



46TH ISCOS ANNUAL SCIENTIFIC MEETING 10TH NOSCOS CONGRESS

27–30 June 2007, Reykjavík, Iceland



PROGRAM AND ABSTRACTS

Celebrating 50 years of experience

Coloplast invites you to our 50th Jubilee

When: Every day between 2 - 3 pm.

Where: Coloplast stand

What: Surprise



In September 2007 Coloplast celebrates its 50-year jubilee.

Listening and responding is how and why we were founded – and also the path for the future.

It all started 50 years ago with Nurse Elise Sørensen listening to her sister Thora's problems following her ostomy operation. She learnt of her sister's fear that her stoma would leak in public - and the dramatic, negative effect this was having on her lifestyle. As Thora no longer dared to leave the house, Elise was determined to find a solution.

The result was a simple, yet ingenious idea, with far-reaching consequences: the world's first ostomy bag with an adhesive - eliminating leakage, and restoring self-confidence. This idea would give her sister and many, many, thousands like her around the world the chance to live a normal life once again.

But the ostomy bag had to be produced. Elise contacted Aage Louis-Hansen in the hope that he would agree to manufacture her product idea. His answer was 'no'. The story could have ended there, had it not been for the support and determination of Aage's wife Johanne. She herself had trained as a nurse and could see the true value of Elise's idea. And so Coloplast was born. Our goal is still the same - making lives easier.

Looking forward to meeting you at the 46th ISCoS NoSCoS in Reykjavik.

**Joint event of the International
and Nordic Spinal Cord Societies**

**46TH ISCOS ANNUAL SCIENTIFIC MEETING
10TH NOSCOS CONGRESS**

27–30 June 2007, Reykjavík, Iceland

Greetings from the President of Iceland Ólafur Ragnar Grímsson

The creative forces which are constantly transforming the nature of Iceland – volcanic eruptions, expanding lava fields, geysers, earthquakes, the ever-changing contrast between fire and ice – have also moulded the souls and the culture of the people.

Although our nation is small it offers important lessons for others drawn from the journey we have made from being one of the poorest countries in Europe into being now among the most affluent in the world, a significant partner in scientific progress within the highly advanced fields of medical and health research.

The Icelandic health care system is based on the principle of equal treatment for all, open access for everybody wherever they live. It has created a strong culture of trust between doctors and the public.

The goodwill shown by the people towards the medical profession has been extraordinary. They have been willing to participate in many different medical research projects, provide private information, blood and bio samples that in many other countries would have led to complicated privacy laws or extensive formal contracts.

This culture of trust has enabled Icelandic doctors and other scientists to engage freely in many different types of research and the nation has rejoiced in the results almost as if they are national achievements.

I hope that your conference, the meetings of the International Spinal Cord Society and the Nordic Spinal Cord Society will be inspired by our cultural heritage and our achievements and also influenced by the creativity demonstrated by the Icelandic nature.



*The President of Iceland,
Mr. Ólafur Ragnar Grímsson
is the patron of the
46th ISCoS Annual
Scientific Meeting and the
10th NoSCoS Congress*



Welcome to Reykjavík!

It is a great pleasure to welcome all of you to Reykjavík for the joint Scientific Meetings of the International Spinal Cord Society – ISCoS, and the Nordic Spinal Cord Society – NoSCoS. The Scientific Meetings of those two societies have been a cornerstone in presenting new research, exchanging experiences and building relations between colleagues and co-workers in the field of spinal cord injury. It has therefore been very exciting to bring together these two societies in a joint meeting, enjoying the best of both. The Organizing Committee has made an effort to arrange an interesting and memorable Congress that will be both scientifically and socially rewarding.

This meeting puts focus on five main topics that represent some of the many faces of spinal cord injury that meet patients and clinicians every day. These topics are Late complications, Metabolism, nutrition and obesity, Functional electric stimulation, Coping strategies and Impact of SCI on the family. In addition the meeting offers a variety of workshops and symposia with in-depth presentations and discussions. There will be emphasis on prevention of SCI, on documentation and data sets as well as on the importance of information to patients related to participation in clinical trials.

In Pre-congress workshops, the focus will among other topics be on the importance of physical activity, movement analysis and robotic locomotion.

We have chosen to the fantastic sculpture of the “Sun vessel” to symbolize the meeting. This abstract Viking ship not only reminds us of Nordic heritage, but its centrepiece also takes a marvellous shape resembling a spinal column.

Iceland has a very unique nature. As your host we want to make sure that you have an opportunity to make the most of your visit. Exciting excursions have therefore been arranged for you to experience beautiful landscapes shaped by ice and fire, and to learn of a remarkable history of survival in a country subject to the strong elements of nature.

The meeting serves to broaden our scientific insights into the complex world of spinal cord injury. Its goal is also to strengthen the relations between the participants and to enhance the important research activities that will be presented. Keep up the good work!

Stefán Yngvason
Chair, Organizing Committee

Organizing Committee

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Sigrún Knútsdóttir, Secretary
Gísli Einarsson
Jón Eiríksson
Marta Kjartansdóttir
Páll E. Ingvarsson
Sigrún Garðarsdóttir

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GENERAL INFORMATION

Preparation for presentations: Speakers are asked to present themselves to the technician with their presentation material at least 2 hours before their session begins. Those speakers that have a presentation in the first session in the morning need to load in their presentation in the afternoon the previous day. Please note that you need to hand in your power point presentation on a CD-ROM or USB key. Information on the location of the technician will be given at the registration desk.

Chairs: Please be present in the meeting room at least 15 minutes before the beginning of your session. It is important that the sessions stay on schedule so that individuals who want to hear a specific presentation may do so without concerns of time. It is thus vital that all speakers observe their timetable.

Posters: Poster presentations will be displayed in Halls F and G on the first floor for the duration of the Congress. Presenters are asked to attend their posters during breaks. There will be a possibility to write down comments and questions to the poster presenters. A pocket for comments will be available at each stand. A pocket for handouts will also be available at each stand. The stands are marked with the number of the poster according to the numbers in the Abstract book. Posters can be set up from 08:00 on Thursday June 28th, the size of the poster board is 90cm wide 120cm high, double tape is provided. Poster presenters are asked to take down their poster after closing session on Saturday.

Poster awards: The International Society of Spinal Cord awards a prize for the three best posters at the Congress. The Poster Presentations will be evaluated by the Scientific Program Committee (SPC) and the three best ones will be awarded the prize. The Prizes for the Poster will be awarded at the Closing of the Congress on Saturday.

Exhibition: The opening of the Exhibition is from Thursday morning 28 June to noon on Saturday 30 June. The Exhibition is located in the foyer in front of Halls A and B.

Conference badges: Your personal badge is your entrance ticket to all sessions. Please wear your badge for easy identification throughout the Congress. Should you misplace your badge, replacement can be obtained at the Registration desk.

Breaks: Coffee, tea and refreshments are served in the exhibition area during coffee breaks.

Lunches: Lunches on Thursday and Friday are included in the registration fee and are served in the Exhibition area.

Messages: Messages to participants will be posted on a bulletin board near the information & registration desk.

Internet Café: Astra Tech invites you to use the internet café located on the first floor.

Mobile phones: Please turn off your mobile phone when entering the meeting rooms.

Registration and information: The registration & information desk will be located in the foyer of Nordica Hotel on the ground floor. Iceland Travel Conferences is in charge of the registration, hotel bookings, social arrangements and excursions. Registration and information desk will be open during conference hours: Tel: + 354 860 0405.

Taxi and shuttle: *Transport will be provided from Nordica Hotel for:*
Clinical Visits to the Department of Rehabilitation at Landspítali University Hospital
Pre-Congress Workshop 1 at the Department of Rehabilitation at Landspítali University Hospital; Get Together at Kjarvalsstaðir Museum; Reception at the City Hall.
Information about the time schedule for the transport will be given at the Registration Desk; Transport will be available for wheelchair users between their hotels and the Nordica Hotel in the morning and in the afternoon. Taxis with wheelchair access will be available. For further information, please contact the registration desk.

Banking facilities: A bank is located in the same building as Nordica Hotel. Opening hours are Monday to Friday from 09.15–16.00. ATM is located outside the bank.

Credit Cards: Commonly accepted Credit cards in hotels, shops, restaurants, taxis and at the Secretariat are: Visa and Master Card.

SOCIAL PROGRAM

Wednesday 27 June

- 19.00 "Get Together" at Kjarvalstaðir Museum
Bus transport from Hotel Nordica at 18.45
Included in Registration fee

Thursday 28 June

- 19.00 Reception at the City Hall
Bus transport from Hotel Nordica at 18.45
Included in Registration fee

Friday 29 June

- 19.30 Dinner Dance at Hotel Nordica
Optional
Tickets are available at the registration Desk

CONGRESS TOURS

Thursday 28 June

City Sightseeing for accompanying persons

Departure from Nordica Hotel at 10:00

Reykjavík is the world's most northerly capital, with more than one third of Iceland's population. Today Reykjavík is a modern city with a variety of restaurants, museums, galleries and theatres. On our tour we cover the city from one end to the other. We will see the old town centre, the Parliament, the Cathedral, the harbour, the National Museum, the Pearl and Höfði house, the summit site of 1986. We drive past the city's salmon river which is an outstanding proof that Reykjavík is a pollution free capital and the Árbæjarsafn outdoor folk museum, which offers an interesting contrast to the

modern buildings of the most recent part of Reykjavík. Drive continues past Reykjavík's largest outdoor swimming pool in Laugardalur which is heated with water from natural hot springs under the city, the Ásmundur Sveinsson Sculpture museum and Hallgrímskirkja Church (whose steeple is a Reykjavík landmark). Lunch at a seafood Restaurant. The tour ends at hotel Nordica or in the city center.

Duration: 4 hours – included in the accompanying persons fee.

Saturday 30 June

Golden Circle (starting at 2 pm), price pr. pers. ISK 7 700.-

The world-famous Geysir geothermal field is highlighted on this tour, where spouting springs of various formations and appearances are seen. Nearby is Gullfoss, the queen of Icelandic waterfalls, and we are given the opportunity to stand next to it, watching as enormous quantities of water tumble violently into a deep, meandering gorge. The Geysir museum is included as a main feature of this tour, an informative multimedia exhibition that vividly shows how the forces of nature shaped the country and the people.

Duration: Approx. 6 hours. Incl. bus, guide and dinner.

Pick up; 14:00 Nordica Hotel

Minumum 25 persons

Blue Lagoon (starting at 2 pm), price pr. pers. ISK 5 900.-

We begin with a short drive to Álftanes peninsula, and past Bessastaðir, the official residence of Iceland's President. Then through Hafnarfjörður and straight ahead to the Blue Lagoon. The Blue Lagoon is known for its special properties and its beneficial effect on the skin and attracts visitors from all over the world in search of health, relaxation and an exotic experience. We stop for a refreshing bath or swim in the pleasantly warm mineral-rich water, reputed for its healing properties, before driving back to Reykjavík.

Duration: Approx. 4 hours. Incl. bus, guide, entrance fee and light refreshments.

Pick up; 14:00 Nordica Hotel

Further information and addititonal Tickets for the Social program and the Congress Tours can be purchased at the Registration Desk.

INVITED GUEST SPEAKERS

SIR LUDWIG GUTTMANN LECTURE

Kristjan T. Ragnarsson, M.D. graduated from the University of Iceland School of Medicine in 1969 and completed a residency in Physical Medicine and Rehabilitation and a research fellowship in spinal cord injury (SCI) medicine at the New York University Medical Center, Rusk Institute of Rehabilitation Medicine in 1975. He was appointed to the faculty of the Department of Rehabilitation Medicine of NYU School of Medicine in 1976. He was involved with the New York SCI Model System of Care from its inception in 1973 and served as its Director from 1981 to 1986, when he was appointed Professor and Chairman of the Department of Rehabilitation Medicine at Mount Sinai, a position that he has held since.

At Mount Sinai, Dr. Ragnarsson has been responsible for the growth of the Department of Rehabilitation Medicine's clinical and academic programs while serving Mount Sinai and other organizations in various leadership roles, e.g., President of the Mount Sinai Hospital Medical Board (1995–1997), Chair, Board of Governors of the Mount Sinai Faculty Practice Associates (1997–2003), Director of the Federally funded Mount Sinai SCI Model System of Care (since 1990), President of the American Spinal Injury Association (1993–1995), Board Member, American Paraplegia Society (1997–1999), member of the Veteran's Affairs Scientific Merit Review Board (1984–2000), Chairman of the NIH Consensus Conference on "Rehabilitation of Persons with Traumatic Brain Injury" (1998), Chairman NIDRR Model Systems Review Committee (2003–2005), President Elect of the Association of Academic Physiatrists (2007–2009), etc.

Dr. Ragnarsson has received numerous honors and awards for his work. His expertise includes evaluation and management of persons with physical disability due to SCI, spine disorders, brain injury, limb amputations and pain. He has conducted numerous research projects and been involved in the development and testing of high technology devices for persons with disability. He has published more than 130 articles and book chapters and made numerous presentations in his field of expertise, locally, nationally and internationally.

LARS SULLIVAN MEMORIAL LECTURE

Marcalee Sipski Alexander is Professor of Physical Medicine and Rehabilitation at the University of Alabama's School of Medicine in Birmingham and holder of the Spain Endowed Chair in Neuroscience Research. Dr. Sipski is also the President of the American Spinal Injury Association and Vice President for North America for ISCoS. Dr. Sipski has been working in the field of Spinal Cord Injury since 1986. She is most known for her laboratory-based research on sexual response in women after SCI and production of the video *Sexuality Reborn*. Most recently she has chaired the international effort to develop standards for description of remaining autonomic function after SCI. Personally she is married to Craig Alexander, PhD and has three young boys, Jagger, Sterling and Graham.

