weeks 52 and 55 (three weeks) of the RCT. Group B was control group during the first six months of the study, and Group A was control during the last six months of the follow study (between 52 and 78 weeks). There was no interventions or evaluations between the weeks 26 and 52. This design allowed us to compare the AIE *vs.* no AIE in acute and chronic post-stroke hemiplegic subjects. The local ethics committee approved the experimental procedure for this study in conformity with the Declaration of Helsinki.

AIE procedure. During AIE, in addition to conventional therapy, subjects performed 30-minute long exercise with paretic arm/hand every day during three consecutive weeks. The exercise was assisted with a four channel electronic stimulator that controlled the opening, grasping, and releasing functions by mimicking natural movement. The pattern and timing of the stimulation were programmed to mimic the slowed down normal-like prehension, grasp, and release phases of the grasp typical for normal hand palmar, lateral and precision grasps. The typical stimulation parameters were: frequency 50 pulses per second, pulse duration T = 200 μs, and current stimulation intensity I = 10 - 40 mA. Four channels of electrical stimulation were applied via self-adhesive surface electrodes positioned over the following muscle groups: finger flexors (*Flexor Digitorum Profundus m.* and *Flexor Digitorum Superficialis m.*), finger extensors (*Extensor Digitorum Communis m.*), thumb extensor (*Extensor Pollicis Longus m.*), and the Thenar muscle group (*Abductor Pollicis m.* and *M. Opponens*). Experienced therapists positioned carefully the electrodes over the innervation points in order to maximize selectivity of stimulation.

The overall goal during a single AIE session was to perform as many as possible daily functions with the following objects: toothbrush, comb, telephone receiver, pen, finger-food, 0.5-liter can, 0.3-liter can, 1- liter container, CD disk, and coffee mug. These objects were selected to force the subjects to practice palmar, lateral and precision grasps. A functional use of an object consisted of the following phases: reach, grasp, manipulate, apply, bring back the object to the original post, and release it. The subjects were taught to push the trigger button on the stimulator with their non-paretic hand at the appropriate time during the reaching of the paretic arm towards an object in order to initiate the "grasp" synergy. Patients also triggered the "release" synergy once they accomplished the task, or established that they were not able to perform it. The AIE sessions were tailored according to individual abilities and recovery during the three weeks of the treatment, that is, patients started with easier and progressed to more difficult tasks upon their recovery status. In most cases the simplest tasks

were: 1) drinking from a 0.3-liter can, and 2) using telephone receiver or similar round, middle-sized objects. The most difficult tasks were the following: 1) handling of a one-liter container, and 2) drinking from a 0.25-liter mug.

A therapist assisted and instructed the subjects while they were trying to reach, grasp, and functionally use the objects during sessions. The assistance comprised of holding the object in the adequate orientation and position, if so required. Patients were instructed how to maximize the use of external control of the paretic hand. AIE sessions were performed five days a week within the rehabilitation institution. Subjects occasionally missed an AIE session, but never more than two days in a row.

Control group procedure. The post-stroke hemiplegic subjects assigned to control group received conventional physiotherapy and participated in the daily 30-minute long supervised exercise with the paretic arm and hand. The exercise tasks were the same as ones in the AIE, yet no electrical stimulation was applied.

Outcomes measures

The evaluation of effects of AIE *vs.* no AIE aimed to assess the following: 1) relearning of the functional motor behavior by applying two tests: the Upper Extremity Functioning Test (UEFT) and the Drawing Test (DT). The UEFT [27, 28] was selected because it shows the ability to perform typical daily activities, and the DT [29, 30] shows the coordination between the shoulder and elbow joints; 2) spasticity of the paretic arm by using the Modified Ashworth Scale (MAS) [31]); 3) amount and quality of use of the paretic arm by using the Reduced Upper Extremity Motor Activity Log (RUE/MAL) questionnaire described in Page *et al.* [32]; and 4) Range of Active Movement (RAM) by goniometric evaluation of the paretic arm joints' rotations. The UEFT and DT were performed at 0, 3, 6, 13, 26, 52, 55, 58, 65, and 78 weeks. The MAS, RAM, and RUE/MAL were performed at 0, 26, 52, and 78 weeks.

1) *The Upper Extremity Function Test (UEFT)* purpose was to determine abilities to perform particular activities of daily living. The following tasks were tested: 1) combing hair; 2) using a fork; 3) picking up a VHS format video tape; 4) picking up a 0.3-liter can; 5) picking up a 0.33-liter bottle; 6) writing with a pen; 7) using the telephone receiver; 8) brushing teeth; 9) pouring from a one-litter juice box; 10) drinking from a 0.25-liter mug; and 11) handling finger-food. The selected activities include: palmar grasp (tasks 4, 5, 7, and 9), lateral grasp (tasks 1, 2, 3, 8, and 10), and precision grip (tasks 6 and 11). The test also assessed the ability to handle small objects (tasks 1, 2, 5, 6, 8, 10, and 11), and large objects (tasks 3, 4, 7, ISSICON-2004, Lecture by Dejan B. Popovic, Aalborg University, Denmark page 4 out of 13 and 9), as well as light objects (tasks 1, 2, 3, 6, 8, and 11), and heavy objects (tasks 4, 5, 7, and 9).

   The UEFT score was defined as the number of successful repetitions of a task that a subject could perform during a two-minute period. The successful operation was the one in which the subject grasped, manipulated and used the object with his/her paretic arm. The same, trained individual evaluated the UEFT by analyzing the video recordings from a session when the UEFT was performed. This excluded inter-variability from the evaluation. We also determined the averaged time to complete a task by dividing the two-minute interval with the number of successful repetitions.

2) *The Drawing test (DT)* showed the ability to coordinate shoulder and elbow movements. The test required subjects to move the paretic hand on the digitizing tablet positioned in the horizontal plane within their workspace. The test was related to voluntary control of muscles that were not stimulated, yet have been voluntarily exercised during AIE. The DT task was to connect corners of a square (20 cm x 20 cm) shown on the digitizing tablet by the magnetic mouse attached to or held in the paretic hand. The subjects were instructed not to move the trunk and shoulder (protraction/retraction) during the DT. The movements were self-paced in clockwise and counter-clockwise directions. The subjects were allowed to practice the drawing sufficiently long before the assessment sessions in order to ensure reproducibility.

   The DT score was defined as the ratio between the area surrounded by the drawing, and the area of the target square (A = 400 cm2), expressed in percent. The final DT scores were determined by averaging the scores from the three consecutive trials. The higher score related to better coordination between the paretic arm joints. The DT was validated in a study that included subjects with no known neurological deficit, and in a study with hemiplegic subjects with compromised upper limb motor functions [29, 30].

3) *The Modified Ashworth Scale (MAS)* was applied to assess the tonus of key muscles of the paretic arm. The spasticity of the elbow joint in the paretic arm was evaluated by the same experienced physical therapist, in order to minimize intrarater variability.

4) *The Reduced Upper Extremity Motor Activity Log (RUE/MAL)* was a structured interview examining how much and how well the subjects use their paretic arm outside of the laboratory setting. The subjects were rating the amount of use of their paretic arm ("Amount" Scale) and the quality of their movement during the functional activities ("How Well" Scale). The best result in "Amount" and "How Well" scales were 60, and the worst score was 0. The RUE/MAL score was the percent of the maximum. The subjects were instructed that the questions were about what they actually did outside of the laboratory setting, not what they think they were able to do with their paretic arm. The RUE/MAL questionnaire included

the following 12 activities: 1) pick up phone, 2) open a door, 3) eat finger foods, 4) control the bathroom faucet, 5) pick up a glass, bottle, or can, 6) brush teeth, 7) use a key to unlock the door, 8) write on a paper, 9) use the removable computer storage media (CD or floppy disk), 10) use utensils for eating, 11) pick up a cup for handle, and 12) carry an object in the hand.

5) *The Range of Active Movement (RAM)* was measured at eight different locations: index finger PIP and MCP joints, thumb adduction/abduction, wrist palmar/dorsal flexion, wrist ulnar/radial deviation, elbow flexion/extension, shoulder adduction/abduction, and shoulder flexion/extension. Flexible goniometers (Penny and Giles, Biometrics, U.K.) were attached at the corresponding body segments. The output signals were amplified by a custom designed device, sampled at 100 Hz, low-pass filtered with the third order Finite Input Response (FIR) filter at 30 Hz, and recorded on a PC computer for off-line analysis. A therapist supported the proximal paretic arm segments during measurements of the range of movement of the more distal joints. Each movement was repeated three times, and the average value used for analysis.

Statistical design

We performed the Mann-Whitney rank sum test in order to compare the age, period between the CVA and start of treatment, and functioning (UEFT and DT) of the hemiplegic subjects at the entry point to the study. For each of the primary endpoint variables (UEFT, DT, MAS, RUE/MAL, and RAM scores) we ISSICON-2004, Lecture by Dejan B. Popovic, Aalborg University, Denmark page 5 out of 13 conducted the one-way ANOVA. The within-subject factor was the time (start of study - baseline, after the treatment – 3 weeks, and at follow-up sessions). The primary test of the treatment was a test of the difference between base-line scores (week 0 of treatment) and scores at the end of treatment. The statistically significant difference was assumed at $p < 0.01$.

RESULTS

41 acute hemiplegic subjects (7 ± 2 weeks after the CVA, 59.9 ± 9.3; mean age ± S.D.) were randomly selected from group of 50 acute hemiplegic subjects that met the inclusion and exclusion criteria. A random generator assigned patients to groups A and B (Table 1). The study was blinded since the evaluator did not know to which group subjects belonged. Patients, when participating in AIE, were aware that they received electrical stimulation since it resulted in visible movement.

Patients	Age (years)		Time between CVA and week 0 (weeks)		MAS for the elbow joint		Side of hemiplegia		CVA type	
	Mean ± S.D.	Range	Mean ± S.D.	Range	Mean ± S.D.	Range	Left	Right	Hemorrhage	Ischemia
Group A	60.5 ± 8.5	38-72	6.7 ± 3.0	4-11	2.5 ± 1	1-4	4	12	3	13
Group B	58.5 ± 9.5	37-71	6.0 ± 2.2	3-10	2.5 ± 1	1-4	3	13	4	12
Dropouts	61.5 ± 9.0	39-77	6.3 ± 2.1	5-11	2 ± 1	1-3	3	6	2	7

Table 1: Basic patients data at the entry to Randomized Clinical Trial (RCT). CVA-Cerebrovascular accident, MAS – Modified Ashworth Scale with scores from 0 to 4.

Matching of the Groups A and B

The Mann-Whitney rank sum test applied to the age of Groups A and B ($p = 0.824$) shows good matching.

At the beginning of the study (week 0) both Groups A and B had similar UEFT and DT scores: UEFTA = 5.2 ± 3.6, and UEFTB = 4.9 ± 3.1, DTA = 41.9 ± 6.4 %, and DTB = 43.7 ± 5.3 %. The Mann-Whitney rank sum test for UEFT scores ($pA = 0.856$, $pB=0.879$), as well as for DT scores ($pA = 0.694$, $pB = 0.682$) shows good matching between Groups A and B.

The Upper Extremity Function Test (UEFT)

Table 2 shows the differences in the UEFT scores at 3, 6, 13, 26, 52, 55, 58, 65, and 78 weeks with respect to the week 0 (base-line): UEFTA = 5.2 ± 3.6, and UEFTB = 4.9 ± 3.1. In Group A the increase in the UEFT scores after first 26 weeks was statistically significant ($p < 0.01$, $F = 7.8$), and significantly different ($p < 0.01$, $F = 5.6$) from the score in Group B. The difference in the UEFT scores in Group B between the weeks 52 and 55 was not significant ($p = 0.04$, $F = 2.1$). The difference in the UEFT scores between Groups A and B at the end of the follow-up (78 weeks) was significant ($p < 0.01$, $F = 5.3$).

The Drawing Test (DT)

Table 2 also shows the differences in the DT scores at 3, 6, 13, 26, 52, 55, 58, 65, and 78 weeks with respect to the week 0 (base-line): DTA = 41.9 ± 6.4 %, and DTB = 43.7 ± 5.3 %. The increase of the DT score in Group A after 26 weeks of the follow up was statistically significant ($p < 0,01$, $F = 8.3$), and the difference between the DT scores of Groups A and B at 26 weeks was significant ($p < 0.01$, $F = 6.7$). The AIE in the chronic phase of hemiplegia (Group B, weeks 52 to 55) increased the DT score, yet the difference was not significant ($p = 0.18$, $F = 1.6$). The difference in DT scores between Group A and Group B with respect the week 0 at the end of the follow-up, that is, at the week 78 was significant ($p < 0.01$, $F = 4.8$). The final DT score of the Group A was about 85 percent, compared with the DT score of 70 percent in Group B.