SOCIETY MEDAL HOLDERS

| | | | |
|------------|-------------------------------|----------------|----------------|
| 1975/1976: | Sir Ludwig GUTTMANN | (UK) | (Deceased) |
| | Dr Ernest BORS | (USA) | (Deceased) |
| 1978: | Dr L MICHAELIS | (UK) | (Deceased) |
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| 1983: | Pror Hans FRANKEL | (UK) | |
| 1984: | Dr Y NAKAMURA | (Japan) | (Deceased) |
| 1985: | Dr M WEISS | (Poland) | (Posthumously) |
| | Mr Phillip HARRIS | (UK) | |
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| 1990: | Dr Paul DOLLFUS | (France) | |
| 1991: | Dr Ed CARTER | (USA) | |
| 1992: | Dr A KEY | (South Africa) | (Deceased) |
| 1993: | Air Marshal (Rtd) Amar CHAHAL | (India) | |
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| 2006: | Dr Lee ILLIS | (UK) | |

The Organizing Committee gratefully acknowledges
and thanks the financial support from the following
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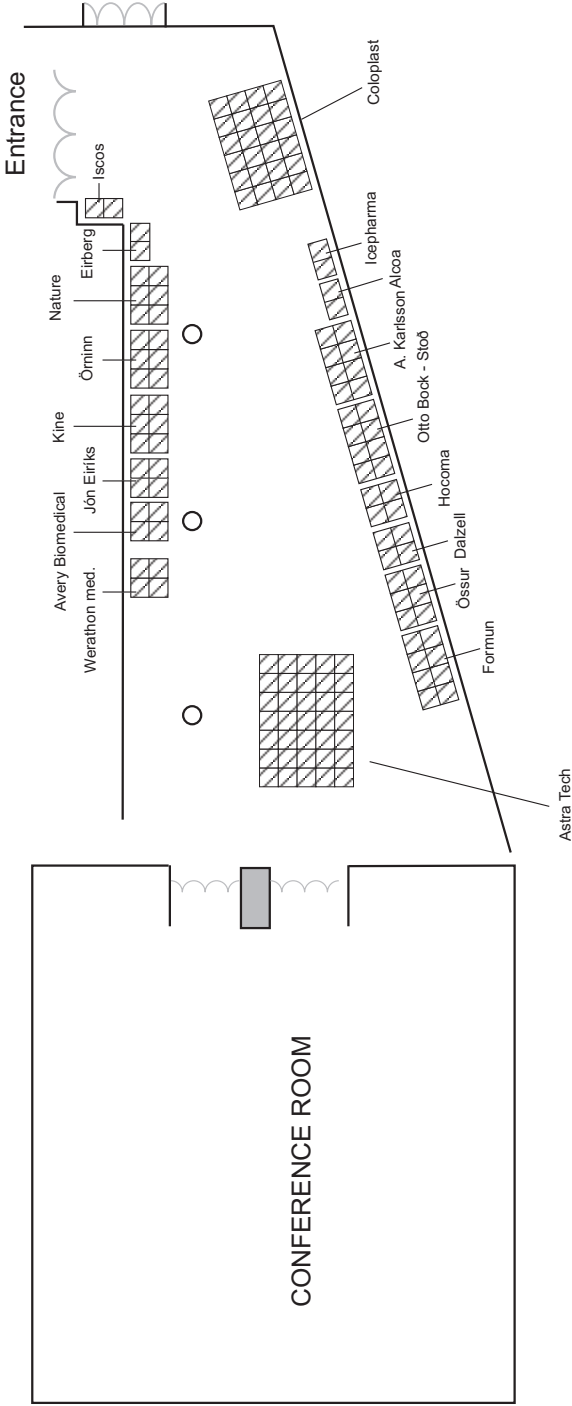
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- Available spaces
- Occupied



PROGRAM AT A GLANCE

Wednesday 27 June – Pre-Congress Events

| | |
|-------------|--|
| 08.00 | Registration opens |
| 09.00–11.30 | Pre-Congress Workshop |
| 09.00–11.30 | Pre-Congress Workshop 1 Lokomat – Robotic Gait training with Body Weight Support, held at the Department of Rehabilitation at Landspítali University Hospital <i>Sponsored by Hocoma AG and Landspítali University Hospital</i> |
| 09.30–11.30 | Clinical visit to the Department of Rehabilitation at Landspítali University Hospital |
| 13.00–18.00 | Pre-Congress Workshops |

| | HALL A | HALL B |
|-------------|---|---|
| 13.00–16.15 | Pre-Congress Symposium Physical Activity as health promotion for Disabled Individuals | |
| 13.30–16.00 | | |
| 13.30–18.00 | | Pre-Congress Workshop 2 Cross Disciplinary Treatment: A means of improving patient Quality of Life – Management of bladder, bowel and sexual dysfunction <i>Sponsored by COLOPLAST</i> |
| 16.30–18.00 | Pre-Congress Workshop 4 Movement analysis, Electromyography and clinical applications <i>Sponsored by KINE</i> | |

19.00 “Get Together” at Kjarvalstaðir Museum

| HALL D | | | |
|--------|--|--------|--|
| HALL H | | HALL I | |
| | | | |
| | Pre-Congress Workshop 3 Advanced C-Spine Stabilization <i>Sponsored by ÖSSUR</i> | | |
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PROGRAM AT A GLANCE

| | | |
|------------------|---|---|
| Thursday 28 June | | |
| 08.00 | Registration opens | |
| 08.45–09.30 | Opening Ceremony – Hall A and B | |
| 09.30–10.15 | Sir Ludwig Guttmann Lecture – Hall A and B Functional Electrical and Therapeutic Stimulation in SCI: Current use and future direction | |
| 10.15–10.45 | Coffee break/Exhibition/Posters | |
| | HALL A | HALL B |
| 10.45–12.30 | Main topic Late Complications | Main topic Functional Electrical Stimulation |
| 12.30–13.45 | Lunch/ Exhibition/Posters | |
| 13.45–15.30 | Main topic – cont. Late Complications | Workshop 1 The International Data Sets |
| 15.30–16.00 | Coffee break/ Exhibition/Posters | |
| 16.00–17.00 | | |
| 16.00–17.15 | Main topic – cont. Late Complications | Workshop 1 – cont. The International Data Sets |
| 17.15–18.15 | ISCoS General Meeting – Hall A | |
| 19.00–21.00 | Reception at the City Hall | |

| HALL H | | HALL I |
|--------|--|--------|
| | General session 1 Measurement- Assessment | |
| | | |
| | General session 2 Physical Activity, Health And Well-Being | |
| | | |
| | General session 3 Function – Recovery | |
| | | |

PROGRAM AT A GLANCE

| Friday 29 June | | |
|----------------|--|---|
| | HALL A | HALL B |
| 08.30–10.15 | Symposium 1 Prevention of Spinal Cord Injury | Symposium 2 Use of electrical stimulation in paraplegics with long-term Denervated Degenerated Muscles |
| 09.00–10.15 | | |
| 10.15–10.45 | Coffee break/ Exhibition/Posters | |
| 10.35–12.15 | | Symposium 2 – cont. Use of electrical stimulation in |
| 10.45–12.15 | Symposium 1 – cont. Prevention of Spinal Cord Injury | |
| 12.15–13.30 | Lunch/ Exhibition/Posters | |
| 13.30–15.15 | Workshop 2 Report of the project “Development of ICF core sets for Spinal Cord Injury” (SCI) | Workshop 3 Recent updates in Functional Electrical Neuromusclar Stimulation research in SCI |
| 15.15–16.00 | Coffee break/ Exhibition/Posters | |
| 15.45–17.00 | Workshop 5 ESCIF: Towards a unified voice in Europe for people living with Spinal Cord Injury | Workshop 3 – cont. Recent updates in functional electrical neuromusclar stimulation research in SCI |
| 17.00–18.00 | NosCos General Meeting – Hall I | |
| 19.30 | Dinner Dance at Hotel Nordica | |

| HALL H | | HALL I |
|--------|---|--|
| | | General Session 4 SCI-Care and follow-up |
| | Main Topic Impact of SCI on the family | |
| | | |
| | Main Topic Coping Strategies | General Session 5 Sexual Function – Bowel Function |
| | | |
| | Main Topic Metabolism, Nutrition and Obesity | Workshop 4 Sexuality and the person with Spinal Cord Injury – An awareness workshop |
| | | |
| | Main topic – cont. Metabolism, Nutrition and Obesity | Workshop 4 – cont. Sexuality and the person with Spinal Cord Injury – An awareness workshop |
| | | |

PROGRAM AT A GLANCE

Saturday 30 June

| | HALL A | HALL B |
|-------------|---|--|
| 09.00–10.15 | Workshop 6 Translating SCI repair strategies to human application | |
| 09.00–10.30 | | General Session 7 Bladder function |
| 10.15–10.40 | Coffee break/ Exhibition/Posters | |
| 10.45–11.25 | Workshop 6 – cont. Translating SCI repair strategies to human application | |
| 11.00–11.25 | | General Session 7 – cont. Bladder function |
| 11.25–13.00 | Plenary Session | Plenary Session |

| | |
|-------------|---|
| 11.30–12.15 | Lars Sullivan Memorial Lecture: Autonomic Function and Spinal Cord Injury: Are we at a Crossroad? |
| 12.15–12.30 | Awards for best posters |
| 12.30–12.45 | Invitations to the 11th NoSCoS Congress and the 47th ISCoS Scientific Meeting |
| 12.45–13.00 | Closing of the Congress |

Sunday 1 July

| | |
|-------------|--|
| 09.30–11.30 | Clinical visit to the Department of Rehabilitation at Landspítali University Hospital |
|-------------|--|

| HALL H | | HALL I |
|--------|--|--------|
| | Workshop 7 Living with Spinal Cord Injury, coping with a new life-long situation | |
| | | |
| | | |
| | Workshop 7 – cont. Living with Spinal Cord Injury, coping with a new life-long situation | |
| | | |
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| | | |

PROGRAM

Tuesday 26 June

Committee Meetings

| | |
|-------------|----------------------------|
| 08.00–10.30 | ISCoS Executive Committee |
| 10.30–11.00 | ISCoS Nomination Committee |
| 11.00–12.00 | ISCoS Prevention Committee |
| 12.00–13.30 | Lunch |
| 13.30–15.30 | ISCoS Scientific Committee |
| 15.30–17.00 | ISCoS Education Committee |
| 17.00–18.30 | ISCoS Editorial Board |
| 17.00–18.30 | NoSCoS Executive Committee |
| 20.00 | ISCoS Council Dinner |

Wednesday 27 June – Pre-Congress Events

| | |
|-------------|------------------------|
| 09.0–12.00 | ISCoS Council Meeting |
| 12.00–13.00 | NoSCoS Council Meeting |

Pre-Congress Program

Morning

Venue: Department of Rehabilitation at Landspítali University Hospital

Bus transport from Hotel Nordica 09.00

09.00–11.30 PRE-CONGRESS WORKSHOP 1

Lokomat- Robotic Gait training with Body Weight Support

Sponsored by Hocoma AG, Switzerland and Landspítali University Hospital

09.00–10.00 Presentation (Theory)

PW-1 Advanced functional movement therapy

Speakers: Michael Stipar, Isabel Gauggel

- Overview
- From manual to automated treadmill training
- Indications/ Contraindications
- Research papers

10.00–10.15 Coffee break

10.15–11.30 Lokomat demo

- Patient training
- Demonstration of functions of Lokomat
- Questions

09.30–11.30 Clinical visit

to the Department of Rehabilitation at Landspítali University Hospital

Wednesday 27 June – Pre-Congress Workshops and Symposium

Afternoon

Venue: Hotel Nordica

13.00–16.15 PRE-CONGRESS SYMPOSIUM

Hall H

Physical Activity as Health promotion for Disabled Individuals

Chairs: Sigrún Knútsdóttir, Anne Lannem

13.00–13.10 Opening of the session

Sigrún Knútsdóttir

- 13.10–13.40 PS-1 Exercise as a countermeasure for deconditioning and accelerated cardiovascular related diseases after SCI: A Worldwide perspective
Mark Nash, PhD. FACSM, Ass. Professor
- 13.40–14.10 PS-2 Psychological and psycho-behavioural aspects of physical activity for SCI Individuals
Marit Sørensen, professor
- 14.10–14.30 PS-3 Motivation for physical activity of individuals with complete and incomplete spinal cord injuries
Anne Lannem, PT
- 14.30–14.50 **Coffee Break**
- 14.50–15.05 PS-4 Health promotion in spinal cord rehabilitation, a model
Anne-Carin Lagerström PT, Kerstin Wahman PT
- 15.05–15.15 PS-5 Adapted physical activity as a part of Rehabilitation in Finland
Paula Leppänen, PT
- 15.15–15.25 PS-6 Adapted physical activity at Clinic for Spinal cord injury in Denmark
Mette Molin Nefling, PT
- 15.25–15.35 PS-7 Fitness Training Programme of SCI individuals in Iceland
Herdís Þórisdóttir PT
- 15.35–16.10 **Panel discussion:**
Ways to motivate and improve health promotion and physical activity of disabled persons
Participants: Mark Nash, Marit Sørensen, Anna-Carin Lagerström, Kerstin Wahman, Anne Lannem
Moderator: Sigrún Knútsdóttir
- 16.10–16.15 **Closing**

| 13.30–18.00 | PRE-CONGRESS WORKSHOP 2 | HALL I |
|-------------|---|--------|
| | PW-2 Cross Disciplinary Treatment: A means of improving patient Quality of life – Management of bladder, bowel and sexual dysfunction <i>Sponsored by Coloplast</i> | |
| 13.15–13.25 | Door opens | |
| 13.25–13.40 | Welcome and Coloplast Introduction <i>John Raabo Nielsen, Vice President Global R&D Coloplast</i> | |
| 13.40–13.50 | Chairman's welcome and introduction <i>Christine Norton PhD.MA.RN, Jens Sönksen, MD, PhD, DMSci</i> | |
| 13.50–14.20 | The "whole person" – patient perspective <i>Michael Cogswell</i> | |
| 14.20–14.50 | Bladder dysfunction <i>Jean-Jacueqs Wyndaele, MD, DSci PhD</i> | |
| 14.50–15.20 | Bowel dysfunction <i>Maureen Coggrave, MD</i> | |
| 15.20–16.00 | Coffee and Network | |
| 16.00–16.30 | Sexual dysfunction – men <i>Dana Ohl, MD</i> | |
| 16.30–17.00 | Sexual dysfunction – women <i>Marcalee Sipski, MD</i> | |
| 17.00–17.10 | Break | |
| 17.10–17.55 | Cross-disciplinary focus in Rehab and Follow-up: Current practice and recommendations <i>Panel: Klaus Krogh, MD, DMSci, PhD, Fin Biering-Sørensen, MD DMSci, William Donovan, MD, Prof., Burkhard Domurath, MD</i> | |
| 17.55–18.00 | Key learning and conclusions | |
| 18.00–18.05 | Closing | |

13.30–16.30 PRE-CONGRESS WORKSHOP 3 HALL D

PW-3 Advanced C-Spine Stabilization
Sponsored by Össur
Presenter: Lisa Tweardy

- 13:30–13:45 Introduction of Speaker and Subject Matter: Cervical Spine Continuum of Care
- 13:45–15:00 Understanding mechanism of injury and principles of care for acute cervical cord injury. This discussion will include radiographic analysis and biomechanics of the cervical spine
- 15:00–15:30 **Coffee break**
- 15:30–16:30 C-spine immobilization algorithm
This discussion will include an analysis of proper orthotic application based upon injury level, severity of instability, and patient management considerations

16.30–18.00 PRE-CONGRESS WORKSHOP 4 HALL H

PW-4 Movement analysis, Electromyography and clinical applications
Sponsored by Kine

Speakers: Einar Einarsson B.Sc. PT MTC, MSc. Bio-Medical Engineering, Johan Jonsson M.Sc. Electrical Engineering w. focus on Medical Science

- 16.30–16.45 Introduction
- 16.45–17.10 Biological and biomechanical signals and processing
- a) Kinematics
 - b) Kinetics
 - c) EMG
 - d) Objective Methods
- 17.10–17.20 **Coffee break**

- 17.20–18.00 Application & Product Demo
- a) KineGait-gait control in 5 minutes with video recording
 - b) KineView-sophisticated movement analysis with video recording
 - c) KineLive-Visual EMG-Biofeedback
 - d) KinePro-Synchronised movement analysis and EMG
 - e) Discussion

Thursday 28 June

- 08.00 **Registration and poster setup** **HALL A and B**
- 08.45–09.30 **Opening Ceremony**

09.30–10.15 **PLENARY SESSION** **HALL A and B**

Chairs: Fin Biering-Sørensen, Stefán Yngvason

SIR LUDWIG GUTTMANN LECTURE

K-1 Functional Electrical and Therapeutic Stimulation in SCI: Current use and future direction

Kristján T Ragnarsson

- 10.45–12.30 **Concurrent Sessions**

10.45–12.30 **LATE COMPLICATIONS** **HALL A**

Chairs: Susan Charlifue, Stefán Yngvason

- 10.45–11.15 O-1 Introduction Presentation:
Late Complications in Spinal Cord Injury – Anticipating and Planning for the Consequences
Susan Charlifue
- 11.15–11.30 O-2 Medical Complications and their Impact on Life Satisfaction in Adults with Pediatric-onset Spinal Cord Injury
Lawrence Vogel
- 11.30–11.45 O-3 Performance: Capacity ratio – a new clinical tool?
Lone Skriver Rose

- 11.45–12.00 O-4 Ultrasonographic findings of shoulder able-bodies, paraplegic and tetraplegic subjects
Eija Ahoniemi
- 12.00–12.15 O-5 Long-term paraplegia and the weight-bearing shoulder. A Comparison of Functional and Structural Changes in Paraplegic Patients and Controls
Michael Akbar
- 12.15–12.30 O-6 Repetitive Transcranial Magnetic Stimulation in SCI Patients with Central Pain: a PET Study
Hyung-ik Shin

10.45–12.30 FUNCTIONAL ELECTRICAL STIMULATION HALL B

Chairs: Kristján T. Ragnarsson, Páll E. Ingvarsson

- 10.45–11.00 O-19 Cardiorespiratory adaptations to 12 months of high volume functional electrical stimulated (FES) cycle training in paraplegic subjects
Helen Berry
- 11.00–11.15 O-20 The use of Functional Electrical Stimulation during Rehabilitation and at Home
Ines Bersch
- 11.15–11.30 O-21 Brain-Computer interface for “Thought” – Control of grasp neuroprosthesis
Rüdiger Rupp
- 11.30–11.45 O-22 Functional Results Following Implantation of an Upper Extremity Neuroprosthesis Utilizing Myoelectric Control
Anne Bryden
- 11.45– 12.00 O-23 Rehabilitation robotics with electrical muscle stimulation control, a pilot study in SCI population
Patrick Métrailler
- 12.00–12.15 O-24 Laparoscopic Motor Point Diaphragm Pacing Stimulation (DPS) System: Clinical Results for Tetraplegia
Raymond Onders
- 12.15–12.30 Questions and discussion

| 10.45–12.30 | GENERAL SESSION 1 | HALL H |
|-------------|--|--------|
| | Measurement and Assessment | |
| | <i>Chairs: John Ditunno, Finnbogi Jakobsson</i> | |
| 10.45–10.55 | O-25 MRI as a reliable alternative to CT in the assessment of healing of fractures in spinal injury <i>Rowena Warwick</i> | |
| 10.55–11.05 | O-26 MRI imaging assessment in spinal cord injury: experience from a Phase 2 randomized controlled trial <i>Daniel Lammertse</i> | |
| 11.05–11.15 | O-27 A computerised program for AO Comprehensive Classification of Thoracic and Lumbar Injuries <i>Dajue Wang</i> | |
| 11.15–11.25 | O-28 The determination of the level of spinal cord injury according to the measurement of skin resistance <i>Bafak Sahir Karamehmetoglu</i> | |
| 11.25–11.35 | O-29 Responsiveness of a short-form sensory exam II in Spinal Cord Injury <i>Ralph Marino</i> | |
| 11.35–11.45 | O-30 A novel method for improving the reproducibility of electrical perceptual thresholds for detecting change in spinal cord function <i>Susan Rutkowski</i> | |
| 11.45–11.55 | O-31 Modified Cold Pressor Test by Cold Application to the foot after Spinal Cord Injury suggests hemodynamic control by the Spinal Cord and can be used to assess Spinal Cord Autonomic integrity <i>Amiram Catz</i> | |
| 11.55–12.05 | O-32 Neurological changes or interrater variability – human vs. computerised ASIA classification <i>Rüdiger Rupp</i> | |
| 12.05–12.15 | O-33 Feasibility of incorporating peripheral Quantitative Computed Tomography scans in SCI annual reviews <i>Sylvie Coupaud</i> | |
| 12.15–12.30 | Questions and discussion | |

13.45–15.30 **Concurrent Sessions**

13.45–15.30 LATE COMPLICATIONS HALL A

Chairs: Waghi El Masri, Björn Zoëga

- 13.45–14.00 O-7 Long term follow up of operatively treated sacral fractures
Thomas Glott
- 14.00–14.15 O-8 Spinal Cord Injury Pain and Quality of Life Post-Discharge: New Research Initiatives
Kathryn Boschen
- 14.15–14.30 O-9 Late diseases due to inadequate treatment of vertebral fractures in paraplegics
Homère Mouchaty
- 14.30–14.45 O-10 Hip and Spine Deformities following Childhood onset Spinal Cord Injury
Vivien Jörgensen
- 14.45–15.00 O-11 Survival following ventilation after spinal cord damage
Pedro Silva
- 15.00–15.15 O-12 Predicting the risk of lung infection after a spinal cord injury with spirometric parameters
Karin Postma
- 15.15–15.30 O-13 Real costs of colonised paraplegic patients with MRSA
Markus Eichler

13.45–15.30 WORKSHOP 1 HALL B

The international data sets

Chairs: Fin Biering-Sørensen, Marcalee Sipski Alexander

- 13.45–14.00 W-1 International Spinal Cord Injury Data Sets. What have we done?
Fin Biering-Sørensen
- 14.00–14.30 W-2 International Classification of External Causes of Injury (ICECI) Toward an international SCI Prevention Module
Bonne Lee

- 14.30–14.50 W-3 Vertebral injury and Spinal Surgery
Peter Wing
- 14.50–15.10 W-4 Non-traumatic Spinal Cord Lesions
Ruth Marshall
- 15.10–15.25 W-5 Urological Data Sets
Jean-Jaques Wyndaele

13.45–15.30 GENERAL SESSION 2

HALL H
Physical activity, health and well being
Chairs: Nils Hjeltnes, Sigrún Knútsdóttir

- 13.45–13.55 O-34 Restoration of the level of everyday physical activity after a spinal cord injury
Rita van den Berg-Emons
- 13.55–14.05 O-35 Prognostic factors of fitness: Management and behavioural aspects following spinal cord injury
Janneke Haisma
- 14.05–14.15 O-36 Spinal cord injury, health and well-being, association between self-reports and objective measures
Anne Lannem
- 14.15–14.25 O-37 Evaluation of lung function and maximal oxygen uptake in spinal cord injured subjects at Sunnaas Rehabilitation Hospital: A comparison between two time periods
Matthijs Wouda
- 14.25–14.35 O-38 Peripheral vascular changes after home-based passive cycling training in people with paraplegia
Laurent Ballaz
- 14.35–14.45 O-39 Tilt Table Studies (TTS) prior to mobilization of patients with Incomplete Spinal Cord Injury (SCI)
Jane Weston
- 14.45–15.55 O-40 Hand Management in patients with Cervical Spinal Cord Injury in 31 German Speaking Spinal Units
Helga E. Lechner

- 14.55–15.05 O-41 Patient performance and satisfaction after reconstruction of hand function in tetraplegia
Johanna Wangdell
- 15.05–15.15 O-42 Rehabilitation robotics with closed loop electrical muscle stimulation, a pilot study in SCI population
Abdul-Wahab Al-Khodairy
- 15.15–15.25 O-43 Incidence of smoking after spinal cord injury
Imon Chakraborty

16.00–17.15 **Concurrent Sessions**

16.00–17.15 LATE COMPLICATIONS, cont. HALL A

Chairs: Sergio Aito, Marta Kjartansdóttir

- 16.00–16.15 O-14 Spinal Cord Injury and Pressure ulcers – a follow-up study
Per Åkerlund
- 16.15–16.30 O-15 Enoxaparin Thromboprophylaxis in Spinal Cord Injury Patients: Five Years of Experience
Fadel Derry
- 16.30–16.45 O-16 Does time since injury affect colorectal dysfunction in SCI patients?
Pia Moeller Faaborg
- 16.45–17.00 O-17 Lack of correlation among colonic transit, bowel motion frequency and stool form in SCI patients
Gabriele Bazzocchi
- 17.00–17.15 O-18 A brief follow-up evaluation and early detection of complications in Spinal Cord Injury patients.
Gerardo Correa-Illanes

16.00–17.15 WORKSHOP 1, cont. HALL B

The international data sets

Chairs: Fin Biering-Sørensen, Marcalee Sipski Alexander

- 15.45–16.05 W-6 Bowel Data Sets
Klaus Krogh

- 16.05–16.25 W-7 Pain Data Set
Eva Widerström-Noga
- 16.25–16.40 W-8 Activity and Participation
Susan Charlifue
- 16.40–16.55 W-9 Well-being
Susan Charlifue
- 16.55–17.15 Discussion and Sum-up and what next
Marcelee Sipski Alexander

| | | |
|--------------------|--------------------------|---------------|
| 16.00–17.00 | GENERAL SESSION 3 | HALL H |
|--------------------|--------------------------|---------------|

Chairs: Ralph Marino, Gísli Einarsson

- 16.00–16.10 O-45 Human embryonic stem cell-derived Oligodendrocytors Progenitors for the treatment of Spinal Cord Injury: Translation from Preclinical studies to clinical trials
Edward Wirth
- 16.10–16.20 O-46 Characteristics of sports related spinal cord injuries: Data from Northwest of England, 1999 through 2003
Babu Naveen Kumar
- 16.20–16.30 O-47 Trampoline accidents causing spinal cord injury
Nazakat Hussain
- 16.30–16.40 O-48 Outcomes in patients admitted to rehabilitation with spinal cord lesions following Multiple Sclerosis
Jacob Ronen
- 16.40–16.55 O-44 Thrombophilia is associated with failure of heparin to prevent venous thromboembolism (VTE) in patients with acute traumatic spinal cord injury (ATSCI)
Gabi Zeilig
- 16.55–17.00 Questions and discussion

| | | |
|--------------------|------------------------------|---------------|
| 17.15–18.15 | ISCoS General Meeting | HALL A |
|--------------------|------------------------------|---------------|

Friday 29 June

08.30–10.15 **Concurrent Sessions**

08.30–10.15 SYMPOSIUM 1 **HALL A**

Prevention of spinal cord injury

Chairs: Douglas S Brown, Sigrún Knútsdóttir

Prevention: The extent of the problem, the data and prevention

08.30–08.35 Introduction

Douglas Brown

08.35–08.55 S-1 Epidemiology and programmes for prevention of spinal injuries in India

H Singh Chhabra

08.55–09.15 S-2 Spinal Cord Injury in New Zealand; Incidence, Cause and Prevention

R H Acland

09.15–09.35 S-3 Do we have all the pieces? Assembling the SCI prevention puzzle in South Africa

Robert Campbell

09.35–09.55 S-4 Spinal Cord Injury in Victoria, Australia: Incidence, Cause and Prevention

Douglas Brown

09.55–10.15 S-5 Spinal Cord Injury in the Nordic Countries; Incidence, Cause and Prevention

Sigrún Knútsdóttir

08.30–10.15 SYMPOSIUM 2 HALL B

Use of electrical stimulation in paraplegics with long-term denervated degenerated muscles (DDM)
Chairs: Jonathan Jarvis, Winfried Mayr

- 08.30–08.40 S-10 The European R&D Project RISE – use of electrical stimulation to restore standing in paraplegics with long-term denervated degenerated muscles (DDM)
Winfried Mayr
- 08.40–09.10 S-11 Stimulation of long-term denervated lower hind limb muscles in animals
Jonathan Jarvis
- 09.10–09.20 S-12 Stimulation equipment for FES of denervated muscles in experiment and their clinical application
Winfried Mayr
- 09.20–09.50 S-13 Restoring the denervated human muscle by FES: Clinical results of the European research project RISE
Michael Vogelauer
- 09.50–10.05 S-14 The Icelandic experience on FES of denervated muscles – including patient demonstration
Páll E. Ingvarsson

09.00–10.15 IMPACT OF SCI ON THE FAMILY HALL H

Chairs: Margareta Kreuter, Sigrún Garðarsdóttir

- 09.00–09.30 O-49 Introduction Presentation: Impact of SCI on the Family
Margareta Kreuter
- 09.30–09.45 O-50 Health Status, Quality of Life and Strain in Carers during Community Reintegration after SCI
James Middleton
- 09.45–10.00 O-51 Severely disabled SCI Person as an employer for a personal assistant
Matti Koikkalainen

- 10.00–10.15 O-52 Evolution of the Cervical Traumatic Spinal Cord injury at Elderly Subjects
Aurelian Anghelescu

08.30–10.15 GENERAL SESSION 4 HALL I

Sci-care and follow up

Chairs: Dan Lammertse, Björn Zoëga

- 08.30–08.40 O-53 The future of spinal cord injury care: Results of an international workshop
Claire Weeks
- 08.40–08.50 O-54 Early acute management in adults with SCI: A clinical practice guideline for health-care providers
Peter Wing
- 08.50–09.00 O-55 Clinical pathways for spinal cord injury
Charlotte Kiekens
- 09.00–09.10 O-56 Evidence based medicine and spinal cord injury: A clinical case
Andrea Townson
- 09.10–09.20 O-57 Pragmatics and recruitment issues in a phase II, randomized, controlled trial
Linda Jones
- 09.20–09.30 O-58 ICU and intermediate intensive care in high cervical injuries at Spinal injury unit in Göteborg Sweden
Lena Rutberg
- 09.30–09.40 O-59 Time course of respiratory function after spinal cord injure: A prospective cohort study
Gabi Mueller
- 09.40–09.50 O-60 Telemedicine: A tool to improve spinal cord injury care in Southwest England?
Anba Soopramanien
- 09.50–10.00 O-61 Adults with Spina Bifida in the greater Stockholm region – follow-up study
Lars Werhagen

10.00–10.10 O-62 The Development of Spinal Cord Injury Programs and Services in Lithuania
William Waring

10.45–12.15 SYMPOSIUM 1 **HALL A**

Prevention of Spinal Cord Injury

Chairs: Douglas Brown, Dajue Wang

10.45–12.15 Prevention Workshops:

10.45–11.10 1. S-6 SCI and Road Traffic Accidents
Traffic accident prevention:
Fin Biering-Sörensen
Panel: H.Sing Chhabra, Richard Acland, Robert Campbell, Douglas. Brown, Ágúst Mogensen, Peter Wing, Fin Biering-Sörensen
Chair: James Middleton

11.10–11.35 2. S-7 SCI and Work Accidents
SCI and work
Peter Wing
Panel: James Middleton, H. Shing Chhabra, Richard Acland, Robert Campbell, Þórunn Sveinsdóttir, Peter Wing, Fin Biering-Sörensen
Chair: Douglas Brown

11.35–12.00 3. S-8 SCI and Rugby HALL A
Strategies to prevent spinal cord injury from rugby football
James Middleton
Panel: James Middleton, H. Shing Chhabra, Richard Acland, Robert Campbell, Peter Wing
Chair: Peter Wing

4. S-9 SCI and Horse Riding HALL D
Spinal Injuries among Horseback Riders in Iceland; what measures can be taken?
Þórir Björn Kolbeinsson
Panel: Þórir Björn Kolbeinsson, Erika Nilsson, Fin Biering-Sörensen
Chair: Stefán Yngvason

12.00–12.15 Conclusions and closing

10.35–12.15 SYMPOSIUM 2 HALL B

Use of electrical stimulation in paraplegics with long-term denervated degenerated muscles (DDM)

Chairs: Jonathan Jarvis, Winfried Mayr

- 10.35–11.00 S-15 Myogenesis in denervated human muscle and FES-induced muscle recovery in chronic flaccid paraplegia
Ugo Carraro
- 11.00–11.15 S-16 Test- and measurement equipment for functional assessment of denervated muscles
Dietmar Rafolt
- 11.15–11.35 S-17 Bone Density Distribution (BDD) in Spinal Cord Injured (SCI) Patients with Denervated and Degenerated Muscles (DDM) treated with Electrical Stimulation (ES)
Pórður Helgason
- 11.35–11.45 S-18 Segmentation of muscle bellies: Monitoring of denervated degenerated muscle growth influenced by FES
Paolo Gargiulo
- 11.45–12.15 Panel Discussion: Practical use and appropriate place of FES in the future treatment of paraplegias of Lower Motor Neurone type – preclinical, technological and clinical viewpoints.
Chair: Páll E. Ingvarsson