TIME (weeks)	Differences in UEFT with respect the week 0 (Average ± S.D.)		Differences in DT with respect the week 0 (Average ± S.D.)	
	Group A	Group B	Group B	Group B
3	13.8 ± 5.9	26.6 ± 6.9	10.1 ± 7.1	6.3 ± 3.9
6	22.8 ± 3.1	33.3 ± 7.3	8.2 ± 7.0	7.7 ± 3.1
13	23.4 ± 6.1	37.6 ± 7.0	22.1 ± 7.8	10.5 ± 4.3
26	23.3 ± 6.0	39.9 ± 7.9	22.7 ± 7.4	11.3 ± 4.1
52	23 ± 6.1	40 ± 6.9	23.1 ± 6.6	12.3 ± 4.9
55	23 ± 5.6	40 ± 6.1	25.6 ± 6.0	13.7 ± 4.3
58	23 ± 5.2	40 ± 6.8	26.8 ± 5.9	13.7 ± 4.9
65	23 ± 5.2	40 ± 7.2	27 ± 5.9	13.9 ± 4.5
78	23.1 ± 5.1	39.9 ± 6.4	26.8 ± 5.8	14.0 ± 4.6

Table 2: The differences between the Upper Extremity Function Test (UEFT) scores with respect the scores at week 0 in hemiplegic patients assigned to Group A (left column) and Group B (third column). The differences in the Drawing Test (DT) scores with respect the DT scores at week 0 in hemiplegic patients assigned to Group A (fourth column) and Group B (right column)

The Modified Ashworth Scale (MAS)

The assessment of spasticity was carried out four times: 0, 26, 52, and 78 weeks. The averaged score for the Group A was 2.5 ± 1 at the beginning of the study, and the score decreased to 1.5 ± 0.25 after 26 weeks. The score at 52 week was 1.5 ± 0.5, and it did not change throughout the remaining part of the follow-up (78 weeks). The difference was 1 ± 0.5; thus, the score was decreased, yet not significantly ($F = 3.1$, $p < 0.06$). The score for the group B was 2.5 ± 1 at the beginning of the study (base line), and decreased to 2 ± 0.75 after 26 weeks. The total difference was 0.5 ± 0.5; thus, the score was decreased less compared with the AIE (Group A), and the decrease was not significant ($F = 2.6$, $p < 0.11$). The score remained the same (2 ± 0.75) during the remaining period of the follow-up (between the weeks 52 and 78).

The Range of Active Movements (RAM)

Fig. 1 shows the averaged increase of the RAM at 26, 52 and 78 weeks with respect the base-line RAM for both groups A and B. Group A scores are at the top panel, and the scores for the Group B in the bottom panel. The averaging was done over 6 subjects in Group A, and 5 subjects from the Group B. Other subjects were not tested consistently; thereby, their results were not included. The differences of the joint angles between the groups A and B at the end of treatment *vs.* the base-line values are in Table 3.

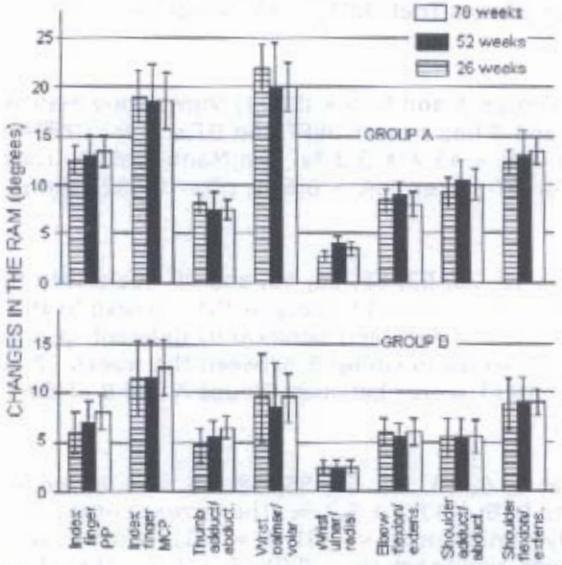

Fig. 1: Differences in RAM at 26, 52 and 78 weeks in patients from the A (top panel) and B (bottom panel) compared with the base-line RAM (week 0). Patients A participated in the AIE during the first three weeks, and B participated in the AIE between weeks 52 and 55. PIP is the acronym for proximal intra-phalangeal joint, and MCP for the meta carpo-phalangeal joint.

Joint rotation	Difference in RAM between A and B (angle± SD deg.)	p	F
Index finger PIP	7.5 ± 1.5	<0.05	8.7
Index finger MCP	8 ± 2	<0.05	7.2
Thumb adduct./abduct	3 ± 1.5	<0.05	4.5
Wrist palmar/dorsal flexion	12 ± 3	<0.05	11.6
Wrist ulnar/radial deviation	1 ± 0.5	0.31	1.3
Elbow flexion/extension	3.5 ± 1	0.30	2.1
Shoulder adduct/abduct.	4 ± 1	0.29	1.9
Shoulder flexion/extension	3 ± 1.5	0.21	1.8

Table 3: The differences between the Ranges of Active Movement (RAM) in A and B at the end of the followup PIP - proximal intra-phalangeal joint, MCP - meta carpo-phalangeal joint.

This shows that there was a larger change of the RAM in Group A compared with the change of RAM in Group B patients in all joints; yet, the changes were significant in the hand joints, but not in the arm joints (Table 3).

The Reduced Upper Extremity Motor Activity Log (RUE/MAL)

TIME (weeks)	RUE/MAL "AMOUNT SCALE" (Mean ± S.D. % of the maximum)		RUE/MAL "HOW WELL SCALE" (Mean ± S.D. % of the maximum)	
	Group A	Group B	Group A	Group B
0	13.1±4.5	12.6 ± 6.5	16.5 ± 5.5	12.9 ± 6.6
26	59.7 ± 8.5	28.3± 7.7	66.7 ± 8.4	33.8 ± 6.1
52	56.8 ± 9.5	27.6 ± 9.6	65.6 ± 9.4	28.8 ± 10.6
78	58.7 ± 9.0	31.4 ± 9.3	65.7 ± 8.4	30.1 ± 9.9

Table 4: The Reduced Upper Extremity Motor Activity Log (RUE/MAL) scores at the base line (week 0), and at the follow-ups (at weeks 26, 52, and 78). Group A received FET in acute phase of hemiplegia, and group B in chronic phase of hemiplegia (weeks 52 to 55). There was no intervention between weeks 26 and 52.

Table 4 shows the results of the RUE/MAL. The statistics indicated that the Group A use their paretic arm at 26 weeks for about 59.7 ± 7.6 percent ($p < 0.01$, $F = 8.15$), and that in average they were satisfied with the performance (66.7 % ± 7.5, $p < 0.01$, $F = 7.12$). This was not the case with the Group B.

DISCUSSION AND CONCLUSIONS

In the 18-month long randomized clinical trial of AIE of upper limbs in hemiplegic patients we studied five outcome measures in order to assess the following: motor re-learning abilities of acute and chronic hemiplegic subjects, grasping ability related to strength, spasticity, amount of actual use of the paretic arm in real-life, and range of active movement.

Table 2 summarizes improved abilities to functionally grasp various daily necessities and manipulate objects. The main conclusion from the UEFT and DT scores was that AIE greatly increased the UEFT and DT scores if applied during the acute phase of hemiplegia. This finding indicated that AIE influenced in a positive manner motor re-learning. The recovery in AIE acute hemiplegic patients during first few weeks was comparable to the six months recovery in control group. Three weeks of AIE had very small effect when applied in chronic phase of hemiplegia: UEFT and DT scores showed small increase. The overall suggestion from the study was that the natural recovery was greatly augmented by AIE if applied in the acute post-stroke hemiplegic subjects.

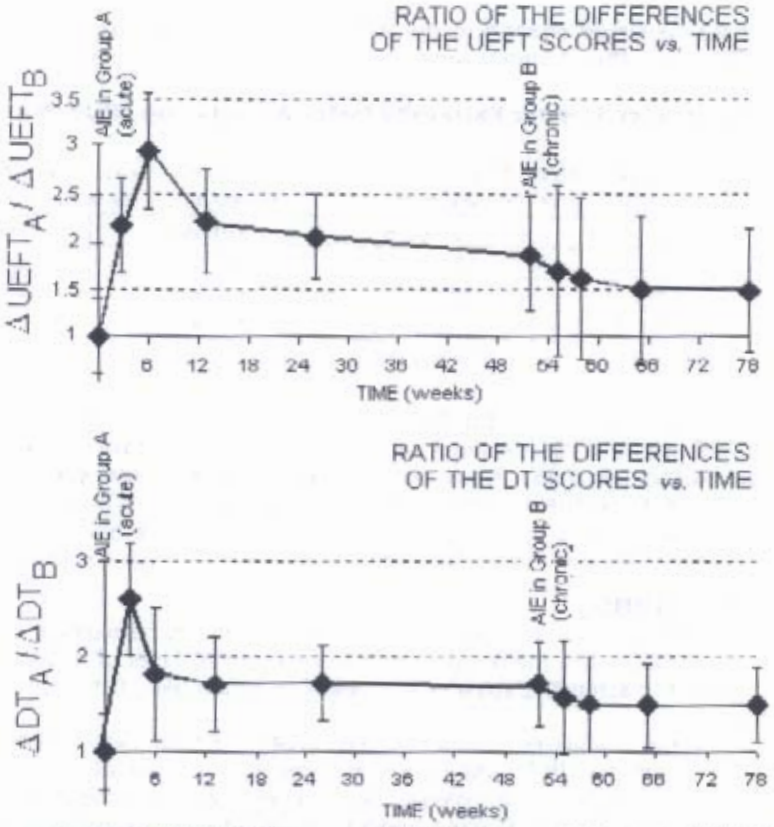

Fig. 2: The top panel shows the ratio of the differences in the UEFT scores between A (.UEFTA) and B (.UEFTB) *vs.* time. The bottom panel is the ratio of the differences in the DT scores between A (.DTA) and B (.DTB) *vs.* time. The large increase of the ratio during the first weeks shows that the A that participated in AIE improved their functioning much more than the B (controls) during the same period. The ratio decreases after the week 52 because the functioning of the B improved due to participation in the AIE.

The purpose of the UEFT test was to determine differences in the performance of particular arm/hand activities. Among these activities we would like to single out a task to grasp the one-litter container and poor juice from it. The UEFT score for this task was the worst among all 11 tasks, because the object was heavy and the size of the object required high aperture of the hand during the prehension phase of grasping. The base-line (week "0") UEFT score across the patients from groups A and B was 1.3 ± 1 for this task. At 26 weeks the UEFT score for the same task was 9.8 ± 2.5 in Group A, and 3.0 ± 1.6 in Group B. The relative increase of the UEFT score was bigger in Group A compared with the change of the UEFT score in Group B. The second notable UEFT score was found for the 0.25-liter mug. Drinking from the mug requires lateral grasping of the handle, and the position of the handle required strong grasping force for stability. The base-line UEFT score for this task was 2.7 ± 1 (average for all subjects), and it reached 10.4 ± 2.8 (Group A), and 3.1 ± 1.7 (Group B). At 26 weeks the differences between the performances were comparable with the described change for the one-liter container task. These two results suggest that AIE contributed to the increased grasping strength.

The group B subjects showed improvement in the UEFT and the DT after the AIE was applied; yet, the changes were not significant. It is possible that a longer treatment would lead to better functioning; this suggestion was supported by the fact that the biggest gains were recorded during the three weeks of AIE, compared with smaller gains in the 23 weeks of the follow-up.

The top panel (Fig. 2) shows the ratio of the differences in UEFT scores for Group A (.UEFTA) and Group B (.UEFTB) *vs.* time. The large increase of the ratio during the first few weeks shows that Group A that participated in AIE improved their functioning more than twice compared with the control group (Group B) during the same period. It can be noticed that the ratio slowly decreases during the follow up, yet still remains above 1.7 favoring AIE. The decrease of the ratio after the week 52 corresponds to the participation of Group B in AIE suggesting that the exercise in chronic phase also increases functioning. The ratio between the UEFT scores stays about 1.5 during the last six months suggesting that AIE early after stroke leads to better recovery of paretic arm.

The bottom panel (Fig. 2) shows the ratio of the differences of DT scores for Group A (.DTA) and Group B (.DTB) *vs.* time. The large increase of the ratio during the first few weeks of the RCT shows that the Group A,

which participated in AIE, improved their coordination abilities more than twice compared with the group B during the same period.

The results of our RCT can be put in the frame of recent publication by Duncan and colleagues [33]. They documented that the recovery was leveling out below normal functioning approximately six months after stroke. This statement was based on the analysis of the Fugl-Meyer (FM) score. The recovery was largest during the first month, somewhat smaller during the second and third months, and slowly leveled out afterwards. The standard deviation, that is the variation of the FM score from the mean value, after six months was high: some subjects with major disability at the time of stroke reached higher FM scores compared with some hemiplegics who had minor disability, yet improved only a little. In the RCT that followed hemiplegic patients for more than 18 months, it was suggested that the therapy in chronic subjects could lead to moderate improvement [34]. It was also shown that the functioning deteriorated at later times of the follow up for various reasons: non-use of the paretic arm, hemiplegia affecting the nondominant arm/hand, aging process, and major life style changes leading to decreased activities [35].

The significant recovery after AIE in acute hemiplegic subjects suggests that synchronizing spontaneous and training induced recovery is instrumental for promotion of upper limb functions. An explanation of this phenomenon is that the central nervous system plasticity is greater shortly after the lesion compared with the ability to adapt in chronic phase of disability. Studies using Positron Emission Tomography (PET), functional Magnetic Resonance Imaging (fMRI), transcranial magnetic stimulation (TMS), and magneto encephalography (MEG) support the concept of functional reorganization after stroke [36-40]. PET studies on blood flow distribution during finger movements in a paretic hand have demonstrated complex patterns of activation, with increased activity with large individual variations [36].

Hebb suggested that neuronal cortical connections could be remodeled by new experiences [41,42]. Many later studies have demonstrated chemical and anatomic plasticity in the cerebral cortex of adult animals [43-45]. Merzenich et al. [46,47] suggested another aspect of brain plasticity: they demonstrated that cortical representation areas can be modified by sensory input, experience, and learning, as well as in response to brain lesions [48-51]. Transient alterations of the cortical representation areas may be common in everyday life, as indicated by transcranial magnetic stimulation studies during learning tasks in human volunteers [52].