10.45–12.15 COPING STRATEGIES HALL H

Chairs: Paul Kennedy, Sigrún Garðarsdóttir

- 10.45–11.15 O-63 Introduction Presentation:
Coping with Spinal Cord Injuries: What Makes the Difference?
Paul Kennedy
- 11.15–11.30 O-64 A cross-national validation of the Spinal Cord Lesion-related coping strategies Questionnaire
Magnus Elfström
- 11.30–11.45 O-65 Describing mood, illness, cognitions and well-being in a Dutch Spinal Cord Injured Population
Marieke Wollaars

- 11.45–12.00 O-66 Psychosocial aspects of traumatic spinal cord injury with onset during adolescence
Marika Augutis

10.45–12.15 GENERAL SESSION 5 HALL I

Bowel function and Sexual function

Chairs: Jens Sønksen, Marta Kjartansdóttir

- 10.45–10.55 O-67 A randomised controlled trial of a stepwise protocol for bowel management after spinal cord injury
Maureen Coggrave
- 10.55–11.05 O-68 Physiopathology of constipation and fecal incontinence in motor incomplete spinal cord injury (SCI)
Margarita Vallés
- 11.05–11.15 O-69 Surgical options for the treatment of faecal incontinence in patients suffering from conus-cauda-syndrome
Karin Gstaltner
- 11.15–11.25 O-70 Vibratory ejaculation and home insemination in 140 spinal cord injured men and their partners
Jens Sønksen
- 11.25–11.35 O-71 Prediction of Erectile Response with Sildenafil by the new '100 Erection Scale' in Persons with SCI
Bum-Suk Lee
- 11.35–11.45 O-72 Self-triggered dorsal penile/clitoral nerve stimulation to treat neurogenic detrusor overactivity
Eloy Opisso
- 11.45–11.55 O-73 Sexual life of males over 50 with spinal cord lesions of 20 or more years post-injury
Giulio Del Popolo
- 11.55–12.10 O-74 Sexual function and quality of life of traumatic SCI male Individuals
Rafi Heruti

13.30–15.15 **Concurrent Sessions**

13.30–15.15 WORKSHOP 2

HALL A

Report of the project “Development of ICF core sets for spinal cord injury” (SCI)

Chairman: Gerold Stucki

- 13.30–13.40 Introduction
W-10 Evaluation of different perspectives on problems experienced by individuals with SCI: report of the project ‘Development of ICF Core Sets for Spinal Cord Injury (SCI)’
Gerold Stucki
- 13.40–13.55 W-11 Identification of common problems in functioning of individuals with Spinal Cord Injury using the International Classification of Functioning, Disability and Health (ICF)
Susan Charlifue
- 13.55–14.10 W-12 Identification of problems in functioning related to Spinal Cord Injury from the individuals’ perspective: an international focus group study
Anne Sinnott
- 14.10–14.25 W-13 Identification of relevant aspects of functioning in individuals with Spinal Cord Injury from the health professional perspective: an international Expert Survey
Monika Scheuringer
- 14.25–14.40 W-14 Systematic review of parameters reported in published studies focusing on Spinal Cord Injury
Marieke Wollaars
- 14.40–14.55 Conclusion and next steps
- 14.55–15.15 Discussion

13.30–15.15 **WORKSHOP 3**

HALL B

Recent updates in functional electrical neuromuscular stimulation research in spinal cord injury

Chairs: Graham Creasey, Raymond Onders

- 13.30–13.35 Introduction
Gary Clark
- 13.35–14.00 W-15 Restoration of Cough with FES
- Video Presentation (10 minutes)
Graham Creasey
 - Demonstration Video (5 minutes)
Eric Schnetz
 - Questions and answers (10 minutes)
- 14.00–14.25 W-16 Restoration of Breathing in Tetraplegia with FES
- Presentation (10 minutes)
Raymond Onders
 - Demonstration Live or Video (5 minutes)
Laszlo Nagy
 - Questions and answers (10 minutes)
- 14.25–14.50 W-17 Restoration of Bladder Bowel and Sexual Function in SCI with FES
- Presentation (10 minutes)
Graham Creasey
 - Demonstration Video (5 minutes)
Jason Shaw
 - Questions and answers (10 minutes)
- 14.50–15.15 W-18 Restoration of Walking in Paraplegia with FES
- Presentation (10 minutes)
Ron Triolo
 - Demonstration Video (5 minutes)
Don Wheeler
 - Questions and answers (10 minutes)

13.30–15.15 METABOLISM, NUTRITION AND OBESITY HALL H

Chairs: William Bauman, Gísli Einarsson

- 13.30–14.00 Introduction Presentation
O-75 Current Thoughts on the Risk Factors for Coronary Heart Disease and Its Occurrence in Individuals with Spinal Cord Injury
William Bauman
- 14.00–14.15 O-76 Cardiovascular disease risk in persons with long standing spinal cord injury
Gordana Savic
- 14.15–14.30 O-77 Glucose tolerance in women with Spinal Cord Injury
Yuying Chen
- 14.30–14.45 O-78 Intermuscular thigh fat mass and insulin sensitivity in athletes with Spinal Cord Injury
Mina Mojtahedi
- 14.45–15.00 O-79 The relationship between physical activity and lipid profile in persons with spinal cord injury
Sonja de Groot
- 15.00–15.15 O-80 Energy expenditure during FES-Cycling in trained paraplegic subjects
Claudio Perret

13.30–15.15 WORKSHOP 4 HALL I

**Sexuality and the person with spinal cord injury
– An awareness workshop**

(Registration on site)

Chair: Rafi Heruti

- 13.30–14.25 W-21 Re-evaluating attitudes regarding Sexuality and Disability.
Rafi Heruti, Liora Reches, Liat Dori, Ram Kamin
- 14.25–14.50 From the emergency room to the delivery room – Effects of SCI on sexual function and management in the sexual rehabilitation clinic
Rafi Heruti

14.50–15.15 Sexuality after SCI and ways to deal with it – A theoretical approach will be presented with a case study of a man who survived severe SCI Injury and was sexually rehabilitated with the use of a surrogate partner
Liora Reches

15.45–17.00 **Concurrent Sessions**

15.45–17.00 WORKSHOP 5 HALL A

The European Spinal Cord Injuries Federation: Towards a unified voice in Europe for people living with Spinal Cord Injury

Chair: Daniel Joggi

15.45–16.15 W-22 The European Spinal Cord Injury Federation
Daniel Joggi

16.15–16.45 W-23 Acute care and primary rehabilitation in ESCIF member countries
Jane Horsewell

16.45–17.00 W-24 Nutrition and well being – the users’ perspective
Daniel Joggi and Jane Horsewell

15.45–17.00 WORKSHOP 3 HALL B

Recent updates in functional electrical neuromuscular stimulation research in spinal cord injury

Chairs: Graham Creasey, Raymond Onders

15:45–16:10 W-19 Restoration of Arm and Hand Function with FES

- Presentation (10 minutes)
Harry Hoyen
- Demonstration Video (5 minutes)
Annette Coker
- Questions and answers (10 minutes)

- 16.10–16.35 W-20 Restoration of Trunk Stability using FES
- Presentation (10 minutes)
Ronald Triolo
 - Demonstration Video (5 minutes)
Tim Smiley
 - Questions and answers (10 minutes)
- 16.35–17.00 Conclusion
Gary Clark
- Questions and Answers with live video feed from The MetroHealth Rehabilitation Institute of Ohio and The Cleveland FES Center
Laszlo Nagy, Emma Freeman, Don Wheeler, Jason Shaw, Alison Battaglia, Eric Schnetz, Tim Smiley

15.45–17.00 WORKSHOP 4 HALL I

**Sexuality and the person with spinal cord injury
– an awareness workshop**

Chair: Rafi Heruti

- 15.45–16.30 Participants will discuss case studies of their own or provided by instructors, using role playing technique
Rafi Heruti, Liora Reches, Liat Dori, Ram Kamin

- 16.30–16.45 Closure
Rafi Heruti, Liora Reches

15.45–17.00 METABOLISM, NUTRITION AND OBESITY, cont. HALL H

Chairs: Gísli Einarsson, Ann Spungen

- 15.45–16.00 O-81 Leg Skeletal muscle mass measured by partial body potassium counting versus leg lean mass by DXA in SCI
Ann Spungen
- 16.00–16.15 O-82 GLP-2 and bone resorption in Spinal Cord Injury
Dennis B. Henriksen

| | | |
|-------------|--|--|
| 16.15–16.30 | O-83 Early Use of Weekly Alendronate in Spinal Cord Injury <i>Rick Acland</i> | |
| 16.30–16.45 | O-84 Anaemia in early and chronic spinal cord injury: A role for hormonal factors? <i>Ruth Marshall</i> | |
| 16.45–17.00 | O-85 Effect of menopause on bone strength in the lower extremities of women with chronic SCI <i>Angela Frotzler</i> | |

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| 17.00–18.00 | NosCos General Meeting | Hall I |
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Saturday 30 June

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| 09.00–10.15 | Concurrent Sessions |
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| 09.00–10.15 | WORKSHOP 6 | HALL A and B |
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**Translating SCI repair strategies to human application:
What information does a clinician or patient require to
make an informed decision to participate in a clinical trial?**

Chair: John Steeves

| | |
|-------------|---|
| 09.00–09.25 | W-25 Overview of the preclinical status of several experimental therapeutic strategies <i>John Steeves</i> |
| 09.25–09.55 | W-26 Urological function and dysfunction after SCI <i>Michael Craggs</i> |
| 09.55–10.15 | W-27 Interventions for SCI which involve an invasive (surgical) approach <i>Michael Fehlings</i> |

09.00–10.15 GENERAL SESSION 6 HALL H

Bladder function
Chairs: Olof Jonsson, Guðmundur Geirsson

- 09.00–09.15 O-86 Recovery of spontaneous micturation related to level and degree of injury
Ann-Katrin Karlsson
- 09.15–09.30 O-87 Outcome of cystectomy for bladder cancer in spinal cord injury – can it be improved?
John Reynard
- 09.30–09.45 O-88 Long term follow-up study of bladder management of the spinal cord injured under the care of a specialised centre (Urodynamic studies)
T. Chong
- 09.45–10.00 O-89 Long term results of sacral root stimulation for neurogenic bladder in spinal injuries
Alfred Rodríguez
- 10.00–10.15 O-90 Dimercaptosuccinic Acid (DMSA) scan Vs. Magnetic Resonance Imaging(MRI) in detection of upper urinary tract infection in spinal cord injured patients
Balraj Singhal
-

09.00–10.15 WORKSHOP 7 HALL I

Living with spinal cord injury, coping with a new life-long situation
Chairs: Mette Molin Nefling, Sigrún Garðarsdóttir

- 09.00–09.10 Introduction
Mette Molin Nefling
- 09.10–09.30 W-29 Experiences with patient-relative seminar
Mette Molin Nefling
- 09.30–09.45 W-30 Course in communication, identity, self perception and sexuality for physically challenged women
Mette Mörken

- 09.45–10.00 W-31 Health Promotion in Spinal Cord Rehabilitation: A Patient's education manual for the aging Spinal Cord Population. A Model
Kerstin Wahman
- 10.00–10.15 W-32 Health promotion in Spinal Cord Rehabilitation: Food, Health and Motivation. A new Patient Education Module
Anne-Carin Lagerström

10.40–11.25 **Concurrent Scientific sessions**

10.40–11.25 WORKSHOP 6, cont. HALL A and B

**Translating SCI repair strategies to human application:
What information does a clinician or patient require to
make an informed decision to participate in a clinical trial?**

Chair: John Steeves

- 10.40–11.00 W-28 Strengths and weakness of relevant "functional outcome measures"
Armin Curt

- 11.00–11.25 Discussion/conclusions

10.40–11.25 GENERAL SESSION 6, cont. HALL H

Chairs: Olof Jonsson, Guðmundur Geirsson

- 10.40–10.50 O-91 Efficacy of repeat detrusor injections of botulinum A toxin in neurogenic bladder
Brigitte Perrouin-Verbe
- 10.50–11.00 O-92 Botulinum toxine (BTXA): How many patients with neurogenic detrusor overactivity become really dry?
Helmut Madersbacher
- 11.00–11.10 O-93 Trends in emptying of neurogenic bladder- did anything change in the last 30 years?
Bernd Wiedenhöfer
- 11.10–11.20 O-94 Bladder volume decreases with time after injury. Management affects outcome?
Karin Petterson

10.40–11.25 WORKSHOP 7 **HALL I**

Living with spinal cord injury, coping with a new life-long situation
Chairs: Mette Molin Nefling, Sigrún Garðarsdóttir

10.40–10.55 W-32 Negotiating Identity. A Qualitative Study of How Spinal Cord Injury Patients recreate Meaning during the first year after the Spinal Cord Injury

Sanne Angel

10.55–11.25 Discussion

PLENARY SESSION
HALL A and B

Chairman: Stefán Yngvason

11.30–12.15 Lars Sullivan Memorial Lecture
K-2 Autonomic Function and Spinal Cord Injury: Are we at a Crossroad?

Marcalee Sipski

12.15–12.30 Awards for best posters

12.30–12.45 Invitations to the 47th ISCoS Scientific Meeting the 11th NoSCoS Congress

12.45–13.00 Closing of the Congress

Sunday 1 July

10.00–12.00 CLINICAL VISIT

to the Department of Rehabilitation at Landspítali University Hospital

PRE CONGRESS

Abstracts

Advanced functional movement therapy

Michael Stipar, Isabel Gauggel, Hocoma AG, Switzerland

In the past two decades, body weight supported treadmill training has been proposed as a useful adjunct to enhance locomotor function but often it is too demanding. The patients need the help of two or even three therapists to engage in training even at a very slow speed.

Robotic technology, such as the driven gait orthosis Lokomat® can partially automate movement training following injury to the central nervous system (CNS). The rationale is that the Lokomat might enrich the sensorimotor experience by providing novel patient-environment interactions during active repetitive training.

The workshop will consist of a theoretical and a practical part:

In theory, key facts of the sensory- locomotor training, the development from manual to automated gait training, indications and advantages of this training strategy will be explained. Furthermore, most recent clinical findings will be discussed and future developments presented.

In the practical part the application of the Lokomat system will be explained step by step. Focus will be the correct patient set-up, the individual adjustment of training parameters and the use of the biofeedback. With the assessment tools, the possibility to quantify the patients training progress and the use of the Lokomat system as research tool will be explained.

Finally some volunteers might have the opportunity to experience the Lokomat therapy!

Cross Disciplinary Treatment Focus: Means to Improve Patient Quality of Life – Management of bladder, bowel and sexual dysfunction

The workshop will be chaired by Christine Norton PhD, MA, RN, UK and co-chaired by Jens Sønksen, MD, PhD, DMSc, Denmark.

Speakers: Jean-Jacques Wyndaele, MD, DMSc, PhD, Belgium, Maureen Coggrave, PhD, MDSc, SRN, UK, Dana Ohl, MD, USA, Marcalee Sipski, MD, USA, Klaus Krogh, MD, DMSc, PhD, Denmark, Fin Biering-Sørensen, MD, DMSc, Denmark, Prof. William Donovan, MD, Burkhard Domurath, MD, Germany and Michael Cogswell

The Coloplast symposium will focus on the theme of crossing boundaries between disciplines, and on the patient's experience and quality of life, rather than on the physiology and medical treatment of dysfunction. The workshop will be a combination of presentations and interactive discussions on treatment options, best practices, and patient benefits of good management – with special focus on the link between bladder, bowel and sexual dysfunction. Our speakers will summarise what they see as the main research priorities, and what developments are on the horizon, near or far.