The results from this RCT where Augments Intensive Exercise (AIE) by Electrical Stimulation was added in acute or in chronic hemiplegia suggest better recovery of function compared with conventional treatment only. This difference is likely arising from the fact that AIE provides intensive traffic of neural information towards the brain; thereby, promotes to a larger extent neural plasticity. The mechanisms through which this may happen are as yet not completely understood. We believe that the following mechanisms jointly contribute to the recovery of function: 1) Electrical stimulation in AIE activates directly sensory nerves, 2) AIE activates indirectly sensory nerves, that is, when motor nerves are stimulated they cause movement that activates receptors and through that sensory nerves, 3) visual input of the actual movement is integrated into the control of movement, 4) ability to use the paretic hand contributes to increased motivation to exercise, and 5) increased near-natural activity of the paretic hand contributes to the development of normal synergies instead of compensatory movements and disuse of the arm and hand. This suggestion complies with recently published results of Page [53], where he suggested that the nature of post-stroke motor therapy should be altered and made task-specific while still remaining within the typical treatment time (30 to 45 minutes daily). This alteration leads to better recovery compared with the improvement induced by traditional rehabilitative approaches.

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ROLE OF FES IN THE MANAGEMENT OF NEUROGENIC BLADDER

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SPINAL CORD REPAIR, AN EVOLUTION AND A DEVOLUTION PROCESS

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Introduction: Before my talk on the topic, I would like to pay respect to the great Spanish neuro-anatomist, Nobel Prize Laureate 1906, Dr Ramón Y Cajal. It was him who first attracted enormous attention of the world scientific community to spinal cord regeneration. My knowledge about neuro-anatomy owes much to him. As a young assistant of anatomy at the Beijing University, I could spend hours standing in front of a specimen of neuron prepared by my professor using Cajal gold staining technique. I enjoyed its beauty immensely. It is a perfect marriage of science and art.

Almost seven decades have elapsed since his passing away in 1934. Great progresses have been made in the experimental studies of spinal cord repair and regeneration. It has developed from morphological to molecular level, and probably soon will also at quantum level.

Despite these important developments, criticisms are too often heard about the progress. Some compare researches on spinal cord repair with space projects. They cannot help to show their impatience. The space scientists have already reached the Mars. Why are medicine and biology scientists so incompetent that they cannot even solve a problem on the Earth? Such impatience is due to ignorance of evolution of matters.

It has to be pointed out that a vehicle to the Mars is made of the simplest materials of the Universe. The basic ingredients making up a space ship are at best non-organic and non-living organic materials. To reach the spinal cord, the primitive part of the central nervous system of a human body, the evolution has gone through hundreds of stages, from non-protein organic material, through protein, living protein, single living cell and plants to animals. Within the animal kingdom, evolution from lower animals to highest vertebrates is a long journey of millions of years. Inside the human body, the brain and spinal cord that constitute the central nervous system are the most complex of all organs. How can we compare the lowest inorganic and non-living organic materials with the highest organs of the highest animal?

Indeed, space technology involves sophisticated physics, chemistry and mathematics but they are all created by human brain. Human brain can create a space ship but a space ship can never make a human brain. Therefore, comparing space technology and spinal cord research and asking them to have same speed in achieving positive results and breakthrough is obviously absurd! Compared with space technology, the progress in researches on spinal cord repair can be painstakingly slow.

Patience is needed in organising researches on spinal cord repair and expecting a breakthrough. Lack of patience quite often leads to lack of funding. Together with public pressure, such impatience can force or lure researchers to report exaggerated or false results. Since the first clinical trial on a prisoner by Freeman in mid 1960, I have been involved in and watching the development of these attempts closely. So many encouraging clinical attempts have been published by the media and even by scientific journals but so far I have only seen a Chinese neurosurgeon who has achieved some convincing improvement as a result of human intervention.

The relationship between evolution of matters and spinal cord repair

I led a group of basic scientists in the study of spinal cord repair in the 60s of last century. The results were the following.

1. Nerve Growth Factor was extracted from placenta using methods similar to that of Rita Levi-Montalcini (see more about her below). It only facilitated axon growth of the most primitive nerve cell, ganglioblast in histoculture. It had no such effect on any other more developed nerve cell.
2. The severed long tracts of the spinal cord of dog grew across the injury site for 1-2 cm. Even such limited effect could not be repeated on higher animals.

These led me to believe that evolution of matters and living objects played key role in spinal cord repair and rejection of spinal cord repair. This is an extremely complex phylogenetical problem. Unless this is thoroughly investigated and fully understood, there is slim chance to find correct methods to achieve spinal cord repair. The successful mapping and sequencing of human genome further support my belief. We do not fully understand yet why a difference of less than 0.1% in genome gives about 3 million differences in our genetic code. We may need to go down to lower levels, such as quantum mechanics at atom and sub-atom levels to understand all the secrets inside a molecule.

The protection systems of the human central nervous system

Human brain and the spinal cord are well protected due to its utmost importance. Let us use the brain as an example. Brain has its extrinsic and intrinsic defence systems.

The extrinsic system consists of the skull and the organs of sense on the face. The brain is protected mechanically all round. From the back, due to absence of monitoring and alarming systems the skull is much

thicker in the back. In the front, the brain relies on the monitoring and alarming systems such as eyes, ears, nose and mouth for protection.

However, as far as central nervous system regeneration is concerned, the intrinsic system is more relevant.

People all know the term brain tumour but they may not realise that most brain tumours are not tumours of nerve cell at all. The only real nerve cell tumour is the extremely rare ganglioblastoma (Cushing Classification) from very primitive nerve cells. All other so-called brain tumours are from supporting tissues, glial cells and immature or undifferentiated cells. This is an important natural mechanism to protect mature nerve cells from neoplastic growth. If this intrinsic protecting system breaks down, it is expected to see more and more brain tumours from mature nerve cells. The consequences could be disastrous. This protection system is good in normal situations but it causes problems in rare occasions of injury. The nerve cell is reluctant to grow to repair the damage inflicted upon by injury. This is the thorny problem we are faced with in the research on spinal cord repair. Our challenge is to facilitate nerve cell to grow normally (in fact the growth itself is already abnormal) without triggering tumour growth.

The above-mentioned indicates that there is a close relationship between nerve cell growth and tumour cell growth. A Cambridge biology scientist once told me they were two sides of the same coin. If you know how to stop the unstoppable growth of cancer, you may also know how to make the reluctant nerve cell grow. Of course, the latter is much more complex due to complexity of the nerve cell. Now we already know that many nerve growth factors are cancerogens. Please do not worry, further studies have allowed us to differentiate nerve trophic factors from cancerogens.

Recent advances in the study on spinal cord repair

What do we know now about spinal cord regeneration and repair compared with 40 years ago? A big lot more! However, compared with millions of years of evolution, it is only a drop in the ocean. What are they? We can divide them into facilitating factors and prohibiting factors for convenience of discussion.

A. Facilitating factors include the following.

1. Stem cell. We know that stem cell can grow into any cell, including nerve cell. We have to know how to steer it exactly into its direction and to the destination of spinal cord repair without causing untoward effects.
2. Olfactory cell. This is the nerve cell of the central nervous system that stretches outside the cranial cavity. It can be harvested from the nose and used for transplantation to bridge the gap between the injured ends of the spinal cord and stimulate nerve cell to grow.
3. Nerve trophic factors. Rita Levi-Montalcini, an Italian scientist who started her research in Italy and later immigrated to the US to continue it. She was granted the Nobel Prize in 1986 for discovery of nerve growth factor, later known as nerve trophic factor. Dozens more such factors have been discovered since then. These factors can facilitate nerve growth. The original nerve growth factor discovered by her was extracted from snake venom, equivalent to saliva. We all know that dogs' wounds heal easily because they lick the wounds with saliva. The science is so simple if we are observant.
4. Schwann's cells. These cells surround the peripheral nerves. They do not exist in the central nervous system. Therefore, many, many years ago, scientists thought that this could be the reason why nerves did not grow in the central nervous system. This led to repeated attempts of transplanting these cells into the injury site hoping they would solve the problem. Although there have been some progresses in the laboratory and human being. These progresses can hardly be described as successes. Such attempts are still going on.

B. Factors prohibiting nerve growth

1. Supporting tissues surrounding nerve fibres seem to have prohibiting effects on nerve repair. These cells include glial cells and myelin cells. Their effects and how to control them have not yet been fully understood.
2. Prohibiting factors. Discovery of these agents was relatively new. More and more such factors have been found and studied.

The most important discovery is the Genome, the gene map. Armed with this map we are able to manipulate the above-mentioned factors. Our aim is to make the facilitating factors win whilst the prohibiting ones lose.

It would be naïve to think that with all the above-mentioned progresses, the success of spinal cord repair is already round the corner or within arm's reach. This is because all the above-mentioned progresses only provide us with a vehicle or vehicles but how to steer the vehicle or vehicles to the destination is a much more difficult and complex process. Let us compare this process with travelling.

Even if one has cars, trains, ships and aeroplanes at your disposal, one needs roads, railways, tunnels and canals to travel to the destination. Even if one has all these, he or she needs a navigation system or map to help reach the destination. There will be many, many failed attempts before he or she can reach the actual destination. Christopher Columbus ended in Caribbean instead of his planned destination India. However, this failed attempt was a great success. Without this failure, the New World would not have been found at that time.

We should not expect every research in spinal cord repair to be a success. It is unrealistic. When we have nothing, a little means a lot and should be encouraged.

The real world

Bearing the above-mentioned in mind, we should live in reality rather than in fantasy. Before the research on spinal cord repair makes any practical and meaningful breakthrough, spinal cord injured individuals should use all existing methods to improve their health and quality of life.

For the past few years, the heavy weight campaign launched by Christopher Reeves gives people at least the impression (may not be his intention) that spinal cord repair is soon within our reach. This impression made many people refuse sacral anterior root stimulation, a very successful method of treating bladder with spasm of sphincter. The number of such operations has dropped to almost zero in UK whilst patients who want to try spinal cord repair soar to hundreds. This perception is detrimental to these individuals. The process of deterioration of kidney functions with a spastic sphincter is beyond any doubt much faster than the progress of research on spinal cord repair. If one does not carefully look after his or her kidneys using available methods, urological complications can kill the kidneys definitely before the spinal cord can be repaired. Therefore, my advice is to be realistic.

As to clinical trial of spinal cord repair on human beings, there are ample patients who volunteer to try. The problem is ethical approval. In Europe, the only criterion of selecting candidates for the trial that can be ethically approved is complete chronic injury of mid thoracic level. The rationale of such selection is that even if the trial fails it would not do much further harm to the patient. The difficulty of such a criterion is assessment of the results because at thoracic level there is not much to observe. The disadvantage of selecting cervical patients, be complete of incomplete, is that every tiny residual function of upper limbs is extremely important for the SCI individual's life. Any loss of such residual function due to the trial can make an already difficult life a disaster. Such ethical concern does not seem to be a problem in China. A Chinese neurosurgeon has tried on some incomplete cervical patients. He achieved some success in restoring hand and autonomic functions in his patients who received olfactory ensheathing cell transplantation.

We can anticipate even faster development of research on spinal cord repair for decades to come. The country where the greatest neuroanatomist of all times, Dr Ramón Y Cajal was born and worked, must be the front runner in the race of spinal cord repair in human beings.

Session - XXI - Conference Room
MISCELLANEOUS COMPLICATIONS

PROPHYLAXIS AND MANAGEMENT OF DEEP VEIN THROMBOSIS IN PATIENTS WITH

Dr. (Mrs.) Arundhati Perkash

Clinical Pathologist V. A. and Clinical Associate Prof., Stanford, USA

1. The incidence of DVT/PE varies with the period after SCI/ Surgery/trauma, presence of risk factors for venous thrombosis and prophylactic management for venous thrombosis.
2. Venous thrombo-embolism in majority of acute SCI patients is transient due to one or more of the following factors:
2. Release of tissue thromboplastin or other pro-coagulants from tissue trauma, inflammation, stasis, and acute phase response. It is associated with extensive trauma, multiple fractures, surgery, unhealed wounds, severe infection, and inadequate or early withdrawal of prophylaxis.
3. Venous thrombo-embolism in Sub-acute and chronic SCI patients (Prophylaxis Comparatively neglected), observed up to 36 years post SCI, is associated with fresh trauma or fracture, surgery, severe infection, chronic inflammation (e.g. chronic inflammatory bowel disease, ankylosing spondylitis), respiratory insufficiency, acute heterotopic ossification, post- thrombosis syndrome and malignancy. Multiple recurrent episodes of DVT/PE in chronic SCI patients were invariably associated with an identifiable hyper-coagulable diathesis. Paralysis alone did not appear to trigger but increases the chances of venous thrombosis in the presence of other risk factors. Without appropriate management SCI patients with a prior DVT/PE have 1 in 5 chance of recurrence of venous thrombosis. (Similar to the recurrence rate in non-SCI patients in acute care).
4. Current prophylactic programs are much better but failure rate is still about 6-30 % being based on fixed dose & fixed duration of anticoagulation for all patients. When thrombosis occurs despite prophylaxis, the risk for venous thrombosis is either greater than the effect of prophylaxis, and/or, continues beyond the period covered by prophylaxis.
5. Our approach to prophylaxis is by risk monitoring. The incidence and recurrence rate of DVT/PE can be minimized by individualizing the prophylactic regimen according to the risk factors present and the ongoing monitoring of hyper-coagulation status by a combined evaluation of clinical and laboratory findings. The thrombosis-hemostasis clinic.

A. Stratification of risk by the combined clinical and laboratory data

I: Assessment of clinical risk factors

- General risk factors
- Factors related to surgical procedure- anesthesia, tissue trauma, stasis
- Associated pathology
- Local condition of the limb- tissue trauma, fracture, abscess, pressure ulcers, heterotopic ossification
- Drugs-other e.g. steroids
- Lifestyle –stasis lurks beyond the bedridden status. Transit situation, pressure from load

II. Panel of laboratory tests to asses hyper-coagulability (No single laboratory test reflects all facets of hyper-coagulation)

1. Tests related to hemostasis: suggest hypercoagulation if:

Routinely available

- APTT: Short (5 sec shorter than the upper limit of the normal range)
- Fibrinogen: > 400 mg/dL2.
- D-Dimer: > normal(up to 500ng/ml) or > expected after specific surgery,
- FDP: Positive
- Platelet count: > 800,000/cmm
- Heparin or warfarin needs greater than average

Special tests

- Antiphospholipid antibodies: Positive Anticardiolipin antibodies (ACA), DRVVT, Lupus anticoagulant
- Factor V Lieden, Prothrombin 20210: if positive
- Deficiency of Protein C & S, Anti thrombin III,
- Plasminogen activator inhibitor (PAI-1): if increased
- Whole blood clot lysis time: if increased
- Abnormal fibrinogen: if present

2. Nonhemostasis lab tests helpful in monitoring hyper-coagulation

- Erythrocyte sedimentation rate: when increased indicates focus of inflammation
- Complete blood count: Leucocytosis, hemorrhagic anemia
- Biochemistry profile: organ failure, acidosis
- Lipid profile: hyperlipidemia

3. Radiological tests-Acute phase- advantages and limitations in diagnosis.
   Chronic phase- ultrasound to see if clot from old DVT has re-canalized

B. Prophylaxis: continually adjusted according to changing clinical and laboratory status:

1. **Physical** : Elastic stockings, Intermittent pneumatic compression, electrical stimulation, circumference measurements
2. **Drugs:** Heparin-Un-fractionated (Dose adjusted to upper limit of reference APTT), Low molecular weight Heparin, Warfarin, Aspirin and Nsaids, Thrombolytic
3. **Drug use** considerations: Dose, Duration, Cost, and Ease of administration, Compliance
   Drug tolerance, Sensitivity and Interactions
4. **Surgical:** IV filter, Thrombolectomy
5. **Lifestyle modifications**: Patient education Surgical: IV filter, Thrombolectomy
6. **Tailoring prophylaxis regimen based on risk**

Standard risk	Moderate risk	High risk	Very High risk
Early amb.	Early ambulation	Early ambulation	Early ambulation
TED STOCK, serial leg measurements	TED + IPC + serial leg measurements	TED + IPC + serial leg measurements	TED + IPC + serial leg measurements
	Post operative, fixed dose SC Heparin, Enoxaparin Wafarin, Fixed period	Post operative Adjusted dose SC Heparin, Enoxaparin, warfarin till clinical & lab suggest rist Frequent lab tests	Pre and postoperative adjusted dose SC or IV heparin, warfarin till clinical & lab suggest risk, very frequent lab tests
		Vena caval filters Anti platelet drugs?	Vena caval filters Trombolysis Thrombolectomy Anti platelet drugs?
		Assess labs after D/C anticoagulation. Lifelong anticoagylation	periodic assessment of Efficacy of anticoagulation, Assess labs after D/C anticoagulation. Life long anticoagulation
		Treat associated risk factors Modify life style	Treat associated risk factors Modify life style

C. To prevent venous thrombosis (initial and recurrent) in sub-acute and chronic SCI patients

- A patient or family history of venous thrombosis should be routinely included in the problem list and discharge summary of SCI patients to identify the patient at risk.
- The patient with unprovoked or recurrent DVT/PE should be investigated for hypercoagulable diathesis.
- The patient at risk should receive regular evaluation and appropriate prophylaxis for each initial or subsequent stimulus for enhanced thrombosis such as trauma, fracture, surgery or infection. The prophylaxis should continue till the risk factor(s) are operative.

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HETEROTOPIC OSSIFICATION

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COMPLICATIONS FOLLOWING SPINAL CORD INJURY – THE SMS JAIPUR EXPERIENCE

Dr. Navnender Mathur
Physical Medicine and Rehabilitation, SMS Medical College and Hospital, Jaipur

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Session - XXII - Auditorium
Late Surgical Complications

MANAGEMENT OF POST TRAUMATIC SYRINGOMYELIA

Prof. A. K. Singh
Head of Neurosurgery, G. B. Pant Hospital, New Delhi

MANAGEMENT OF IATROGENIC AND POST-OPERATIVE CERVICAL DEFORMITIES

Mr. Gerry Towns
Consultant Neurosurgeon, Leeds, UK

There are a small number of patients who for largely medical reasons may need to be treated medically however in general terms these problems need to be treated surgically. It must be remembered that surgery is not merely a technical exercise and the patient needs to be medically fit, have a reasonable life expectancy and some expectation of improvement in symptomatology or mobility before undertaking what can be a technically challenging surgery.

Analysis of failures shows that most problems can be traced back to bad pre operative planning and the failure to appreciate the biomechanical consequences of the original disease process and/or deformity. It is

therefore clear that the first step in managing these problems is to prevent them happening. This involves good pre operative planning in relation to anterior column integrity and the presence of a posterior tension band. Failure to identify a deficiency in either of those may lead to post operative deformity.

The majority of the patients dealt with are secondary or tertiary referrals however we all have our own disasters and I will illustrate some of those. The planning for the correction of these deformities however is exactly the same as if the patient had had no prior surgery, looking for deficiencies in either the anterior column or the posterior tension band. In general terms surgery will usually involve both anterior and posterior correction but occasionally correction of one side with the mobilisation in a halo vest for eight to twelve weeks post operatively may be adequate.

Once a decision has been made about the approach, one has to consider the length of any fusion. In general terms in the cervical spine this should be as short as possible in order to preserve function. Nonetheless one has to pay particular attention to lower cervical instrumentation as in general terms it would be inappropriate to stop a fusion at C7 as this is likely to lead to failure at the junctional zone at C7/T1. This will inevitably mean extending a fusion down into the upper thoracic spine. The principles of management of these cases will be illustrated using several difficult cases. It goes without saying that such deformities may be complex and surgically demanding and the availability of instrumentation which can be extended from the occiput through the cervical spine into the thoracic spine is mandatory.

IATROGENIC INSTABILITY OF THE CERVICAL SPINE FOLLOWING SURGERY

Mr. Gerry Towns
Consultant Neurosurgeon, Leeds, UK

This is probably common than is appreciated and may be a cause of ongoing muscular skeletal pain in a patient who has been treated for simple single level disc disease. Clinically instability can manifest itself as pain, either muscular skeletal or radicular, deformity, usually kyphotic but occasionally lordotic, or they may present with a usually progressive neurologicaly problem either radicular or myelopathic.

There are numerous causes of such instability. Most of these can be traced back to a failure to appreciate the biomechanics in relation to the particular patient but it may also be related to overly aggressive surgery with too much bone resection anteriorly, inadequate surgery with poor preparation of enplates prior to fusion or simply failure to fuse. Far less frequently infection may play a role however this is extremely unusual in anterior cervical spine but unfortunately more common following posterior surgery. These patients extensive investigations in order to identify the precise cause for their instability. Despite modern imaging techniques it can be very difficult to say whether fusion has or has not taken place particularly with the widespread use of internal fixation. Some of the devices used in internal fixation may themselves be the cause of a problem and this opens the debate as to whether an anterior fixation should be rigid or semi rigid.

Establishing a diagnosis of instability can be very difficult when dealing with a diverse group of patients who may present simply with musculo-skeletal pain at one end or severe progressive neurological deterioration at the other. Unfortunately the bulk of these patients do tend to present with structural pain rather than neurological deficit and psychological testing, accurate pain charting and pain management programmes all have a role to play.

CORRECTION OF NON-SATISFYING RESULTS IN PREVIOUS TREATMENT OF SPINAL INJURIES

Dr. Patrick Kluger
Spinal Surgeon, Stoke Mandeville Hospital, UK

Session – XXIII - Conference Room

Pressure Sores

PATHOPHYSIOLOGY AND PREVENTION OF PRESSURE SORES

Dr. H. C. Goel
Deptt. of Rehabilitation, Safdarjung Hospital, New Delhi

CONSERVATIVE MANAGEMENT OF PRESSURES SORES

Dr. (Capt.) Dilip Sinha
Associate Professor Orthopaedics, Patna Medical College Hospital, Patna

SURGICAL MANAGEMENT OF SACRAL AND COCCYGEAL PRESSURE SORES

SURGICAL MANAGEMENT OF SACRAL AND COCCYGEAL PRESSURE SORES

Dr. H.N. Bajaj
Consultant Orthopaedic Surgeon, ISIC, New Delhi

SURGICAL MANAGEMENT OF PRESSURE SORES OVER THE ISCHIAL

Dr. Sunil Katoch
Consultant Orthopaedic Surgeon, ISIC, New Delhi

SURGICAL MANAGEMENT OF TROCHANTERIC PRESSURE SORES

Dr. K. Das
Jr. Consultant Orthopaedic Surgeon, ISIC, New Delhi

Session – XXIV - Auditorium
FAILED BACK

FAILED BACK – ETIOLOGY AND EVALUATION

Prof. Mohamed A. Maziad
Ain Shams University, Cairo, Egypt

RADIOLOGICAL EVALUATION OF THE FAILED BACK

Dr. Rajesh Kapur
Consultant Radiologist, New Delhi

COMPLICATIONS IN SPINAL SURGERY – AN OVERVIEW

Dr. S.M. Hardikar
Hardikar Hospital, Pune

CHRONIC POST-OP PAIN – THE COMMONEST COMPLICATIONS IN LUMBAR SPINE SURGERY & CHRONIC POST-OP RADICULOPATHY

Dr. V. T. Ingalhalikar
Consultant & Surgeon for Spinal Affections, Thane, Maharashtra

SOME FACTS OF LIFE !

Most Orthopaedic Problems :

- Straight forward, Uncomplicated solution.
- Generally long lasting, good result.
- Patients have got used to good results & expect only good results !

Any residual problem is often viewed as

- Natural Sequel.
- Simple Misfortune.
- (Now also as surgeon's mistake !)

Chronic Pre-op Suffering.
+ Fresh Acute Suffering.

Post-op Pain.

Patient's Expectations &
Misinterpretations.

Patient's Perception =
PO. Pain Is Result of
Surgical Intervention.

UNHAPPINESS !

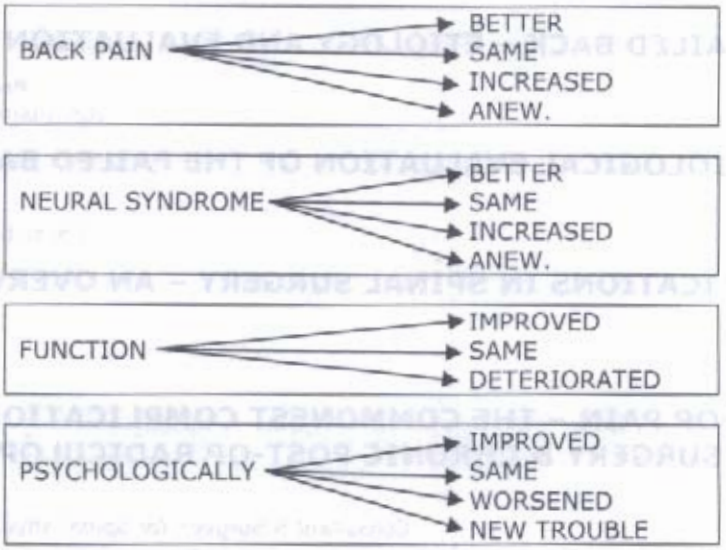
'HALLA GULLA' AROUND POST- OP. PAIN

- Poor Pre-op. Communication.
- Poor Post-op interest and interaction.
- (Surgeons interest in post op case reduces at geometric proportions with postoperative duration)
- Patient's distrust.
- Other professional's contribution.

FAILED SURGERY SYNDROME !

POST-OP PAIN

- The Pre-op Pain :
  - Not relieved at all !
  - Relieved for the duration of rest.
  - Returned after resuming function.
  - Returning after an interval.



LEARNING SPINAL SURGERY .

- Many a surgeon learn 'X' or 'Y' procedure. (especially instrumentation).
- Then they try to fit all possible cases in the indications, irrespective of necessity or rationality.
- Many start with an idea of making a series.
- Complications are always higher when proper homework is not done.
- Many a surgeon do not go beyond the learning curve.

MOTION SEGMENT : TORSIONAL STIFFNESS

- Contribution to stability : Disc - 45%, Facet – 45%, Ligaments – 10%.
- Excision post. elements :
  - Torsional stiffness reduced to 25%.
  - Rotational degree increased by 150%
- Loss of stability :
  - Laminectomy ..... : loss - 16%.
  - Laminectomy + Facetectomy ..... : loss - 60%
  - Laminectomy + Facets + Disc gone ..... : loss - BAD !

SOME MORE FACTS !

- Kadish and Simmons showed a 14 per cent incidence of various forms of nerve root anomalies that affect the patient's symptoms and the surgeon's decompressive technique.

SOME MORE FACTS !

- Even with today's technology and radiographic studies, one is often uncertain of all the

pathology that may contribute to the patient's back pain and radiculopathy.