PW3

Advanced C-Spine Stabilization Workshop

Lisa Tweardy

This course is designed to provide a solid overview of the use of cervical orthotics along the continuum of care for acute cervical spine injury. We will review cervical spine anatomy, biomechanics, mechanism of injury and pathology. Cervical orthotic selection algorithms and the use of halo fixation will be a focus. A practical overview and discussion of radiographic analysis and common halo complications are also included. The course is designed to be interactive and will challenge you to select and recommend cervical orthotics based upon injury level, severity of instability, and patient management considerations.

Lisa Tweardy is the Vice President of the Orthopaedic division of Ossur Americas. Ossur is a leading manufacturer of non-invasive orthopaedic products, including functional and sports medicine bracing, orthopaedic supports, and spinal orthotics. Formerly, she was the General Manager of the Spine business unit at Ossur and Director of Research and Development and Business Development at Jerome Medical, prior to its acquisition by Ossur. Lisa earned a B.S. in Biomedical Engineering from Lehigh University in 1986 and a M.S.E. in the Management of Technology from the Wharton School of Business at the University of Pennsylvania in 1995. In addition to her 18 year career with Jerome Medical, she served as Assistant Instructor of Orthopaedic Surgery at Hahnemann University Hospital in Philadelphia, Pennsylvania between 1986 and 1988.

Movement analysis, Electromyography and clinical applications

Einar Einarsson, B.Sc. PT MTC, M.Sc. Bio-Medical Engineering; Johan Jonsson, M.Sc. Electrical Engineering with focus on Medical Science

Physiotherapists and other movement specialists rely on movement analysis in their everyday clinical practice. This we have done for decades mostly based on our experience and other available common measuring tools like a goniometer, tape and a stopwatch. With the demand of evidence based practise, better outcome measures and documentation is needed. Documentation is not just good for the therapist to set goal and measure results of intervention but also as encouragement for the patient, hard copy data for the referring doctor and in many cases insurance companies or another third party paying customer needs documentation. At Kine we are providing several solutions for researchers and the busy clinician to do easy and quick movement analyses with a two dimensional (2D) video synchronised with wireless electromyogram (EMG). In less than 5 minutes a report with spatial-temporal parameters of gait can be made, enabling objective evaluation for patient groups that usually are just subjectively evaluated. Our pride is the wireless EMG which enables total freedom of movement and also there is no bound to laboratory. The EMG can be combined with our sophisticated video analysing system providing immediate viewing of acquired data on the screen and interactive screen tools like marker, ruler, goniometer and timer. Data can be analysed in system or exported to other applications. We are also introducing a new training equipment completely wireless EMG-Biofeedback system, with clearest visual biofeedback on the computer screen and an audio feedback as well. There are promising results of using biofeedback in the field of rehabilitation, and with this new designed program the patient is highly motivated. The therapist can save time because the program monitors the work of the patient, while you attend other things. Afterwards performance data can be looked at and kept in a report or printed out. It is easy to start using our solutions, to test or train you only need our system a laptop computer and some space. In the workshops participants will be introduced to the background of movement analysis and EMG measurements in general. The Kine products will be introduced and applications of our products in everyday clinical practise will be demonstrated. The use of motion analyses and EMG biofeedback for the neurological patient will be discussed.

PRE CONGRESS

Symposium

PS1

Exercise As a Countermeasure for Deconditioning and Accelerated Cardiovascular Related Diseases after SCI: A Worldwide Perspective

Mark S. Nash, Ph.D., FACSM

Persons with SCI comprise a high-risk population for early CVD, and commonly develop related sequela including diabetes, obesity, metabolic syndrome, and inflammatory disease. These primary and secondary complications occur at alarming rates, and typically call for primary, guideline-driven medical management starting with risk assessment using authoritative guidelines. A systematic assessment of these needs has shown that nearly 7 of 10 young, otherwise-healthy persons with SCI qualify for therapeutic lifestyle intervention (TLI), although professional intervention has been undertaken in relatively few.

Risk assessment of those with SCI should be undertaken with clinical pathways that would first intervene on tobacco use and medicines that elevate disease risk. Secondary intervention would institute dietary therapies, although little is known of optimal dietary management after SCI, and in some cases extreme caloric restriction may worsen, not improve the lipid profile.

Various medications offer hope for reduced CVD risk after SCI, although direct testing has been limited. As low, high-density lipoprotein cholesterol (HDL-C) is the most common lipid abnormality, a niacin-containing compound is best targeting, and has shown significant promise in a randomized clinical trial. HMG-CoA reductase inhibitors ("Statins) pose greater risk for myositis with more aggressive dosing, and may actually lower HDL-C in some patients.

Exercise conditioning enhances both fitness and the maximal work capacities of persons with tetraplegia and paraplegia. It has also been shown effective for correcting dyslipidemia in young and middle-aged men with paraplegia, and for enhancing glucose disposal following acute activity. Improvements in lean body mass and in daily energy expenditure represent adaptations to exercise that increase body fat utilization and reduce disease risks. Importantly, exercise is widely available, can be undertaken without major adverse effects, effectively targets common secondary complications of SCI, and offers benefits that cross major body systems.

With benefits of exercise after SCI now being understood, global initiatives are needed to identify region-specific impediments for the widespread use of conditioning as a TLI in primary management of SCI. Direct evidence is still needed to establish the ability of exercise to serve as a countermeasure to imprudent diet, post-prandial lipemia, oxidative stress, vascular inflammation, and longstanding deconditioning. Recommendations for routine exercise would also be bolstered by testing of benefits using disease-specific surrogates and assessment of disease prevention at the vascular and molecular levels.

Logic and empirical evidence suggest a need for use of exercise in primary prevention of CVD and related secondary disorders after SCI. The adoption of guideline-driven assessment and TLI needs to be a priority. All of these goals must be pursued to assure that the lives of those with SCI can be optimally active, productive, and healthy.

Psychological aspects of physical activity of individuals with a physical disability

Marit Sørensen

Introduction: After an initial review of research comparing psychological characteristics of athletes with and without a disability, the potential of physical activity to empower individuals with a disability will be examined.

Purpose: To identify empowering and disempowering factors of the physical activity context for individuals with a physical disability.

Material and method: Based on a qualitative pilot study of 5 individuals with various types of disability and wide experience with participation in physical activity and sport, we developed a theoretical framework of factors moderating and mediating the experience of psychological empowerment in the physical activity context. The framework was empirically tested in two data collections by questionnaire among participants in physical activity with and without disabilities in Norwegian sports clubs, one in 1998 (N=248), and one in 2002 (N=396).

Results: The findings of the empirical studies generally supported the theoretical framework, demonstrating the potential of the physical activity/sport context to empower individuals with a disability. A mastery oriented motivational climate and athletic identity explained most of the variation in empowerment, but also type of disability, competitive level, gender, and perceived choice as to organizational integration contributed. Practical consequences of these findings will be discussed.

Motivation for physical activity of individuals with complete and incomplete Spinal Cord Injury

A.M. Lannem

Introduction: To be regularly physically active seems to be beneficial for persons with Spinal Cord Injury (SCI). Self perceptions in relation to physical activity are important for the motivation too sustain regularly physically active.

Purpose: to compare perceived exercise mastery and perceived physical fitness in individuals with SCI ASIA A-C (complete lesions) with individuals with SCI ASIA D (incomplete lesions).

Material and method: Data were collected by survey questionnaires. In total 55 persons classified as ASIA A-C and 69 persons with SCI ASIA D participated. Perceived exercise mastery and fitness were measured by the Self perceptions in Exercise scale (SPEQ), and level of physical activity was measured by self-rating exercise habits.

Results: Median age was 47 (26–73) years, and the median time since injury was 28 (22–47) years (SCI ASIA A-C) versus median age 46 (26–80), and median times since injury was 19 (8–38) years (SCI ASIA D). Physically active SCI ASIA A-C individuals scored significantly higher than the inactive, on both perceived exercise mastery ($p < 0.002$) and perceived fitness ($p < 0.003$). Physically active individuals with SCI ASIA D scored significantly lower on perceived exercise mastery ($p < 0.029$) and significantly higher on perceived physical fitness ($p < 0.004$) than those who were inactive.

Conclusion: Persons with complete and incomplete SCI perceive their exercise mastery differently and this may influence their motivation for physical activity.

Health promotion in spinal cord rehabilitation, a model

Kerstin Wahman, Anna-Carin Lagerström, Richard Levi

Many studies point out the need for SCI care providers to incorporate concepts of health promotion in order to support the patient to a. maintain general health and to b. prevent or delay secondary complications.

Purpose: To optimize health in the SCI person by, within the clinical setting, integrate structured health promotion, thus bridging disability management with general health habits and lifestyle.

Method: A new module has been added to the annual medical check-up comprising screening for SCI- and lifestyle related health problems, health risk behavior and health counseling.

The program is lead by health coaches using established methods for behavioral change, and includes patient education lectures and a wellness program based on a fitness book (Friskboken), focusing on physical activity, diet and motivation after SCI.

Results: Health promotion is integrated in the rehabilitation concept, questions and measures about health habits, such as physical activity level and diet thereby increasing the awareness of both patient and staff of how habits can improve and sustain health after SCI.

Conclusion: With a systematic health promoting program it seems possible to create awareness of the importance of health habit choices and to support the SCI person to get or maintain long-term health.

Adapted Physical activity as a part of rehabilitation in Finland

Paula Leppänen

Physical activities are closely integrated to rehabilitation process at Käpylä Rehabilitation Centre in Finland. The use of different adapted physical activities or sport disciplines, which achieve positive experiences, may be more motivating for patients than traditional physiotherapy alone. This approach involves patients receiving several opportunities to engage in different sporting activities, with a view to identifying and encouraging sports discipline(s) within their home community.

During the sub acute rehabilitation period, patients are advised to consider suitable sports in cooperation with their therapist and a qualified sports instructor. A peer counsellor, who is also member of staff, coordinates patients' involvement and contact with external peer support groups, and other active participants, including disabled athletes. The patients take part in their chosen sport(s) on a weekly basis and are able to test specialised sports equipment. In addition, regular evening activities have been organised, including wheelchair rugby, wheelchair basketball, electric wheelchair hockey.

Continuity is maintained by collaboration with Disabled Sports Organisation. In addition, during rehabilitation, patients are supplied with information on relevant courses, camps and the use of sports equipment. Adapted physical activity equipments are available via a specialist Disability Sports Equipment Service, SOLIA.

Adapted physical activity at Clinic for spinal cord injury

Physiotherapist Mette Molin Nefling

At the NOSCOS congress in Bergen (2005) a colleague and I presented a paper called: Physical Activities and Perceived Self-Efficacy in Rehabilitation.

It was a qualitative study that showed several good reasons to organize optional physical activities in the rehab centre. One of the very important reasons is for health promoting reasons, but facts as:

- Development of skills
- Perceived self-efficacy
- Basis of choosing physical activities after being discharged from rehab centre and
- Qualifications for participation in the social and cultural community of sports we found was crucial elements in rehabilitation as tools to improve functioning and quality of life.

I will like to share our way of taking care of this important area at Clinic for Spinal Cord Injury now and present our ideas and wishes of how to focus even more on adapted physical activity in the future.

Fitness Training Programme of SCI individuals in Iceland

Herdís Þórisdóttir

Background: In Iceland much emphasis is made on general health and fitness among the general public.

Accessibility for wheelchair users in the sport and fitness centers is insufficient and there is no fitness center in Iceland which has the proper equipment or experience needed to train people with SCI, especially tetraplegics.

The Sports Club for Disabled in Reykjavík offers some sport training for exercise and/or competition and some of the younger SCI individuals have been active in the club.

In connection with a regular follow-up for SCI we noticed increasing interest and need for general fitness training among SCI individuals rather than traditional physiotherapy or sports. Therefore we decided to commence a training group for SCI individuals in wheelchairs.

Methods: A letter was sent to all SCI individuals that use a wheelchair, in Reykjavík and surroundings inviting them to participate. The programme commenced in October 2005 and it is located in the Rehabilitation center for SCI at Grensás.

Each course is 8–10 weeks long and the max number of participants is 12. The training takes place twice a week, each session is 1½ hrs long. We have individualized training programmes based on endurance- and strength training, stretching and wheelchair skills.

19 people have attended the training programme since we began, 8 of them have participated in all the courses. 12 individuals are tetraplegics and 7 are paraplegics, 4 women and 15 men.

Results: Participants have been extremely pleased with this fitness programme and describe better general health and well being along with better physical strength and endurance. Last but not least they all describe improved social participation and that belonging to such a group has positive social effects.

KEY LECTURES

Functional Electrical and Therapeutic Stimulation in SCI: Current use and future direction

Kristján T. Ragnarsson

Repair of the injured spinal cord by regeneration therapy remains an elusive goal. In contrast, progress in medical care and rehabilitation has resulted in improved health and function of persons with spinal cord injury (SCI). In the absence of a cure, raising the level of achievable function in mobility and self-care will first and foremost depend on creative use of the rapidly advancing technology that has been so widely applied in our society. Building on achievements in microelectronics, microprocessing and neuroscience, rehabilitation medicine scientists have succeeded in developing functional electrical stimulation (FES) systems that enable certain individuals with SCI to use their paralyzed hands, arms, trunk, legs and diaphragm for functional purposes and gain a degree of control over bladder and bowel evacuation. This review presents an overview of the progress made, describes the current challenges and suggests ways to further improve FES systems and make these more widely available.

Autonomic Function and Spinal Cord Injury: Are we at a Crossroad?

Marcalee Sipski Alexander

For 25 years the International Standards have evolved to allow description of the impact of specific spinal cord injuries (SCIs) on motor and sensory function. Although originally designed for clinical use, these standards have also been used in retrospective research and clinical trials to assess remaining neurologic abilities of persons with SCIs.

Recently the importance of adding an accurate description of remaining autonomic function to the Neurologic Standards has been acknowledged and International Standards to document remaining Autonomic Function after SCI have been drafted. It is believed that the successful completion, validation and implementation of these standards will provide common terminology to discuss the autonomic effects of SCI. This work, however, is just a start. With the development of these standards, we need to determine how specific injury patterns affect autonomic responses and how people with SCIs are able to appreciate various sensory and autonomic experiences.

Craig Alexander, Raymond Rosen and I have spent the last 15 years assessing the neurologic control of sexual response after SCI. Based upon our work, it appears that one can predict the potential for psychogenic genital responsiveness based upon the preservation of the ability to perceive pinprick and light touch sensation in the T11-L2 dermatomes and that the capacity to experience orgasm persists in people with SCIs provide they have intact lower sacral reflexes. Similar findings have been noted in an animal model by Dr. Lesley Marson. In addition to assessing the impact of injury on sexual responses, it has been refreshing to see that these findings may prove useful in deciphering the neurologic physiology of sexual response in the able-bodied.

While it is important to know about sexual function, there are many more aspects of the autonomic nervous system that deserve better assessment after SCI including neurogenic bladder, bowel and cardiovascular, sudomotor and respiratory function. Currently we cannot adequately predict which individuals with incomplete SCIs should have control of bowel and bladder function. Might it be possible to better predict these functions based upon the exact pattern of neurologic injury that a person sustains? Is the occurrence of autonomic dysreflexia and its severity related to the location and degree of SCI and can we determine a link between pattern of injury and components of dysreflexia? These and other questions deserve answers and further

study of correlations between remaining autonomic function and somatic neurologic function is warranted.