- Even for a seemingly simple and minor case comprehensive thinking is mandatory.
- Patience and meticulousness is required all through the surgery.

SOME MORE FACTS !

Sometimes Surgery is done when it is likely to fail !

- High grade listhesis with near horizontal sacrum.
- Microdiscectomy or percutaneous discectomy in stenotic segment.
- Severe paranoid schizophrenia.

SOME MORE FACTS !

- Post op. Adhesive arachnoiditis is a nonspecific inflammatory process, resulting in fibrosis and adherence of the nerve roots to the dura.
- Surgery is futile for these patients.
- It is sometimes difficult to distinguish recurrent disc herniation from scar.
- It is difficult to predict who is at risk for recurrence.

SOME MORE FACTS !

- Since there is no effective medical and surgical treatment for Epidural Fibrosis, prevention is of utmost importance.
- In the presence of instability, the post-op. peridural fibrosis is more and profuse than in a stable segment. (Steffee)

It seems like an attempt on the part of the nature to stabilize the segment.

SOME MORE FACTS !

- Pseudarthrosis may be painless due to local denervation and may represent potential problem.
- Occasionally a fibrous union may be as effective as bony fusion. One must clearly establish pseudarthrosis or instability as the cause of the patient's symptoms before reoperating .

SOME MORE FACTS !

- The bacteria responsible for postoperative discitis are identified in less than 50 per cent cases.
- Tobacco usage and Cigarette smoking contribute to the poor result.
- Adequate postoperative immobilization and rational protected mobilization, are important for the good result.

PSYCHOSOMATIC ASPECTS.

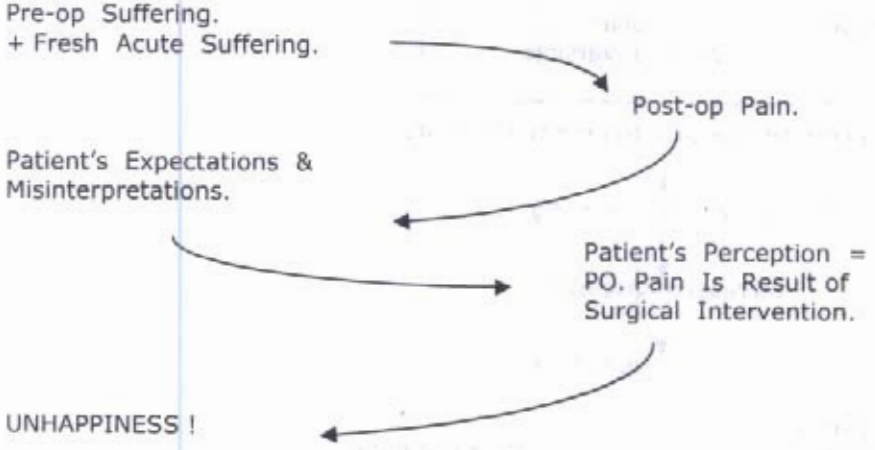
- Cheating positive investigations.
- Placebo effect of Surgery.
- Beware of a patient demanding surgery !
- ? Authentication of suffering by surgery !

Results are often poor in :

- Chronic depression
- paranoid Schizophrenia.
- Manic disorders.

Sometimes it is better to accept small physical difficulty, rather than permanent worsening of psychological posture !

This is not true !

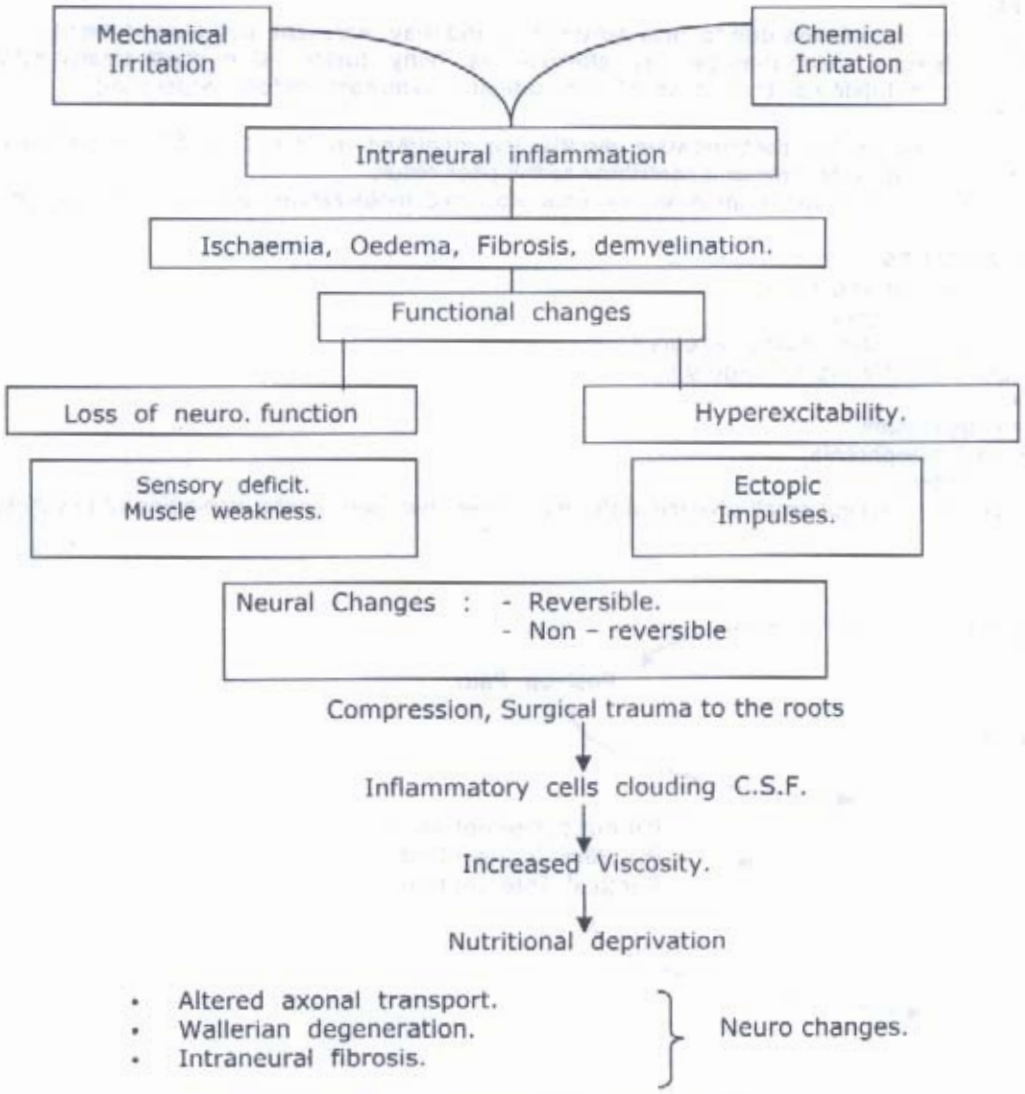


Pre-op back pain
- Not relieved at all !
- Relieved for the duration of rest.
- Returned after resuming function.
- Returning after an interval.

New pain.
CHRONIC POST OP PAIN.
PAIN PRODUCTION.
PAIN TRANSMISSION.
PAIN PERCEPTION.
PAIN COGNIZANCE.
CENTRAL & PERIPHERAL CONTROL OF PAIN TRANSMISSION.
CENTRAL & PERIPHERAL CONTRIBUTION TO PAIN PERCEPTION.
MIDBRAIN SPINAL GATE.
EXCITATORY INHIBITORY.

SOME FACTS.

- The operated lumbar spine may often function near normalcy, but is structurally, physiologically, always something less than normal.
- The normal ageing process cannot be arrested. It may get accelerated.
- It is reasonable to expect that the surgery must disrupt the benign anatomy minimally. It must produce significant reduction in present symptomatology.



BATTERED NERVE ROOTS.

(WITHRINGTON)

Most abnormal EMG. cases showed, Atrophic, scarred, bulging, hyperaemic and compressed roots.
Release of such nerves from compression did not always relieve their symptoms.
(OCHOA)
Compression 220 mm Hg for 15-20 min. Produced Paraesthesiae, buzzing, tingling, vibration. But not pain.
After the nerve was damaged same compression produced pain.

- Acute / subacute ischemia : Entire distal nerve can produce ectopic discharges.
  - Chronic compression and ischemia :
  The nerve & DRG are chronic ectopic generators.
- Simple relief of pressure may not help.
  (Wall)
  - Where myelinated and Unmyelinated axons lie side by side, Inter-connections (Ephaptic foci) develop.
  - There is cross-talk between the fibers.
  - Hypersensitivity to noradrenalin,
  - Hypersensitivity to stretch & pressure.
  - Ongoing ectopic firings.
- Compression :
  - Partial denervation, → many fibers go thru' Wallerian deg. And then regeneration.
  - This degeneration is not only peripheral but also central .
  - Sprouting locally and also wide spread on afferent and efferent sides. → Ectopics → CAUSALGIA
  - Causalgic pain reason :
  Regenerating sprouts sensitive to noradrenalin.
  - After complete or partial division :
  neuroma → ectopic discharges.

CLINICAL FACTS

- Recurrent root disorders often more painful than original episode.
- Release of adhesions during Surgery may produce ischemia & may exacerbate the problem by producing further nerve damage with increased central & distal changes in the nerve.
- Chronic nerve root disorder is sometimes a preceeding stage of partial nerve lesion causing causalgia.

DORSAL HORN : NERVE CELLS .

Nerve cells :

- Nociceptive specific cells : selectively respond to noxious stimuli.
- Wide Dynamic Range Neuron cells : respond to variety of noxious and non-noxious stimuli. contribute to the perpetuating chronic back pain.

WIDE DYNAMIC CELL NEURONS

- Capable of structural and functional changes. Very prone to sensitization.
- Abnormal persistence of these changes,
  - Pathological chronic pain.
- Once sensitized, non-nociceptive input converted into nociceptive (pain).
- C – fibers from deeper structures, predominant in sensitization.

PSYCHOSOMATIC ASPECTS

- 10-12% general population depressed.
- 62% Back Pain patients depressed.
- Depression increases pain sensitivity.
- Depression interferes with rehabilitation.
- Substance abuse (alcohol – drugs – tobacco) gives poor result. Local milieu not conducive for nerve healing.
- Patients on mind altering drugs are a difficult pain management problem post-operatively.

BACK DISABILITY

CHRONIC BACK DISABILITY PATIENT SPENDS MUCH OF HIS TIME RESTING ON HIS BACK HAVING PLENTY OF TIME TO THINK OF HIS PAIN AND DOING LITTLE ELSE.

Post op pain requires early aggressive management to prevent :

- Establishing Chronic pain patterns in CNS.
- Changed psychological posture & behavioral changes.

AUTO - IMMUNITY AND DISC

- Nuclear proteins unknown to immune system because of avascularity.
- Following endplate injury or annular injury, exposed to vasculature and the immune system.
- Auto antibodies develop.
- Antibodies come in contact with the nuclear material either in the epidural space / disc.
  - Immunogenic inflammation.
  - Intense discogenic pain .
  - Intense radicular pain.

SCOPE OF REVISION SURGERY.

- The first operation : Greatest chance of success.
- The second operation : Danger of producing more peripheral & therefore more central root damage.
- If second surgery to be undertaken indications must be exact, localization accurate & nature of the pathology nearly correctly understood.

CHRONIC PO. BACK PAIN MANAGEMENT.

- In recalcitrant cases, spontaneous discharges from the neuroma can be silenced by electrical stimulation, by TENS, electrode implantation in the nerve root or dorsal column.
- If a nerve can be blocked for any appreciable duration, it may allow various abnormal patterns of activity to be modified or stop them.

CHRONIC PO. BACK PAIN : MANAGEMENT.

- I.V. Chlorprocaine. / Serial Epidural inj.
- Often these people require indoor care.
- Mobilization of central inhibitory pathways is a powerful means of stopping pain.
- Willpower, distraction, hypnosis, meditation useful.

CHEAPER IMPLANTS – ARE THEY MORE PRONE TO COMPLICATIONS

Dr. Raj Bahadur
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CONSERVATIVE MANAGEMENT OF FAILED BACK

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NON-SURGICAL INTERVENTIONS IN MANAGEMENT OF FAILED BACK

Dr. G. P. Dureja
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Session – XXV - Conference Room
SYMPOSIUM ON PREVENTION OF SPINAL CORD INJURIES

PREVENTION OF SPINAL CORD INJURIES – THE AUSTRALIAN EXPERIENCE

Dr. Douglas Brown
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The proliferation of motor vehicles after the end of the II World War resulted in road traffic accidents

becoming the commonest cause of traumatic injury and death in the Australian community. The possibility of preventing these accidents first took hold in Victoria. Alcohol was recognised as a significant contributory factor. The laws had been changed to extend drinking hours in public houses (hotels) with a decline in drunkenness. With the development of easily performed blood alcohol measurement, the blood alcohol limit was set for drivers at 0.05%. A blood test was compulsory for the driver after an accident, which was to be taken at the nearest public hospital. There was a dip in the road toll due to the road traffic accidents but it then began to rise again.

Compulsory seat belt wearing for driver and front passengers was introduced in 1970. Fines were imposed for those not wearing seat belts, but have rarely been applied because of general community acceptance. This law was accompanied by an extensive community campaign, which contrasted the horror of the injuries and the tragedy of the deaths with the ease of prevention.

The law was later extended to compel all people in moving vehicles to wear seat belts or, in the case of children, specially designed restrainers. Rigidly enforced standards for seat belts and restrainers have led to improved quality of these devices.