The 21st century will bring many changes to the world. We will be constantly challenged to maximally utilize resources. These changes may limit the funding available to address the concerns of persons with SCIs. However, as we have shown with neurogenic sexual function, there is much to be learned about able-bodied neurophysiology from the study of SCI. Thus we must use this caveat to help justify our studies. The time is now to pool our resources with regards to research, clinical care and conservation of resources. In all our studies, we must perform detailed assessments not only of the neurologic function of persons with SCIs but also their autonomic function. And we must responsibly use this information to learn more about the impact of injury on autonomic responses. In sum we must all work together as a global team to develop solutions to improve the lives of persons with SCIs while maximizing the use of the knowledge obtained.

MAIN TOPIC

Late Complications

Late Complications in Spinal Cord Injury – Anticipating and Planning for the Consequences

Susan Charlifue

Decades of clinical experience, recent research, and personal reports from individuals with SCI provide a detailed picture of the likely health and psychosocial complications that occur in the years following injury. With improved post-SCI survival and life expectancy, clinicians are facing not only the anticipated conditions that accompany aging with SCI, but also must address the more common conditions associated with normal aging. This introductory talk describes the types of changes and complications that have been identified both for SCI and general aging. Even when armed with excellent resources and technology, we continue to face challenges in managing the long term consequences of aging with SCI. In addition, emphasis on only medical and functional issues may not be adequate, as the interrelationship between perceived stress, depression and quality of life with health outcomes is well-documented. Suggestions for screening, intervention and, when possible, prevention of health complications based on various practice guidelines are outlined. Additional recommendations are made for integrating quality of life assessments into routine follow-up. By incorporating a multi-disciplinary approach to facilitate successful aging with SCI, involving a team of clinicians as well as family and community members, we may help our clients avoid unexpected and unwanted long-term complications.

Medical Complications and their Impact on Life Satisfaction in Adults with Pediatric-onset Spinal Cord Injury

Lawrence Vogel, CJ Anderson, KM Chlan, RR Betz, CM McDonald

Objectives: Identify medical complications and their impact on life-satisfaction in adults with pediatric-onset SCI.

Design: Cross-sectional follow-up questionnaire

Participants/methods: Subjects sustained SCI at 18 years or younger, interviewed at age 24 years or older. A telephone interview included a structured questionnaire and standardized measures, including the Satisfaction with Life Scale (SWLS).

Results: 353 participants with mean age of injury of 14 years (0–18), mean age at interview of 27 years (24–37), and mean duration of injury of 13 years (6–31); 64% male, 44% with paraplegia. The most common medical complications were urinary tract infections (UTI) (74%), pain (71%), autonomic dysreflexia (60% of those with T6 or higher level lesions), shoulder pain (51%), spasticity (50%), pressure ulcers (40%), bladder incontinence (32%), and back pain (27%). In univariate analyses, SWLS was associated with severe UTI ($p=.002$), bowel incontinence ($p=.04$), pressure ulcers ($p<.001$), spasticity ($p=.022$), and elbow ($p=.027$), shoulder ($p=.032$), back ($p=.001$) and any site pain ($p=.001$). In multiple regression analysis, SWLS was associated with back pain, spasticity and age at interview.

Conclusions: Medical complications are common in adults with pediatric-onset SCI and impact life-satisfaction.

Performance: Capacity ratio – a new clinical tool?

Lone Skriver Rose, G Nicholson, L Hills, M Ferguson-Pell

Very little of the international research into wheelchair biomechanics has translated into clinical practice. A pilot study was carried out to assess the potential for the ratio between the power applied in continuous pushing ('performance') and the power exerted in a single push against maximum resistance ('capacity') to be used as a clinical outcome measure to assess the risk of over-exertion in manual wheelchair users. Over-exertion may be linked to secondary upper limb injuries in this population.

Nineteen newly injured (age $33 \pm \text{sd}10$ yrs) and 10 experienced (age $36 \pm \text{sd}10$ yrs) wheelchair users were assessed pushing on the flat and up a slope in a lightweight wheelchair (Quickie GPV). Data was collected using the Smartwheel TM (an instrumented pushrim). Pushing at $>80\%$ of capacity was classified as over-exertion. Median values of the P: C ratio for both groups were below 80%. However, the experienced users were less likely to over-exert, possibly due to superior propulsion technique and greater ability to appropriately assess and pace such tasks.

These results indicate that the P: C ratio has the potential to reveal the risk of over-exertion and may assist the clinician in establishing the best strategies for balancing the risk of over-exertion with maximum functional independence.

Ultrasonographic findings of shoulder able-bodies, paraplegic and tetraplegic subjects

Jorma Kivimäki, Eija Ahoniemi

Objectives: To evaluate the association between spinal cord injury (SCI) and ultrasonographic findings of shoulder.

Study design: Cross-sectional

Settings: Randomly selected SCI patients in Käpylä Rehabilitation Centre and able-bodies citizens in Helsinki.

Methods/Participants: Ultrasonography of the shoulder was performed on able-bodied (103) and tetraplegic (64) and paraplegic (46) subjects (ASIA A15%, B22%, C19%, D44%). Patients with spinal cord injury were 18–65 years old and injured more than 3 months before the examination. 90% of paraplegics were manual wheelchair users, 70% of tetraplegics were manual and the rest of patients were electronic wheelchair users. Ultrasonography was performed in standardized manner with Aloka SSD 900 and using a 7,5 MHz transducer.

Results: Findings of glenohumeral joint differed most clearly between the groups. Slight differences were noted in supraspinatus tendon and acromioclavicular joint. Association between SCI level and edema in glenohumeral joint remained significant in regression analysis where also other background factors were considered.

Conclusions: Paraplegics and tetraplegics are prone to glenohumeral changes that can be verified with ultrasonography.

Long-term paraplegia and the weight-bearing shoulder. A Comparison of Functional and Structural Changes in Paraplegic Patients and Controls

Akbar M, Balean G, Ludwig K, Gerner HJ, Loew M

Introduction: The purpose of this study was to compare the functional and structural changes in weight-bearing shoulders of paraplegic patients who are wheelchair dependent for more than 30 years with able-bodied volunteers.

Methods: This was a randomized study with 80 patients (mean age 54 years) who had been paraplegic and wheelchair dependent for a mean of 33 years. These patients were matched for gender, age, occupation, and hobbies to a group of 80 able-bodied volunteers (mean age 51 years). Shoulders from both groups were prospectively evaluated.

Results: The shoulder function according to the Constant score was significantly worse in paraplegic patients compared to able-bodied volunteers ($p < 0.001$). Similarly, the VAS pain scores were significantly greater in the paraplegic patients. Comparison of the MRI films of the paraplegic patients and the volunteers revealed the following significant differences: rotator cuff tears 67% (108/160) vs 5.6% (9/160); tendonitis 50% (80/160) vs 23% (37/160); tendonitis of the long head of the biceps 25% (40/160) vs 3.7% (6/160); rupture of the long head of the biceps 10% (16/160) vs 2.5% (4/160).

Conclusions: This is the first study comparing the long-term effect on shoulder pathologies of paraplegic wheelchair users to a cohort of able-bodied volunteers.

Repetitive Transcranial Magnetic Stimulation in SCI Patients with Central Pain: a PET Study

H. I. Shin, Y. K. Kim, M. S. Bang, S. E. Kim

Researchers have reported that high frequency repetitive magnetic stimulation (rTMS) on primary motor cortex can reduce central pain. But its mechanisms remain obscure. Using 2-[18F] fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET), we investigated the changes in cerebral glucose metabolism after rTMS in 10 spinal cord injury patients with chronic central pain. Each subject received rTMS over primary hand motor cortex for 20 minutes. The stimuli were composed of intermittent 20 trains (5s stimulation and 55s rest) with 10 Hz frequency and 80% intensity of resting motor threshold. This stimulation paradigm was repeated for 5 consecutive days. Pain was assessed using a visual analogue scale (VAS) before, after the first, fourth, and fifth sessions. After the end of rTMS sessions, pain was assessed once a week for 8 weeks. FDG PET images were obtained before and 2 days after the end of rTMS sessions. At 3 weeks after the end of rTMS sessions, the VAS scores were decreased from 6.5 ± 4.2 to 4.4 ± 1.6 . And six of 10 subjects showed good response of more than 30% reduction of pain. On PET image, significant increase in cerebral metabolism was found in the ipsilateral thalamus, brain stem, bilateral dorsolateral prefrontal cortex, and anterior cingulate cortex.

Long term follow up of operatively treated sacral fractures

Glott T, Tötterman A, Røise O

Introduction: Unstable sacral fractures can be associated with lesions of the cauda equinae and/or nerve roots.

Aim: To describe the prevalence of long term complications in patients with operatively treated sacrum fractures.

Methods: Prospective, longitudinal single cohort study with a minimum 1-year follow up.

Results: Thirty-two out of 39 consecutive patients admitted to a trauma referral hospital with unstable sacral fractures were available for follow-up. Multifactor assessment was done with a mean of 15 months since injury (range 12–30). On follow up, 28 (87%) had a sensory dysfunction and 14 had a motor dysfunction (44%). Fifteen (47%) reported voiding problems and 7 (22%) had a bowel dysfunction. Independence in activities of daily living (ADL) was achieved by 20 patients (65%). Seven out of 23 (33%) patients who had been employed at the time of accident had returned to work. All patients in white-collar professions (n=6) were back to work, compared to only 1 out of 17 of blue-collar professionals. As a group, the cohort reported 29% (11–57%) lower SF-36 raw scores compared to the age and gender adjusted data.

Conclusions: Unstable fractures of the sacrum are frequently associated with serious neurological injuries and these patients require specialized surgery and rehabilitation.

Spinal Cord Injury Pain and Quality of Life Post-Discharge: New Research Initiatives

K. Boschen, J. Katz, C. Craven, J. Hunter, S. Hitzig

Funding was received from the Canadian Institutes of Health Research to undertake a Team Planning and Development Initiative on Spinal Cord Injury (SCI) Chronic Pain and its Impact on Quality of Life. The goal was to bring together researchers, clinicians, and SCI consumers to identify a strategic research agenda and to initiate opportunities for multi-disciplinary and multi-centre studies. The following data collection was undertaken. A 50-item Spinal Cord Injury Pain Impact Questionnaire (SCI-PIQ) was given to 28 consumers with SCI-related chronic pain lasting over six months. Twenty-three clinical staff at the largest Canadian SCI rehabilitation centre completed a Professionals' Knowledge and Attitudes Questionnaire (PKAQ) on SCI chronic pain, then a sub-group of nine also participated in a semi-structured interview. As well, consultations on research gaps and priorities in the field were conducted with six purposively selected SCI researchers. Results from these activities and a literature review were compiled in a booklet of materials sent to 39 knowledgeable participants who attended a one-day working meeting to achieve consensus on priority areas for a strategic program of research, and to initiate discussions on building multi-disciplinary and multi-site research teams and submitting grant applications. Details of the consensus meeting outcomes will be presented.

Late diseases due to inadequate treatment of vertebral fractures in paraplegics

H. Mouchaty, S. Aito, P. Conti, R. Conti, N. Di Lorenzo

Spine deformity, syringomyelia, pseudoarthrosis, pseudomeningocele are diseases that manifest at a time distance from trauma causing morphologic changes, instability, pain and/or neurologic deterioration. They are a consequence of inadequate treatment of the initial traumatic lesion. Since they are very bothersome for paraplegic patients and their management is complex, prevention is mandatory. Nevertheless, cases are occasionally encountered. The aim of this study is to collect all cases treated during a three year experience in one center and illustrate causes and solutions.

During the period (2002–2004), seventeen paraplegic patients presenting late diseases related to vertebral traumas were treated. Assumed causes and chosen remedies are illustrated including a two year follow-up and pre and postoperative imaging results.

The causes of these diseases, in order of frequency, were: insufficient re-alignment and/or chronic instability (11, deformity), inadequate evaluation of the interposed soft tissue and/or insufficient immobilization (2, pseudoarthrosis), insufficient decompression (3, syringomyelia) and inadequate treatment of dural infraction (1, pseudomeningocele).

The knowledge of causes of late diseases complicating vertebral fractures and experience in the field are the requisites to avoid a delayed deterioration especially in paraplegics. The specific therapy is based on the correction of those biomechanical factors that were not initially considered.

Hip and Spine Deformities following Childhood onset Spinal Cord Injury

Jørgensen, V., Jahnsen, R., Hjeltne, N.

Study design: Longitudinal, retrospective, descriptive.

Objectives: To provide more information about development of spinal and hip deformities in patients with childhood onset traumatic or non traumatic spinal cord injuries.

Methods: Twenty six patients with childhood complete or incomplete SCI took part in this study (median age at injury 12,5 (0–17), median years of follow up 33 (17–48)). Plain x-rays of spine and hips and goniometric measurements of hips and knees were taken.

Results: Scoliosis was present in twenty and kyphotic deformity in two patients. Seven of eleven patients injured before the age of 11, required spinal fusion due to large scoliotic curves. The two with kyphotic deformities had mid-thoracic injury levels and were injured after the age of 16. Only two of twenty-one patients, had normal hip x-rays. Eight had subluxated or luxated hips, all unilateral. All twenty-six patients had reduced range of motion in hips, ten having contractures.

Conclusions: Younger age at injury is associated with greater scoliotic curves and more (sub) luxated hips. Injury level might have influenced magnitude and shape of spinal deformity. Pathologic radiographic findings in hips were common. Gravity forces acting on paralyzed spine, unbalanced muscle tension and connective tissue contractures are possible explanations of skeletal deformities.

Survival following ventilation after spinal cord damage

JWH Watt, P Silva, S Meehan, E Wiredu

Objectives: To compare survival and causes of death of patients with cervical spinal cord damage (SCD) who had initially required acute ventilation with those who continued to require respiratory support thereafter.

Design: Retrospective review of hospital records of 269 patients ventilated on first admission to the NWRSC between 1981 and 2005. Causes of death were obtained from the Office for National Statistics.

Methods: Descriptive and Kaplan Meier survival statistics were carried out between the two groups and on subgroups according to: Age at injury, level and completeness of injury, aetiology, year of ventilation, ventilatory status at discharge.

Results: Records were obtained from 218 patients, age range from 1½–78 years, of which 184 had acute spinal cord damage (SCD). 137 had been weaned whereas 81 needed continuing ventilatory support after discharge. The 13-year probability of survival is 79% for weaned patients and 62% for ventilator-supported patients, rising to 70% if non-SCD are excluded. Causes of death were respiratory, 40, cardiovascular, 11, gastrointestinal, 5, and renal, 4.

Conclusions: Ventilated patients have a good although shortened life expectancy compared with the weaned group. Age of onset at time of first discharge from hospital significantly affects the survival rate.

Predicting the risk of lung infection after a spinal cord injury with spirometric parameters

K. Postma, J. A. Haisma, L. H. V. van der Woude, S. de Groot, T. A. R. Sluis, J. B. J. Bussmann

Purpose: To assess the feasibility of spirometric parameters in predicting the risk of a lung infection (LI) after a spinal cord injury (SCI).

Methods: As part of a Dutch multi-center prospective cohort study, persons with an SCI (n=136) performed spirometry at discharge from inpatient rehabilitation. The occurrence of respiratory complications was assessed 1 year after discharge.

Results: 13 of 136 (9.6%) persons developed a LI between discharge and one year after. The groups with and without complications were significantly different with respect to spirometric parameters (mean (SD) FVC%: 71.2 (24.8) vs 85.4 (22.0); FEV1%: 64.9 (18.6) vs. 84.0 (20.9); PEF (L/sec): 4.0 (1.7) vs. 5.8 (1.8), respectively).

Conclusions: The group of SCI persons with LI in the year post-discharge from the rehabilitation center appeared to have lower spirometric parameters at discharge than persons without complications. This indicates that spirometric parameters at discharge may be of prognostic value. However, the influence of confounding (personal and lesion) factors should be studied in more detail.

Real costs of colonised paraplegic patients with MRSA

Eichler M, Gerner HJ, Akbar M

Introduction: Due to a prolonged hospital-stay of patients with chronic or acute paralysis there is an elevated risk of infection with strains of methicillin resistant staphylococcus aureus (MRSA).

Methods: A database-inquiry of all documented traumatic and non-traumatic patients between the years 1996–2006 with spinal cord injury in combination with MRSA was started. We found 224 patients and analysed of time of hospital-stay, status of skin, risk-factors, localisation of colonisation, treatment, effectiveness of decolonisation and days of isolation.

Results: The total number of all treated patients was 2732. The number of cases with diagnosis of MRSA was 224. Mean days of isolation/patient was 44,84. Real costs of material expenses were figured with 4319 €/month. Decolonisation efforts of nostrils showed a success of 95%; of body and groin of 75% and bladder 5%. Additional expenditures for nursing have been calculated with 3922 €/month. Lost emoluments due to isolation was figured with 225 €/d. With regard to days of isolation we found additional costs of 503.254 €/year.

Conclusions: There is a stable percentage of colonised patients of 11%. Additional costs can not be reduced with regard of existing hygiene-recommendations. The effectiveness of decolonisation-efforts is dependent on accessibility and status/surface of skin.

Spinal Cord Injury and Pressure ulcers – a follow up study

P Åkerlund, L Larsson, O Risberg, H Glimåker

Purpose: To investigate background and results after plastic operation in a cohort of Spinal Cord Injury (SCI) with pressure ulcers. To identify important factors for success.

Methods: SCI-patients have, among other problems, problem with pressure ulcers. 75 plastic operations were made during the period 1995–2006 in Falu hospital among handicapped patients.

We have retrospectively studied sores-problems in the whole SCI-population in our county (N=80). We have compared these data to a cohort of this group (n=17 patients) with SCI and Myelomeningocele (MMC). We have studied background factors as gender, age, social factors, cooperation ability, weight, time since injury, degree of handicap, handicap aid and other non-SCI-related diagnosis.

Results: Fifteen cases were treated for at least one year conservatively before operation. Many had big problems with infections, osteitis and other complications before operation. Preliminary analyses shows that after surgery there were only a few complications. Four patients (4/17) had recidive. Three of these four patients had other diseases which could explain the recidive. The anti-decubitus programme will be presented shortly. The analyses/discussion and results will be presented in june 2007.

Enoxaparin Thromboprophylaxis in Spinal Cord Injury Patients: Five Years of Experience

W. Khaliq, F. Derry

Objectives: To study the effectiveness of enoxaparin in the prophylaxis of thromboembolic events amongst patients with acute spinal cord injury.

Material & Methods: Retrospective review of all acute SCI over a five year period. All patients received enoxaparin thromboprophylaxis during their first twelve weeks of treatment and rehabilitation. Records were reviewed for various risk factors, to ascertain if certain patients were more susceptible to developing venous thromboembolism, despite enoxaparin thromboprophylaxis.

Results: Of 714 patients, 28 patients developed deep vein thrombosis and 17 others developed pulmonary emboli, of which 3 were fatal. Two peak times for the development of thromboembolism were seen: within a fortnight of enoxaparin being discontinued, and after five months from the initial injury. No link was established between occurrence of venous thromboembolism and a patient's gender, level of injury, completeness of injury, associated injuries, or whether they had spinal fixation. There was a significant association between the presence of malignancy or being aged 31 to 50 years, and the development of venous thromboembolism.

Conclusions: This study shows that enoxaparin is effective in the prevention of venous thromboembolism in most spinal cord injury patients. Certain patients were identified at a higher risk than others.

Does time since injury affect colorectal dysfunction in SCI patients?

P. M. Faaborg, P. Christensen, N. Finnerup, S. Laurberg, K. Krogh

Introduction: Cross sectional studies have indicated that colorectal dysfunction after SCI worsens as time goes by. However, follow-up studies are needed to confirm this. **AIMÓ** To describe long-term colorectal function in SCI patients.

Patients and methods: In 1996, 424 members of the Danish Paraplegic Association answered a detailed questionnaire describing their colorectal function. In 2006 those still members (n= 284) received an identical questionnaire. Data for patients responding both in 1996 and 2006 (n=159) were analyzed.

Results: In 1996, 25% reported that colorectal dysfunction had some or major impact on their quality of life, at follow-up 10 years later it was 38% ($p < 0.005$). In 1996, 11% defecated less than every second day and 16% spent more than 30 minutes at each defecation, in 2006 it was 19% ($p < 0.01$) and 25% ($p < 0.00001$) respectively. Digital anorectal stimulation or evacuation was performed at least once every week by 48% in 1996 and by 56% in 2006 ($p < 0.0001$). Fecal incontinence at least once a month was reported by 22% in 1996 and by 17% in 2006 ($p < 0.001$).

Conclusion: The frequency and severity of constipation related symptoms increases with time since SCI!

Lack of correlation among colonic transit, bowel motion frequency and stool form in SCI patients

G Bazzocchi, A Avogadri, P Pillastrini, R Pederzini, M Menarini

In healthy and disease, hard as well as liquid stools are related to different transit rates. We investigated if a relationship among transit time, evacuation frequency and stool consistency characterize bowel dysfunction in SCI patients. A single abdominal X-ray film was obtained after daily ingestion of 10 radioopaque pellets for six days, during which 31 patients (8 males, 7 tetraplegic and 24 paraplegic, mean age 39 ± 12 years) scheduled defecation with the usual modalities. Evacuation number and types of stool according to the Bristol Stool Form Scale, were recorded. Total Intestinal Transit Time (TITT) was calculated according to the Abrahamsson's method. The average TITT was 4.1 ± 2.6 days, resulting a delay (normal value < 2.6 days) in the 87% of patients, but number of defecation was in the normal range (4.1 ± 2.6 in the 6 days). Over 128 total evacuations, hard stools were in the 28% and mushy, watery stools in the 24%. Regular and soft stools occurred in the remaining 45%. No relationship was found between stool form score and TITT (linear regression: $r = 0.23$, $p = 0.2$). In SCI, a normal frequency of defecation does not trigger normal transport of the intraluminal contents. Moreover, stool consistency is not anymore related to transit rate.

A brief follow up evaluation and early detection of complications in Spinal Cord Injury patients

G. Correa, C. Gutierrez, J. Castillo, A. Mujica, J. Dote, R. Gomez, P. Rebolledo, A. Massabó, R. Urrutia, L. Tapia, G. Ol

Introduction: In 1998, only 33% of SCI patients realized a health evaluation system, due mainly to excessive evaluation time (7 days).

Objectives: To improve the quality of evaluation and early detection of late complications in SCI that reside in rural cities far from worker's Hospital in Santiago, Chile

Methods: During 2000 to 2005, we performed 299 evaluations in 74 patients. In each case we request laboratory and imaging tests in a place near to their home previous to control, subsequently we realized multidisciplinary evaluation in one day in Santiago.

Results: We studied 74 traumatic SCI patients, 70 male and 4 female, age 35+-11 years, time of SCI av. 14 years (3-30). Complete paraplegia 38 (51%), complete tetraplegia 9 (12%), incomplete lesions 27 (37%). In six years, the compliance to evaluation improved significantly, 88% of patients attended controls regularly. In that period we detected 375 late complications; urological 29%, gastrointestinal 15%, chronic and neurophatic pain 13%, pressure ulcers 8%, mental disorders 5%, spasticity 4%, diabetes 3%, hypertension 2% and others 15%

Conclusions: In our context, this evaluation system allows for a very good health evaluation. Early detection and treatment of complications through that system, prevents prolonged hospitalizations.

MAIN TOPIC

Functional Electrical Stimulation

Cardiorespiratory adaptations to 12 months of high volume functional electrically stimulated (FES) cycle training in paraplegic subjects

H. R. Berry, K. J. Hunt, C. Perret, N. Donaldson, T. H. Kakebeeke, D. B. Allan

Purpose: To investigate the physiological responses to a high volume, 12 month FES-cycle training programme using a novel, sensitive test-bed and protocol that permit high resolution metabolic threshold analyses to be performed for the first time in FES-cycling.

Methods: Nine male and two female untrained paraplegic subjects (ASIA A; lesion level T3–T9; years since injury 11 ± 7 years; age 42 ± 8 years; height 176 ± 8 cm; weight; 74 ± 14 kg) completed one year (3.7 ± 0.1 h per week) of FES-cycle training on an adapted recumbent tricycle. Cardiorespiratory parameters were recorded continuously during work-rate and cadence controlled incremental exercise tests to stimulation saturation point. Tests were carried out at baseline, at three-monthly intervals during training and upon completion.

Results: Peak power increased by 9.7 ± 7.6 W (129%) and peak net oxygen uptake increased by 277 ± 162 ml•min⁻¹ (168%), $P < 0.05$. However, the ventilatory threshold (VT) remained almost unchanged at 371 ± 90 ml•min⁻¹ at a work rate of 4.7 ± 1.7 W.

Conclusions: The substantial increase in FES cycling capacity after 12 months was not accompanied by a delay in the VT. This would suggest that progress was due to increases in both aerobic and anaerobic capacity.

The use of Functional Electrical Stimulation during Rehabilitation and at Home

I. Bersch, H. Lechner, M. Baumberger

Purpose: Evaluation of outcome and feasibility of FES (functional electrical stimulation) in treatment of SCI in the clinic and at home.

Methods: Setting retrospective, between 2005, 2006. Stimulation with Motion Stim, 8 channel (Krauth&Timmermann, Germany). Duration of impulses 300usec, Frequency 14–50 Hz, biphasic rectangular. Intensity depends on quality of contraction. Patients were stimulated 5 days a week/30 min. Initially in the clinic. Training should be continued at home after rehabilitation. Effect was controlled by visual testing every 10th session, after hospitalisation every 6th month. Stimulation of deltoid muscle, biceps and triceps in upper limb, finger flexors and extensors, trunk muscles, abdominals, tibialis anterior, peroneus group, gluteus and quadriceps in lower limb.

Results: We observed that FES during the time of rehabilitation is accepted well and leads to an improvement of function, less pain and contractures. FES as a self dependent therapy conducted at home is accepted less and depends on personal motivation. 100 Patients had stimulated 154 muscles during hospitalisation. Only 8 Patients (amount of 9 muscles) continued the stimulation at home.

Conclusions: The feasibility and acceptance of FES at home seems to be very low, even if the effect during rehabilitation was very good.

Brain-computer interface for “Thought” – Control of grasp neuroprostheses

R. Rupp, G. R. Mueller-Putz, Pfurtscheller G., H. J. Gerner

In patients with injuries of the cervical spinal cord every form of improvement of a missing or weak grasp function will result in a large gain of quality of life. With devices for Functional Electrical Stimulation (FES) – so called neuroprostheses – a demonstrably improvement of the grasp function could be achieved in tetraplegic patients with stable, active shoulder function, but missing control of hand and fingers. Especially with the use of implantable systems a long-term stable, easy to handle application is possible. However, the current methods for user driven control of grasp neuroprostheses require a certain amount of preserved voluntary movements e. g. shoulder movements, which are not present in very high lesioned patients. For restoration of the upper limb function in this patient group the coupling of neuroprostheses with a Brain-Computer Interface (BCI) based on electroencephalographic (EEG) signals is proposed and has been successfully implemented in either a neuroprosthesis with surface electrodes¹ and in the implantable Freehand system². The tetraplegic patients were able to switch through several grasp phases by distinct imaginations of movements. From our results it can be concluded that BCI systems have a high potential for widening the application of grasp neuroprostheses.

- [1] Pfurtscheller G., Mueller G. R., Pfurtscheller J., Gerner H. J., Rupp R.: “Thought” – control of functional electrical stimulation to restore hand grasp in a patient with tetraplegia, *Neuroscience Letters* 351, 33–36, 2003
- [2] Mueller-Putz G. R., Scherer R., Pfurtscheller G., Rupp R.: EEG-based neuroprosthesis control: A step towards clinical practice, *Neuroscience Letters*, 382 (1–2), 169–174, 2005

Functional Results Following Implantation of an Upper Extremity Neuroprosthesis Utilizing Myoelectric Control

Bryden AM, Kilgore KL, Hart RL, Hoen HA, Keith MW, Peckham PH

A second-generation implantable neuroprosthesis has been developed for individuals with cervical level spinal cord injury. The user generates myoelectric signals from muscles under voluntary control to activate stimulation to the paralyzed muscles in the arm. This results in functional grasp patterns including activation of shoulder and scapular muscles. The system has been implanted in 10 participants (13 arms) with C3–C7 motor level SCI. There are plans to implement two more participants by January of 2007. The International Classification of Functioning, Disability and Health (ICF) was used to structure measurement of functional outcomes. The impact of the neuroprosthesis on the ICF domain of body functions and structures is demonstrated by median grasp strength of 4.18 lbs. (2.44–7.66) with the neuroprosthesis compared to 1.39 lbs (0.07–6.44) without the neuroprosthesis. Performance of activities of daily living improved in a median of 85% of activities tested (57%–100%). Within the domain of participation, participants are performing more activities in their homes and communities using the neuroprosthesis. System incidents have been few, and have been limited to sub-optimal placement of the myoelectric electrodes, which have been correctable in a minimal second procedure. These results indicate that implanted myoelectric control is an effective control option for neuroprostheses and for restoring function to individuals with cervical level spinal cord injury.

This research is supported by NIH-NINDS (R01-NS-29549), by FDA Orphan Products (FD-R-002389), by the NIH General Clinical Research Center at MetroHealth Medical Center (M01-RR00080), by the Rehabilitation Research and Development Service of the Dept. Veterans Affairs (Merit Review #A3707R) and by the Cleveland VA Functional Electrical Stimulation Center.

Rehabilitation robotics with electrical muscle stimulation control, a pilot study in SCI population

P. Métrailler, A. Al-Khodairy, R. Brodard, R. Clavel, R. Frischknecht

Limb mobilization by a therapist or by a robot is usually used in classical rehabilitation but with controversial results. The Cyberthosis technology provides new solutions by coupling robotic therapy with closed loop functional electrical muscle stimulation (CLEMSTTM). The sensors integrated in the robot feed the control unit with position and force information to modulate the muscle contractions during the whole movement. This innovative method involves the paralyzed muscles in the mobilization even in case of absence of voluntary control. Exercise is no longer passive but active, reducing immobility complications and ensuring coherence between sensory input and motor control to stimulate the neural plasticity. First trials were performed with a motorized knee orthosis with 6 incomplete spinal cord injured (SCI) patients. Quadriceps was stimulated with surface electrodes and controlled to obtain a desired output torque. Then we implemented CLEMSTTM on the MotionMakerTM, a stationary rehabilitation robot composed of two motorized hip-knee-ankle-foot orthoses. Trials with 5 SCI patients during 2 months showed the feasibility of controlling the electro-induced forces of 7 muscles per leg during leg press movements. Next step will be to implement CLEMSTTM on the WalkTrainerTM, a mobile cyberthosis with pelvic and leg orthosis for overground gait rehabilitation.

Laparoscopic Motor Point Diaphragm Pacing Stimulation (DPS) System: Clinical Results for Tetraplegia

RP Onders, MJ Elmo, A Ignagni

Objectives: Ventilator dependent tetraplegics face not only the stigma of being on a ventilator but also the associated significant risks of pneumonia and barotrauma. This study outlines the experience with the Diaphragm Pacing Stimulation (DPS) system for tetraplegics with ramifications for anyone on positive pressure ventilation.