Random blood alcohol breath testing by police, who were given the power to pull drivers to the side of the road at random to perform a compulsory breath test, was introduced in 1976. Very expensive penalties for those who failed the test leading eventually to cancellation of the licence to drive.

New drivers were given a provisional licence, initially for 2 years but later extended to 3. The blood alcohol level of provisional drivers was set at zero in 1984. This had a significant impact on the social behaviour of young adults who faced the penalty of instant loss of licence for 3 months after the first offence. Suddenly the sober driver didn't want drunken passengers in his car, so the group adopted more sober drinking habits.

Very graphic advertisements appeared on television depicting situations which everyone could relate to.

The death rate on the roads has fallen from 1100 per year in Victoria to approximately 3300 last year and is now static at around this level.

In addition to the road users being targets for reduction in number and severity of accidents, other factors have been remedied. Dangerous roads and road junctions have been improved as a better way for the community to spend its money than on health care and support for trauma victims. Cars have been greatly improved with regard to their ability to absorb the force of the impact. Now it is the car that is irreparable, rather than its occupants. How has this come about? Various factors have contributed. One is a law abiding community. Another is an acceptance of parallel importance of rights and responsibilities. If one has the right to drive, one has the responsibility to obey the laws, respect other road users and in general play ones part in making the roads safe for everyone. Another factor is a police force in which corruption is minimal.

Is that the end of the story? No, because we are still aiming to lower mortality and morbidity on the road.

No, because prevention of spinal cord injury goes beyond road traffic accidents.

Reducing accidents in the workplace has also had strong legislative backing with compulsory worker insurance paid for by employers, enforced safety and health regulations in the workplace and heavy fines for violation of these laws and having an unsafe working environment. This has led to reduction in all workplace accidents, which like the reduction in road traffic accidents, has led to a decline in those suffering spinal cord injury as well as a decline in deaths and other major injuries.

Diving into shallow water leading to quadriplegia has also been in decline. Initially emanating from the spinal cord services, public warnings have become part of a major water safety initiative. Incidence of quadriplegia due to driving into shallow water has fallen from 8-12/year to 0-2/year, though we have had 4 this summer.

This indicates an increased sense of responsibility for one's own health care and that of one's friends and is coupled with initiatives in rugby – rule changes and player responsibilities – and general responsibility for personal health care –, prevention of lung cancer from smoking – the percentage of smokers now amongst the lowest in the world at approximately 20% of the population –, and prevention of skin cancer. These personal health responsibilities begin in childhood with sun hats and sun screens at school & play group for young children, health and human relationship courses (skin cancer, lung cancer, water safety, prevention of S.T.D.s) in secondary school for all students in addition to the more general community education through newspapers & magazines, radio and television.

As a result young Australians today are much more responsible citizens in terms of personal health care than previously. This change in social behaviour has taken a generation and has been associated with higher standards of education, higher community expectations regarding the safety of our environment and considerable community backed government support. The decline in spinal cord injury from road traffic accidents (down more than 50%) and diving (down 80%) has produced enormous savings in health costs, loss of productivity and long term care and has prevented much personal and family tragedy. The change in community behaviour seen in Victoria in particular and in Australia in general is reflective of a greater social awareness expected of all citizens and supported by their governments.

PREVENTION OF SPINAL CORD INJURIES – THE AMERICAN EXPERIENCE

Dr. Inder Perkash
Professor Urology, P.V.A. Professor Spinal Cord Injuries and

Professor P.
M & R Stanford And Director Spinal Cord Injuries Center Palo Alto V.A. Health Care System, USA

PREVENTION OF SPINAL CORD INJURIES – THE EUROPEAN EXPERIENCE

Dr. Jean Jacques Wyndaele
Prof. of Urology, University Hospital, Belgium. Chairman of International Spinal Cord Society of Educational Committee

PREVENTION OF SPINAL CORD INJURIES IN DEVELOPING COUNTRIES LIKE INDIA

Dr. (Capt.) Dilip Kumar Sinha
Associate Professor, HOPE Hospital, Mithapur B Area, Patna, Bihar

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Session – XXVI - Auditorium
SYMPOSIUM ON PAIN

PREVALENCE, CLINICAL FEATURES, NEUROBIOLOGY AND TAXONOMY OF PAIN

Dr. Douglas Brown
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PHARMACOLOGICAL MANAGEMENT OF PAIN FOLLOWING SPINAL CORD INJURY

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Pain is a complex phenomenon. Pain is a brain phenomenon. A noxious stimulus may lead to a perception of pain or it may not, depending upon the state of consciousness at the time. For example a toothache may be forgotten during the day, but become unbearable at night. Similarly a severe noxious stimulus may be ignored if the mind is preoccupied by more important or interesting things.

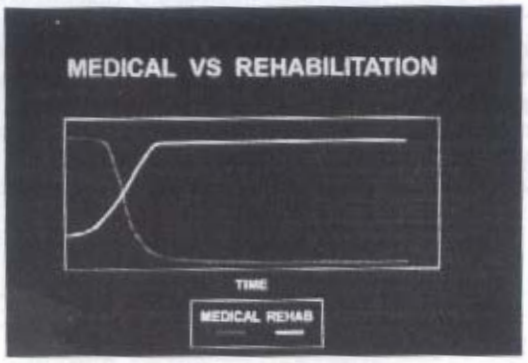
Pain derived from damaged nerves is also perceived as of variable severity depending upon the state of the mind and body. While physical pain is often classified as acute, subacute or persisting and chronic, neuropathic pain is usually chronic.

All forms of pain may occur in spinal cord injury patients, often more than one type at a time. Classification is difficult because of the subjective nature of the phenomenon. (Refs 1-4).

A simple classification is:

- Musculoskeletal
- Neuropathic - at the lesion
  - below the lesion
- Visceral
- Other

For SCI patients, pain after the injury is due to noxious physical stimuli associated with the accident and surgery. This subsides to be replaced by other physical pain, e.g. shoulder and muscular pains and neuropathic pains during rehabilitation. At least 40% of SCI patients complained of ongoing chronic pain, often with acute exacerbations.



Management of all pain needs:-

- good history,
- physical examination and
- function assessment

From this a diagnosis is made of the types of pain present. A management plan is then constructed. For musculoskeletal pain, the management strategies are:

- Remove aggravating factors
- Maintain mobility
- Physical treatments
- Medication

As approximately 50% of paraplegic and quadriplegic patients experience shoulder pain, in both acute and chronic phases of their history, this is the commonest site of nociceptive pain, followed closely by back pain and arthritis. Investigations are often necessary to elucidate a treatable cause such as rotator cuff tear, instability, particularly subluxation in high quadriplegic patients, capsulitis and pain referred from cervical spine pathology. Spasticity and post traumatic syringomyelia may present as shoulder pain and must be distinguished from local causes. Plain x-ray, ultrasound, CT, MRI and arthroscopy may be necessary to determine the diagnosis.

Treatment depends upon the cause. Postural support for the subluxing of shoulder in the form of wheelchair arm gutters may be needed for the quadriplegic patient. Surgical repair of rotator cuff tear may be necessary. Warmth, mobilisation and analgesic medications may be helpful for the arthritic shoulder or neck.

Many pains are related to trigger points in both acute and chronic cases and these may respond to "spray and stretch", deep pressure, dry needling, trigger point injection and gentle mobilisation. Functional assessment, including posture in the wheelchair, is often helpful in both prevention and treatment.

Spasticity can aggravate pain. Mobilisation – joint range of movement and muscle stretches -, postural correction and antispasm drugs all may be necessary. Massage may provide relief for 2 to 4 days or longer.

TENS may be useful for at level nociceptive pain and radicular pain. It seems to be most helpful for treatment of pain in an area of the body, e.g. a leg, rather than generalised pain. Acupunture is reported to have variable success.

In the acute injury situation, intravenous narcotic analgesia by infusion is the best treatment. As healing occurs the mainstays of treatment are regular paracetamol to which are added non steroidal anti-inflamatory drugs (NSAIDs) and oral narcotic medications (Endone, Oxycontin). With further amelioration of pain, the opioids are decreased and stopped and then the NSAIDs and finally paracetamol.

Many patients, especially the elderly with pre-existing arthritis and independent paraplegics of long standing, continue to need some regular analgesia for nociceptive pain.

Neuropathic pain can co-exist with musculoskeletal pain. Differentiation is important and is based on onset, descriptive terminology, character and site.*(See classification of pain).*

The patho phsiology and pathology of central neuropathic pain, such as we see in spinal cord injury, is complex and still not well understood. Interactions are three dimensional and the factors determining pain pathways in the disrupted cord are speculative. Why many, but not all patients, suffer neuropathic pain is not understood. It seems clear that disruption to the spinothalamic cortical pathways is necessary. What alternative pathways are involved is obscure.

The anatomical disruptions at both cellular and fibre pathway level are well known. How they contribute to pain development or lack of it, is not known

Anatomical Pathology

Necrosis, apoptosis,
gliosis, demyelination,
deafferentation,
sprouting, cavitation,
cytoskeletal disruption

The pathophysiology is complex, involving many neurochemical elements including simple ions, amino acids and proteins in cascade reactions which are believed to set the scene for future ongoing pathological processes.

Neurochemistry

AAs (glutamate, GABA)
ionic (Na^+, K^{++}, Cl^-)
peptides (dynorphin, Sub P)
2nd messengers (cGMP, NO,
c-fos, Bcl-x_{L1} NF-$_K$B; cytokines (TNF,
IL-1, IL-6)
enzymes (calpain, PLA_2, PKC)
protein kinases

Excitotoxic components of SCI disruption & healing processes feed into these changes

Excitotoxicity

Glutamate, aspartate
Ionic gradients, NOS
Free radicals, NF-$_\kappa$B
depolarization, cell death

The ensuing and accompanying inflammation involving similar, but different, neurochemicals contribute to the resulting pathophysiology.

Inflammation

NF-$_\kappa$B activation
Cytokines (TNF-α, IL-1β)
Peptides (dynorphin)
Enzymes (COX-2, iNOS)

The ensuing and accompanying inflammation involving similar, but different, neurochemicals contribute to the resulting pathophysiology.

The role of the sympathetic system is not understood, but the involvement of cytokines seen in the sympathetic system regulation and the inflammatory process suggest that it has a role in some pain states.

Of all the thousands of possible interactive processes, it is unknown which ones, and in what order, lead to a chronic pain state, characterised by increased excitability, altered background activity and after discharges of neurons. The variable severity, the trigger factors, the ameliorating factors, etc. are subject for further research. Hopefully it will lead to more targeted treatment. It seems apparent that there will not be a single treatment option until the cure for SCI is found.

The role of the cerebral cortex in determining and modifying the outcome of these changes is not known, though clinically we know patients can often minimise the severity of the pain by using psychological techniques.

Clinically the patient has no obvious cause of pain and often doesn't manifest the physical appearance of being in pain. Therefore its severity is entirely dependent upon the patient's descriptions. It is essential to acknowledge the reality of the pain in order to establish a therapeutic relationship so very necessary for the management of such a chronic and incurable problem.

The characteristics and severity must be elucidated not only by the patient's description of burning, stabbing, etc, but also sleep disturbance, ability to concentrate on tasks and ignore it, symptoms and signs of depression, social problems, relationship problems, personal perceptions of self-worth, etc.

Investigations may be necessary to eliminate treatable causes. Nociceptive pains need to be evaluated and treated as well.

A management plan needs to be organised with the patient and undertaken over a prolonged period to stabilise the pain(s) at a manageable level. The patient must understand that neuropathic pain is incurable with modern treatments, but can be improved. An acceptable level of pain is a patient assessment of 4-6 on a 10 point visual analogue scale (VAS).

- Remove aggravating factors
  e.g. infection, depression.
- Promote positive factors
- Medications
- Other

Aggravating factors that can be relieved include financial and social worries, such as work, housing, psychosocial issues such as relationship problems, problems of social interaction such as anger control, lack of social skills, psychological and psychiatric problems such as anxiety, depression, low self esteem, aloneness and physical problems such as low grade urinary tract infection, severe spasm.

Positive factors to be promoted include good health, physical fitness, active lifestyle, family support, good relationships – family, friends, work, community. These lead to a positive attitude and reduce the impact of pain.

Medications for neuropathic pain

Little is available by way of good scientific controlled trials of medications useful in the treatment of neuropathic pain in SCI patients. Amitriptyline's value is supported by scientific evidence but for the rest there are only case series or uncontrolled trials. No drug works for every patient.

A medication plan is needed. I usually start with two drugs. I use thiamine because it works quickly if it is going to work at all. Its action is often, but not always, short term. This may be long enough to establish another drug treatment. The dose is 100mg TDS or QID and should be given with 1 multi B tablet each day.

Vitamins

Thiamine 100mg TDS or QID
+ multi B 1 daily

I usually start amitriptyline at the same time as thiamine because its sedative effect can be can be helpful in achieving a good night's sleep. The dose can be increased weekly by 25mg to a maximum of 75 to 100mg nocte. High doses don't have any additional benefit for pain relief but may treat associated depression. Side effects such as constipation and sedation may limit its usefulness. If effective, the patient will notice pain relief, as measured by VAS, within 6 weeks.

Tricyclic antidepressants

amitriptyline 25-100mg nocte

clomipramine HCL 25mg BD - 100 mg BD

Gabapentin may be added to amitriptyline or it may used as the first line of treatment. The dose may have to be increased to 1800 to 2400mg/d before there is any effect. High doses have been used, but like amitriptyline there seems to be an effective dose limit. Combinations of therapy are often necessary.

Antiepileptics

gabapentin 300 mg mane - 2400mg/d

carbamazepine 100mg BD - 200mg TDS

clonazepam 1mg BD - 2mg QID

Carbamazepine, clonazepam, mexilitine, clonidine may be effective in a small number of cases. Fentanyl patches may be used. In my experience tramadol and oral opioids are rarely effective. Morphine intrathecal can be helpful though tachyphylaxis limits its usefulness. This seems to be less when it is used in combination with clonidine. The expense, inconvenience and limited usefulness of this approach have curtailed its clinical use in the longterm management of chronic neuropathic pain following SCI.

Other Drugs

mexilitine HCL 50gm - 1200mg/d

clonidine HCL 50 mcg - 150mcg/d

fentanyl citrate patches

intrathecal morphine and/or clonidine

Pure surgical options are limited. Dorsal column stimulation seems to be helpful in some cases and dorsal root entry zone lesioning is reported to be beneficial in some extreme cases. Cost, tediousness and risks of surgery and limited effectiveness have limited clinical application.

Dorsal column stimulators

Dorsal root entry zone lesioning

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SPINAL CORD STIMULATION AND OTHER RECENT ADVANCES IN

Dr. Paolo Marchettini

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Pain is a common secondary complication and often the chief complaint of patients affected by spinal cord injury. The prevalence of pain reported varies from 18 to 96 %, however the majority of the authors dealing with this subject agree on the estimate that about 2/3 of the spinal cord injured patients (64 %) report pain, that in 21 % of the cases is rated as severe or excruciating. It is recognised that spinal cord injury pain has multiple causes and harbours different pathophysiological mechanisms. Consequently, to make the best out of the available remedies, spinal cord injury pain requires careful diagnostic recognition. However, the diagnostic classification is still clouded by disagreement on the descriptive terms, limited understanding of the causing mechanisms and objective limitation in equating the patient's wording to a specific medical cause. Classification of pain following spinal cord injury globally involves two major different approaches: the mechanistic approach in which attention is paid to the possible physiological or physical mechanistic approach, (i.e. bowel or bladder pain as a consequence of mechanical distension as opposed to infection) and on the other side the descriptive approach in which attention is given to the wording of the symptoms, and clusters of definition are taken as indicative of a particular mechanism (i.e. the word ache is considered expression of a mechanical pain). These two major approaches intermingle and superimpose in the different scales used so far. According to a recent review (Richards et al 2002) the authors found that in the last 50 years 29 different pain classification systems have been proposed. However, none of such published classifications has ever undergone the scrutiny of reliability and validity of the proposed criteria and methods. Richards and colleagues have scrutinised the reliability of the "mother of all scales", the Donovan classification system (Donovan et al 1982) that serves as basis for several of them. The Donovan classification system combines both a mechanistic and a descriptive approach; in addition it provides several case examples for each pain type to facilitate pain classification. Unfortunately Richards et al conclusion was that disagreement among 3 raters on pain classification was found on about 30 – 40 % of the pain sites, in spite of the fact that the 3 raters categorised all the pain sites in 3 out the possible different 5 alternatives available. In short, a pain classification system with an interrater reliability of 60 % means that 40% of the patients will be incorrectly classified. Thus it is self evident that pain therapy in spinal cord injury is still in its infancy, because the information about the outcome of the available treatments is blurred by the almost total lack of correspondence between diagnostic definitions. Aleksandar Beric, in a recent review article, properly underlines the need for a meticulous identification of the causative mechanism in spinal cord injury pain. Beric's view is that, unlike common opinion, the majority of the pains in spinal cord injury is either mechanical or of peripheral nerve origin (root avulsion at the level of the injury or overlapping plexus injury) and not central neuropathic pain. This is particularly the case in traumatic spinal cord injury (Beric 2003), where a superimposed peripheral nerve avulsion often remains unrecognised. Thus, it is definitely mandatory that all available diagnostic strategies are launched guided by a careful history taking. All available sophisticated neurophysiological evaluations, including motor and sensory spinal conduction studies and quantitative sensory testing, must allow pinpointing the different and at times eventually coexisting site of nervous system injury. The orthopaedic evaluation is strictly part of this assessment, since bone and joint deformities have a high representation among the mechanism causing pain in such patients. Analysis of the temporal profile of the pain is also crucial. Overall pain tends to decrease following the acute onset at the time of the injury for about 4-8 weeks, however it rises again between the 3rd and 6th month. Allodinia and other feature of neuropathic pain

tend to decrease both in duration and intensity over time, while the orthopaedic causes of pain tend to increase. Pain due to general medical complication (urinary infection, bowel dysfunction) tend to appear later and obviously also increase over time. Such anticipatory information limits quite a great deal the topic of my presentation which is on the available therapeutical strategies, particularly trough techniques of neuromodulation. Since the method of classification of pains in spinal cord injury is still in its infancy the critical interpretation of the available therapies is a long time due, but still far from realistic task. Neuromodulation techniques, both with spinal cord electrical stimulation and intrathecal drug delivery are powerful therapeutical methods, and their use deserves to be implemented for the pain therapy of our unfortunate patients. Spinal cord stimulation might not be as effective in relieving pain as intrathecal drug administration. It is a safer method, however, with a much lower risk of infection and no pharmacological side effect. In addition it provides more independence for the patients who are not compelled in refilling the reservoir at regular intervals. For such reasons electrical spinal cord stimulation is the first choice when neuromodulation has to be used to treat pain in spinal cord injury patients. In this respect is worth to mention, as reported by Eisenberg and colleagues, that spinal stimulation might be effective even when positioned below the level of the injury. Intrathecal drug delivery follows as method of choice, and in such case various drugs may be considered. Although many drugs have been administered intrathecally, there is limited published information for proper selection of the best product for specific pathophysiological mechanism and most of the literature on the subject remains anecdotal. Morphine hydrochloride is still the most used drugs, in spite of the known long term hormonal side effects that it causes. All such techniques are moderately invasive, but they are more invasive than medical and physical therapy. In addition they are still quite expensive. Any physician dealing with neuromodulation should take it as a personal compulsory duty to classify the source of pain as best as possible, eventually seeking a second opinion for that purpose, and using all available diagnostic resources. Neuromodulation shall not be used only on an empirical trial and error approach.

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Session – XXVII - Auditorium
SURGICAL MANAGEMENT OF FAILED BACK

FUSION STRATEGIES IN PREVIOUSLY OPERATED BACK

Dr. Prashant Kekre
Orthopaedic Surgeon, Chennai

ROLE OF ENDOSCOPIC SURGERY IN MANAGEMENT OF FAILED BACK

Dr. Satish Chandra Gore
MBBS, MS (Ortho), FABMISS MRCPS (USA) (Hon.), Kamla Regencey, Pune

SURGICAL MANAGEMENT OF FAILED BACK

Mr. Stuart Ross
Neurosurgeon - Leeds, UK

The surgical management of degenerative spinal disease is itself a failure of medical therapy. The best results are obtained from the first surgical procedure. Repeat surgical procedures should be for specific indications in carefully selected individuals.

REVISION SURGERY FOR FAILED CERVICAL SPINE FIXATION

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CARDIOVASCULAR COMPLICATIONS OF SPINAL INJURED – PREVENTION AND

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OSTEOPOROSIS IN SPINAL INJURED – PREVENTION AND MANAGEMENT

Dr. Deepak Raina
ISIC, New Delhi

One of the inevitable complications of spinal cord injury (SCI) is the osteoporosis that occurs predominantly in the pelvis and lower extremities. The acute treatment of patients with SCI always has focused on the injury itself and the immediate complications that arise subsequently. Bone loss as a consequence of SCI has been of secondary concern historically. Osteoporosis in the SCI population first was studied in relation to calcium metabolism and the associated hypercalcemia and renal calculi that followed. Recently, the differences between SCI-induced osteoporosis and other causes of bone loss (disuse), such as prolonged bedrest, space travel, and lower motor neuron disorders, have become more clear. New technologies allow monitoring of osteoblastic and osteoclastic activity at the microscopic level, while modern radiographic techniques have allowed more refined studies to be undertaken at the macroscopic level. Factors Contributing to Bone Loss

Researchers and clinicians who study osteoporosis have known for some time that weight-bearing exercise contributes to the development and maintenance of bone mass (e.g., Dalsky et al., 1988; Krall, 1994; Nelson et al., 1994). Conversely, studies as far back as 1892 by Wolff have shown that bone is negatively influenced by reduction of its load-carrying role. In fact, without gravitational or mechanical loading of the skeleton, there is a rapid and marked loss of bone.

Wolff's theory that bones become stronger in response to increased exercise is still accepted today (Drink water, 1994). Living bones adapt themselves, both in size and internal structure, to the mechanical forces applied to them, and the amount and strength of the bone are directly linked to the amount of activity that forces the bones to bear weight and move against resistance (Simkin, 1990).

Weight-bearing activity can be thought of as any activity that is done while upright, requiring the bones to fully support the body's weight against gravity (Bonnick, 1994). Impact-loading, weight-bearing activity, therefore, involves some impact or force being transmitted to the skeleton during weight bearing.

While weight bearing and impact loading stimulate the development of healthy bones, it must be remembered that for exercise to be effective, the mechanical stress placed on the bone by an activity must exceed the level to which the bone has adapted (i.e., short periods of intense loading can produce more new bone than long-term routine loading) (Frost, 1990). However, long-term routine loading is important in maintaining bone density. And although bone responds to mechanical loading, it is easier to lose bone through inactivity than to gain more through changes in functional loading. When weight-bearing exercise is not continued, bone mass reverts to pre-training levels (Dalsky, 1988;Drinkwater, 1995).

The loss of bone also may be enhanced by lack of muscle traction on bone or other neural factors associated with SCI. These other factors associated with SCI further separate SCI-induced osteoporosis from other causes of disuse demineralization. Absorption of calcium from the gastrointestinal tract has been found to decrease in the acute period following SCI. Yet, until recently, dietary calcium reduction commonly was recommended as a way to decrease calcium excretion and prevent the complications of hypercalciuria

Bone Metabolism and Disuse

Bone is a dynamic structure that is continuously remodeling itself through a closely balanced process of resorption and formation. During resorption, old bone tissue is broken down and removed by special cells called osteoclasts. Then bone formation begins and new bone tissue is laid down—by cells called osteoblasts—to replace the old.

There appears to be an acute increase in both bone resorption and bone formation during periods of bed rest and immobilization, although there is a higher relative increase in bone resorption, which leads to a net loss of bone mineral in the weight-bearing bones. Over several months the rates of bone resorption and bone formation gradually decrease, and the bones reach a new equilibrium, or "steady state," in response to the reduced load (Sinaki, 1995).

The precise mechanisms that cause the change in bone metabolism are being studied, although it is possible that the absence of weight-bearing alters bone cell function (Mundy, 1995). Other researchers speculate that bed rest triggers an increased recruitment of osteoclasts that continues un til the end of the bed-rest period (Uebelhart, 1995).

When body weight is removed from the bones, the parts of the skeleton most affected are the lower extremities; those least affected are the upper extremities and the skull. This is because the higher a certain

bone is positioned in the skeleton, the less body mass that bone must carry. Hence, the lower extremities and the spine are classified as weight-bearing bones, and the upper extremities as non-weight-bearing bones.

The body that has sustained SCI has been considered the model of premature aging, and the role of parathyroid hormone in osteoporosis following SCI illustrates this point. Acutely, the parathyroid gland is relatively inactive with low parathyroid hormone levels observed up until the 1-year point following injury. Hypercalcemia seen immediately postinjury leads to this low level. A reversal in activity from years 1-9 is noted. The parathyroid gland is stimulated to the point where parathyroid hormone levels are above the reference range. The result is an increase in bone reabsorption or osteoporosis related to parathyroid dysfunction in the chronic stages of SCI. This chronic-stage mechanism of osteoporosis is balanced with an increase in bone mineral in regions of the body in which weight bearing is resumed (eg, in the upper extremities, spine) and adds to the demineralization observed in regions that are chronically non-weight-bearing (eg, the pelvis, lower extremities).

Significant differences in upper extremity bone density are observed between paraplegic patients and tetraplegic patients. The bone mineral density of the arms of paraplegic patients returns to near normal by the 10-year postinjury point, which is approximately 16% more bone mineral than is found in the arms of tetraplegic patients.

Individuals with complete injuries tend to have less bone mineral density than those with incomplete lesions. With complete lesions, significantly lower lumbar spine bone mineral densities have been noted (z value -1.47) in patients 1-26 years post injury. In addition, individuals with incomplete motor SCI demonstrate greater bone mineral density at the areas of greater lower extremity muscle strength.

Some controversy exists surrounding the protective effect of spasticity on bone mineral content. The latest studies find a decrease in losses of bone density in patients exhibiting spasticity, compared with the flaccid group.

Trabecular and Cortical Bone

There are two types of bone in the body: cortical and trabecular. Cortical bone is dense and compact, and comprises 85 percent of the bone in the body. Trabecular bone has a spongy, honeycomb-like structure, and makes up the remaining 15 percent. The rate of remodeling is much faster in trabecular bone (e.g., the spine) than in cortical bone (e.g., the long bones and the hip) because remodeling takes place on the surface of bones, and trabecular bone tends to have greater surface area (Mundy, 1995).

Bone Loss Magnitude

The pattern of calcium imbalance and bone loss due to disuse is similar in prolonged bed rest, immobilization, spinal cord injury, and space travel. Urinary calcium increases within days of the onset of disuse, and the body's calcium balance may become negative, reaching a peak at about five weeks (Hangartner, 1995). However, there are differences in magnitude. In bed rest, the average urinary calcium loss at the peak is about -150 mg per day, which corresponds to 0.5 percent of total body calcium (Deitrick, 1948; Donaldson, 1970; Hangartner, 1995). Losses inbone density are greatest in weight-bearing bones with a large proportion of trabecular bone, such as the heel bone. The amount of bone lossin the spine is smaller and occurs later; in some studies, no significant bone loss was detectable in the spine (Hangartner, 1995; LeBlanc,1987).

Studies of patients whose limbs were immobilized have shown that, if a weight-bearing bone is involved, immobilization leads to bone loss in that limb. The bone loss is more significant in trabecular bone than in cortical bone (Janes, 1993). Fortunately, these studies also suggest that there is a good chance to fully recover the lost bone if the immobilization period is limited to 5 to 10 weeks (Hangartner, 1995).

Spinal cord patients have the longest experience with disuse osteoporosis. In these patients, there is an immediate increase in urinary calcium, leading to a negative calcium balance of about -100 mg per day. The calcium balance usually reverts back to normal within 6-18 months, butby that time about one-third of cortical and one-half of trabecular bone may have been lost (Chantraine, 1979; Hangartner, 1994; Minaire,1974).

Mortality/Morbidity: The most measurable complication of osteoporosis following SCI is pathologic fracture. The historical incidence of fractures in the SCI population has been 1.45-6%; however, this historically low incidence may be deceptive since most SCI patients who sustain subsequent traumas and fractures are not treated in SCI centers. In addition, these studies on fractures have come from inpatient charts. Recently, the Model Spinal Cord Injury System has produced figures on fracture rates based on time following SCI, with incidences of 14% at 5 years, 28% at 10 years, and 39% at 15 years post injury. These incidence rates are based on outpatient studies and have been confirmed.

The sites of fractures mimic the sites of greatest osteoporosis, with the supracondylar region and tibia being the most common. A bone mineral density fracture threshold of 50% appears to exist for the knee, and this most likely is the bone mineral density fracture threshold for most regions in the body.

Fracture rates in the lower extremities are 10 times greater in patients with complete SCI compared to patients with incomplete injuries. Paraplegic patients are at higher risk than tetraplegic patients, due to the higher level of function that paraplegic individuals have with increased mobility and participation in physical activities.

The inciting events that lead to fractures frequently are unknown or associated with relatively minimal traumas. The reason is that less torque is needed to produce failures in bone in the SCI population than in individuals who have not sustained SCI.

Clinical History: Osteoporosis by itself is a subclinical condition. Thus, no associated clinical signs or symptoms exist for this entity. Radiographs following fractures that reveal not only the fracture but also significant bone loss are the common way that osteoporosis is discovered in the SCI population.

Physical examination: No overt physical examination findings exist that lead to the diagnosis of osteoporosis. However, patients with SCI may be predisposed to knee effusions due to osteoporosis, heterotopic ossification, trauma, and benign hydrarthrosis.

Causes

1. primary osteoporosis
2. secondary osteoporosis
3. osteoporosis in spinal injured
4. ageing in spinal injured

Labrotory findings

The biomechanical markers that have been measured in studies of SCI-induced osteoporosis include serum calcium, phosphorous, alkaline phosphatase, 1,25-dihydroxyvitamin D and calcitonin, and urinary calcium and hydroxyproline. These markers may not be followed routinely in the ongoing care of the person with SCI.

Imaging

Advances in technology have resulted in the ability to quantify bone density precisely. Quantitative computed tomography (QCT) scans can isolate densitometric and geometric changes in both cortical and trabecular components of bone. This kind of testing allows for volumetric measurements, grams per cubic centimeter, which is the most precise measurement of bone density. The most commonly used method for clinical studies, dual energy x-ray absorptiometry (DXA) scan, records absolute bone mineral densities in various regions of the body, which allows for comparison of bone mineral densities in patients with SCI with measurements from uninjured individuals of similar age, race, and sex. These imaging studies are not used commonly in the standard of care of SCI patients.

Minimizing Bone Loss Caused by Disuse

In general, healthy people who undergo periods of bed rest or immobilization can regain bone density through the resumption of weight-bearing activities. . The greatest concern is for patients who can never resume weight-bearing activities, because they typically do not regain lost bone density.

Numerous researchers have tested methods to minimize bone loss during the period of disuse. Methods studied include dietary changes, pharmaceutical agents, weight-bearing and strength training exercises when possible, and functional electrical stimulation (FES) of muscles.

Dietary changes, such as increased intake of calcium and/or vitamin D, have not proven effective at minimizing disuse bone loss (Sinaki,1995). Research into the pharmacologic treatment of disuse osteoporosis has shown that several of the bisphosphonates may prove helpful in minimizing bone loss during periods of weightlessness or immobility.

There is some uncertainty as to whether physical activity can minimize bone loss during periods of disuse. Some early studies indicated that the stress on bones from any muscular activity (even in a supine position) can be beneficial (Wyse & Pattee, 1954; Abramson & Delagi, 1961).However, more recent research suggests that weight-bearing activity—through tilt-table exercises or periods of standing—is necessary to minimize disuse bone loss (Kaplan, 1981). Studies of physical countermeasures in space travel tend to support this latter conclusion (NASA,1990).

Several studies have tried using FES with spinal cord-injured patients. Although some of these studies showed no positive effects, others showed that the rate of bone loss was less than expected. This illustrates the importance of assessing bone density data relative to expected losses rather than as absolute values. Even if an intervention does not fully halt or reverse bone loss, slowing down the loss may be a very positive result (Hangartner, 1995).

The search continues for new ways to minimize the bone loss that results during periods of disuse. As more accurate and sensitive techniques are developed to assess bone and connective tissue metabolism, more information will be available regarding bone loss in paralyzed and/or immobilized individuals. These techniques will definitely be helpful in orienting new therapeutic trials with drugs and/or procedures intended to correct the loss of bone density resulting from bed rest, immobilization, or weightlessness.

In this study we evaluated bone mineral density (BMD) in both the upper and lower extremities following SCI sustained for various lengths of time, and related the BMD to the level of the lesion and the time from injury. A study was undertaken in 20 SCI patients. A significant difference in BMD between upper and lower extremities of the paraplegics was found. BMD of upper and lower extremities were similar in tetraplegics. The BMD values were significantly different when the upper extremity scores of paraplegics and tetraplegics were compared but BMD scores of the lower extremities were similar in the two groups. The decrease in BMD was less

in the spastic patients when compared to the flaccid group. There was a positive correlation between time from injury and the degree of BMD deficit in the paralyzed areas.

CAUSES OF MORBIDITY AND MORTALITY IN SPINAL INJURED: CHANGING TRENDS

Dr. Sanjay Wadhwa
Addl. Professor, Deptt. of Physical Medicine and Rehabilitation, AIIMS, New Delhi

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Session - XXIX - Auditorium
NEUROGENIC AND VASCULAR COMPLICATIONS IN SPINAL INJURIES

NEUROGENIC COMPLICATIONS IN SPINE SURGERY

Prof. V. S. Mehta
Head of Neurosurgery Deptt, AIIMS, New Delhi

CSF LEAKS: ETIOLOGY AND REPAIR

Dr. P.S. Bawa
Consultant Neurosurgeon, Mata Chanan Devi Hospital, New Delhi

VASCULAR COMPLICATIONS IN SPINAL SURGERY

Dr. Sharad Shashank Kale
Assistant Professor, Neurosurgery, AIIMS, New Delhi

Session - XXX
COMPLICATIONS OF SPINAL SURGERY IN SPECIAL CONDITIONS

COMPLICATIONS OF SPINAL SURGERY IN ANKYLOSING SPONDYLITIS

Dr. Sajan Hegde
Consultant Orthopaedic Surgeon, Apollo Hospital, Chennai

COMPLICATIONS OF SPINAL SURGERY IN RHEUMATOID ARTHRITIS

Mr. Stuart Ross
Neurosurgeon - Leeds, UK

Surgery for vertebral osteomyelitis should adopt the principles accepted elsewhere. Necrotic and foreign tissue should be excised and viable tissue should be restored. Instrumentation is then acceptable and can be used to support the spine both externally and internally.

COMPLICATIONS OF SPINAL SURGERY IN CHILDREN

Dr. Sajan Hegde
Consultant Orthopaedic Surgeon, Apollo Hospital, Chennai

COMPLICATIONS OF SPINAL FUSIONS IN ADULTS MORE THAN 60 YEARS

Dr. Shankar Acharya
Consultant Spine Surgeon, Sir Gangaram Hospital

MANAGEMENT OF THORACOLUMBAR FRACTURES IN GERIATRIC AGE GROUP:

Dr. Raghava Dutt Mulukutla
Consultant Orthopaedic & Spine Surgeon, UDAI Clinic, Hyderabad

Session – XXXI - Conference Room

PANEL DISCUSSION – CHALLENGES IN PREVENTION AND MANAGEMENT OF COMPLICATIONS OF SPINAL CORD INJURED IN DEVELOPING COUNTRIES

Dr. A.K. Mukherjee, Dr. Anil Shreshtha, Dr. Fazlul Hoque, Dr. U. Singh, Dr. Navnender Mathur, Dr. Inder Prakesh, Dr. Jean Jacques Wyndaele, Dr. Douglas Brown, Dr. S.K. Kame

Session – XXXII
MUSCULOSKELETAL COMPLICATIONS & SPASTICITY

MUSCULOSKELETAL COMPLICATIONS IN SCI – PREVENTION AND MANAGEMENT

Dr. S.S. Sangwan
Department of Orthopaedics, Postgraduate Institute of Medical Sciences, Rohtak, Haryana.

PATHOPHYSIOLOGY OF SPASTICITY – CAUSES & PREVENTION

Dr. Ashwini Sharan
Thomas Jefferson University, Department of Neurosurgery, PA

NON-SURGICAL MANAGEMENT OF SPASTICITY

Dr. S.Y. Kothari
Orthopaedic Surgeon, Spinal Ward, Safdarjung Hospital, New Delhi.

INTRATHECAL BACLOFEN PUMP AND OTHER SURGICAL PROCEDURES IN MANAGEMENT OF SPASTICITY

Dr. Ashwini Sharan
Thomas Jefferson University, Department of Neurosurgery, PA

POST-CONFERENCE WORKSHOP ON "FUNCTIONAL ELECTRICAL STIMULATION"

WORKSHOP AND DEMONSTRATION

Dejan B. Popoviæ, Dr. Techn, Ph.D.

1. Principles of FES
2. Instrumentation for electrical stimulation

Pause

3. Neural prosthesis for movement restoration (with demonstration)
4. Therapeutic effects of functional electrical stimulation – Neurorehabilitation
5. Discussion

Literature:

Popoviæ DB, Sinkjær T: Control of Movement for the Physically Disabled, I edition, Springer, Londor., 2000.
This edition is available through Amazon.com.
Popoviæ DB, Sinkjær T: Control of Movement for the Physically Disabled, II edition. Aalborg University, DK and Akademska Misao, Belgrade, Yugoslavia.
This edition is available through Aalborg University, SMI. Order can be found at:
www.smi.auc.dk/publications.

TEAR HERE

SPINAL CORD SOCIETY
(Indian Chapter)

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Experience in the field of Spinal Injuries / Spine

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Areas of Interest / Speciality .....

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Life membership fee Rs. 500/- only.

Mode of payment ☐ Cash ☐ Cheque ☐ Bank Draft

☐ Money Order ☐ **Bank Transfer (A/C No. 01/2650 - Indian Spinal Injuries Centre)

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Indian Spinal Injuries Centre
Sector - C, Vasant Kunj, New Delhi - 110070
Phones: +91(11) 2689 4884/8448/6642/8115 Extn.: 233/243 Fax: +91(11) 2689 8810
Mobile: 98100 54854, Email: ISIC@nda.vsnl.net.in

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**** Kindly furnish details in case of Bank Transfer**

Spinal Cord Society has been registered to serve as a national coordinating, correlating & advisory non profit making body for the study of all problems concerning the causation & prevention of traumatic & non traumatic lesions spine & spinal cord. For further details write to the secretary at the address mentioned above.

SPINAL CORD SOCIETY

Aims & Objectives

- Serve as a national body for promoting Academics, Education & Research in the field of Spinal Injury.
- Provide an exchange amongst the members and others 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. 500/-.
  - One Year Membership — Rs. 200/- per annum.
- **Associate Member**
  - Life Membership — Rs. 300/-.
  - One Year Membership — Rs. 150/- per annum.

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Maj. HPS Ahluwalia, Chairman, ISIC.

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Dr. Sunil Seth Anesthetist, ISIC	- Member

About ISIC

About ISIC

Gleaming white building, wide airy rooms, polished tile floors, efficient nurses bustling in starched white uniforms, busy doctors moving from ward to ward.... sounds exactly like one of those corporate hospitals that dot the Metros across the country? Yes and no! Yes because this is an extremely modern, ultra efficient hospital; and no it is the only hospital in South Asia, contrary to most corporate hospitals, it is not a money-spinner. It is a hospital with a heart and a soul. Known as The Indian Spinal Injuries Centre (ISIC), it is notable for providing the best medical attention for spinal, orthopaedic and neuromuscular disorders, across the country. Located at Vasant Kunj, Delhi virtually next door to the airport, ISIC is a not for profit venture. Though built with Italian collaboration it is the result of one man's vision. A soldier, a mountaineer, a dreamer, an administrator and a tetraplegic - Major H.P.S. Ahluwalia, Chairman ISIC, has been all this and more.

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