Methods: In a prospective trial, spinal cord injured (SCI) patients underwent outpatient laparoscopic diaphragm motor point mapping and subsequent electrode implantations. Stimulus/output characteristics of each electrode were determined and diaphragm conditioning was initiated. The patients were weaned from their ventilators at home.

Results: A total of 30 patients have been successfully implanted. DPS provided tidal volumes to free 97% of tetraplegics from ventilators. The results also showed DPS leads to an increase in diaphragm muscle thickness and strength, conversion of fast twitch glycolytic (IIb) to the functional slow twitch oxidative muscle fibers (I), reduction in airway pressure, return to negative chest pressure, 64% decrease in secretions, improved posterior lobe ventilation and increased lung compliance leading to decreased work of breathing.

Conclusions: The DPS system is a low risk, low cost system that should replace the ventilator for SCI patients. These benefits provided the basis for ongoing research to decrease ventilator times for any patients.

GENERAL SESSION 1

Measurement and Assessment

MRI as a reliable alternative to CT in the assessment of healing of fractures in spinal injury

B Singhal, R Warwick, J Willatt, J Borremans, T Meagher

Purpose: To compare MRI and CT in the assessment of fracture healing after spinal injury. To establish if MRI can replace CT.

Methods: Prospective cohort study of patients aged over 16 with traumatic vertebral fractures. Scans at 12 weeks within 48hrs of each other. Criteria for fracture healing – CT bridging trabecular bone, MRI absence of odema and bridging T1 signal.

Results: 35 patients. Average age 38. Range 17–83.29 male. 55 fractures, 16 cervical, 28 thoracic, 11 lumbar. 44/55 (80%) CT and MRI findings correlated. 6/55 united on CT, not on MRI. 1/55 not united on CT united on MRI. 4/55 no clear pattern.

Conclusions: The absence of vertebral oedema and the presence of T1 signal across a fracture site at 12 weeks post treatment correlates well with CT criteria. Artefact from pedicle screws in the thoracic spine can cause difficulty in interpretation. In the cervical spine residual oedema in fibular strut grafts is seen in fractures which otherwise appear united. MRI enables assessment of the spinal cord and is radiation free. MRI should replace CT for the assessment of fracture healing at twelve weeks if imaging is indicated on clinical grounds. CT should only be undertaken if MRI criteria are not met.

MRI imaging assessment in spinal cord injury: experience from a Phase 2 randomized controlled trial

D Lammertse, D Dungan, J Dreisbach, L Jones

Objectives: To describe the short term MRI imaging characteristics of acute spinal cord injury correlated with 6 and 12 month follow-up MRI.

Design: Blinded, imaging component of a Phase 2 study for subjects with acute, complete spinal cord injuries.

Participants/Methods: MRI length of contusion and edema were reviewed for SCI patients scanned within 5 days of injury who had repeat exams 6–14 days post injury. Findings on these studies were then compared to follow-up examinations performed 6–12 months post injury.

Results: Initial (1.3 day) contusion length was $2.0 \pm .5$ cm, (range 0.9–2.9). Follow up MRI was performed 9.8 days post injury, with contusion length $2.6 \text{ cm} \pm 1.2$ (range 1.1–6.2). Six and 12 month examinations showed contusion lengths of 2.4 and 2.7 cm respectively. Paired Student's t test showed significant difference between contusion length on initial and follow up examinations ($p=0.014$) and between initial and 6 month examinations ($p=0.010$). No significant difference was noted between short term follow-up and 6 month examinations ($p=0.11$).

Conclusions: MRI length of contusion significantly increases in the first two weeks following SCI. The contusion length measured at short term examination remains relatively stable over one year follow-up.

A computerised program for AO Comprehensive Classification of Thoracic and Lumbar Injuries

Wang D, Sun T, Wang Z, Zhai M

Purpose: The AO Comprehensive Classification of Thoracic and Lumbar Injuries is characterised by the following advantages.

1. It describes detailed elements of bony injury
2. It describes the three basic groups of injury in order of instability by simply using one letter A, B or C
3. Its subdivisions correlate quantitatively with vertebral instability
4. It correlates quantitatively with frequency of spinal cord injury

However, its use is seriously hampered by its sophistication and is mainly popular in Continental Europe and limited institutions in other parts of the world. This computerised program is designed to make its use easy at the touch of a few buttons.*

Methods: An algorithm has been worked out based on various elements of the injury. Various mathematical combinations of elements represent different types of injury. It automatically works out the diagnosis in accordance with AO Classification. The program is written on the commercially available Access of Microsoft Office Professional. No extra software is needed.

Results: The program has been tested more than hundred times. The results prove totally consistent with the Classification.*

Conclusions:

1. It is extremely easy to use.
2. It guarantees inter-rater reliability in diagnosis.
3. It is a powerful tool for education.

The determination of the level of spinal cord injury according to the measurement of skin resistance

Karamehmetoglu PS, Uður M, Aslan YZ, Palamar D, Gökdemir AB.

The aim of this study was to develop a quantitative skin resistance test (QSRT) that could be used for the assessment of the level of sci, especially in unconscious sci patients. Skin resistance (SR) of the key points was measured in 10 control subjects and in 10 sci patients, between C3 and S3 bilaterally. SR was measured by an ohmmeter as Kohm. The level of sci according to QSRT results was determined for right and left as the most caudal spinal segment within the range considered to be normal according to the values of control subjects. This level was then compared with clinical sensory level derived from ASIA standarts. In the control group, QSRT values varied between 50 and 600 Kohm. There was not a strong correlation between corresponding right and left dermatomes and repeated assessments. The SRs of the key points above the level of sci were comparable with the values of the control group while the SRs under the level of sci were very high (above 1000 Kohm). The level of sci according to QSRT and clinical sensory testing was the same in paraplegics. QSRT seemed to be a simple, non-expensive way of assessing the level of sci.

Responsiveness of a short-form sensory exam II in Spinal Cord Injury

RJ Marino, DE Graves

Purpose: Previous reports have indicated that there is a great deal of redundancy in the ASIA sensory examination, and that item reduction is possible with little loss of information. This study compares the responsiveness of 10-dermatome sensory scales to the full 26-dermatome scales.

Methods: This was a secondary analysis of the Sygen® database. Subjects with complete light touch (LT) and pin prick (PP) examinations at baseline and 26 weeks post-injury were included. Short-form scores were obtained by adding bilateral dermatome scores for C4, C6, C8, T4, T6, T10, L2, L4, S1 and S3. Correlations between short-form and long-form raw scores at baseline and 26 weeks, as well as change scores were compared. Effect sizes (mean difference/baseline sd) were also compared.

Results: There were 546 subjects with complete data: 432 male, 406 cervical injuries; 358 complete SCI. Pearson correlations (ρ) between short and long form scores and change scores were all >0.97 . Effect sizes were nearly identical: 0.64 for long forms, 0.65 for short-forms.

Conclusions: These results support the use of short-form sensory scores to evaluate overall change in LT and PP in SCI. Subject and evaluator burden can be greatly reduced by testing 10 instead of 26 dermatomes.

A novel method for improving the reproducibility of electrical perceptual thresholds for detecting change in spinal cord function

S Rutkowski, G Leong, C Gorrie, P Waite, K Ng, J Middleton

Purpose: In keeping with a major initiative of the International Spinal Research Trust, our goal is to develop and validate improved techniques for neurological assessment in spinal cord injury. Current clinical assessments lack resolution and sensitivity for thoracic level injuries.

Methods: The novel technique of measuring cutaneous electrical perceptual thresholds (EPT) to assess somatosensory function involves the application of a non-painful electrical stimulus to the skin, which is perceived as a tapping sensation when amplitude reaches threshold. We have developed the addition of a motor driven control of amplitude change to reduce operator variability. Reproducibility, reliability and stability of the improved technique were assessed in 5 non-spinal cord injured volunteers, who were tested by 2 independent assessors performing EPT at 4 key sensory points, on two separate occasions one week apart.

Results: Thresholds recorded at C4, T1, L4 and S2 were consistent with previous studies using this method (Ellaway et al. 2004, Spinal Cord, 42, 325–337) and showed good inter-rater reliability. Performing simple regression analysis, statistically significant correlations were found for results obtained by the two independent raters from trial 1 and trial 2 and between the left and right sides of the body. A single case study of a spinal cord injured male will illustrate how EPT has the potential to be more sensitive and quantifiable than the ASIA examination in measuring the level and completeness of a spinal lesion.

Conclusions: EPT has good repeatability, inter- and intra-rater reliability in assessing somatosensory function. It is promising as a reproducible, accurate, objective and quantifiable measure of one aspect of spinal cord function. This has implications in detecting early disease/complications, monitoring recovery and measuring outcomes following therapy in spinal cord injury.

Modified Cold Pressor Test by Cold Application to the foot after Spinal Cord Injury suggests hemodynamic control by the Spinal Cord and can be used to assess Spinal Cord Autonomic integrity

A Catz, V Bluvshstein, AD Korczyn, I Pinhas, I Gelernter, T Nissel, Y Vered, NM Bornstein, S Akselrod

Purpose: Study hemodynamic responses to cold application to the foot (CAF) to explore autonomic control by the spinal cord (SC).

Methods: Controlled experimental study. Hemodynamic variables were measured or calculated for 13 healthy subjects, 10 patients with traumatic T4–T6 paraplegia, and 11 patients with traumatic C4–C7 tetraplegia. Subjects were continuously monitored for heart rate (HR), blood pressure (BP), and cerebral blood flow velocity (CBFV) from 5 minutes before to 5 minutes after 40–120 seconds of CAF by ice-water foot immersion. The recorded signals were digitized online and analyzed offline in the time and frequency domains.

Results: During CAF, HR increased in the control group but decreased in patients ($p < 0.001$). BP increased significantly in the control and tetraplegia groups ($p < 0.001$) and non-significantly in the paraplegia group. HR and BP spectral components (LF, HF, LF/HF) did not change significantly. CBFV increased significantly in the patient groups ($p < 0.05$) but not in the control subjects. Cerebro-vascular resistance increased significantly in the control and tetraplegia groups ($p < 0.001$), but not in the paraplegia group.

Conclusions: The findings support the presence of hemodynamic autonomic control by the SC and show that response to CAF can be used to assess its integrity.

Neurological changes or interrater variability – human vs. computerised ASIA classification

C. Schuld, J. Wiese, EMSCI study group, V. Dietz, H. J. Gerner, R. Rupp

The severity and the course of a spinal cord injury are most commonly assessed by the ASIA protocol. The ASIA impairment scale (AIS) and the neurological levels are widely used in interventional studies either as primary outcome measures, as inclusion criteria or for subgrouping. Therefore the consistent evaluation of these parameters is of utmost importance for achievement of unbiased research results. The aim of the present work was to compare the performance of the human classification to a computational ASIA classification. The data for this evaluation was acquired within the framework of the “European Multicenter Study about Spinal Cord Injury” (EMSCI). The algorithm was tested by ASIA experts on hundreds of EMSCI test cases and was identified to be error free. Results of human and computerised AIS classification differ in 15.3% (n=461) of all ASIA records ($p < 0.05$). The largest discrepancies occur in incomplete lesions (ASIA B – 34%, ASIA C – 35.3%, ASIA D – 12.8%). The error rate of the parameters ‘motor levels’ and ‘neurological level’ is 33.63% (n=494, $p < 0.001$), 49.78% (n=223, $p > 0.05$) respectively. The implementation of the ASIA calculations contributes essentially to the consistency/quality of the data evaluation (otherwise only achievable by highly qualified ASIA raters). This work was partially funded by the International Institute for Research in Paraplegia (IFP).

Feasibility of incorporating peripheral Quantitative Computed Tomography scans in SCI annual reviews

S. Coupaud, A. N. McLean, M. H. Fraser, K. J. Hunt, D. B. Allan

Following spinal cord injury (SCI), bone loss occurs in the paralysed limbs and fracture incidence is higher in SCI than in the general population. We are investigating the feasibility of including bone scans in annual reviews of people with SCI. Such routine screening may enable clinicians to detect and treat bone loss early. We are recruiting people with chronic SCI (T2-L2, ASIA A-C) attending the Scottish National Spinal Injuries Unit for annual review. A peripheral Quantitative Computed Tomography (pQCT) scanner (XCT3000, Stratec Medizintechnik) measures trabecular, cortical and total bone mineral density (BMD), and cross-sectional areas, in the tibia, femur and radius. Data from the first 30 subjects (mean time post-injury 5 years) for trabecular BMD (mean \pm s. d., mg/cm^3), are 136.3 ± 84.8 , 155.0 ± 64.6 , and 215.0 ± 42.0 at distal tibia, femur and radius, respectively. Corresponding values (from the literature) for neurologically-intact individuals are 245.8 ± 45.0 , 243.7 ± 30.5 and 219.7 ± 46.1 , respectively. Initial data indicate substantially reduced BMD at key tibial and femoral sites. Radius values remain normal. PQCT scanners are mobile and can be used by appropriately trained personnel. The duration of the scan is one hour, and so can be introduced in Spinal Cord Injury annual review feasibly with significant clinical relevance.

GENERAL SESSION 2

Physical activity, health and well being

Restoration of the level of everyday physical activity after a spinal cord injury

RJG van den Berg-Emons, JBJ Bussmann, JA Haisma, TAR Sluis, MP Bergen, LHV van der Woude, HJ Stam

Purpose: To assess the restoration of the level of everyday physical activity after SCI, as objectively measured with an accelerometry-based Activity Monitor.

Design: Prospective study.

Participants/methods: Forty persons with SCI were included of which 29 persons were completely wheelchair dependent. Measurements were performed during 2 consecutive weekdays at the beginning of the rehabilitation process (T1), 3 months later (T2), at discharge (T3), 2 months after discharge (T4: measurement at home), and 1 year after discharge (T5: measurement at home).

Results: Random coefficient analysis showed that the mean duration of dynamic activities (composite measure of wheelchair-driving, walking and general movement; calculated as percentage of the measurement day) increased from 3.4% at T1 to 5.3% and 4.8% at T2 and T3 respectively ($p=0.001$); corresponding with an increase at T3 of 20 minutes per day. In the home situation, activity levels were lower than at discharge (T4: 3.2%, $p=0.00$; T5: 4.3%, $p=0.26$).

Conclusions: These results indicate that the level of everyday physical activity in SCI improves during the stay in the rehabilitation centre. However, shortly after discharge, there is a strong decline in activity level. One year after discharge, activity levels are partly restored but are low in comparison with normative values.

Prognostic factors of fitness: Management and behavioural aspects following a spinal cord injury

JA Haisma, JBJ Bussmann, HJ Stam, MP Bergen, TAR Sluis, LHV van der Woude

Purpose: To identify prognostic factors for fitness at discharge from inpatient rehabilitation and one year after discharge in persons with a spinal cord injury.

Methods: Longitudinal study at eight rehabilitation centres. In 61 subjects, peak oxygen uptake (peakVO₂) and peak power output (peakPO) were determined on three occasions: at the start of inpatient rehabilitation, at discharge and one year later. The prognostic value of lesion and subject characteristics was investigated with stepwise multiple regression analyses.

Results: At discharge, 60% of the variance in peakVO₂ was explained by management, prior fitness and education; 76% of the variance in peakPO was explained by management, prior fitness and cause. One year later, 79% of the variance in peakVO₂ was explained by prior fitness, sports and work; 81% of the variance in peakPO was explained by prior fitness, sports and body mass index. Disregarding prior fitness, 30–47% of the variance was explained by level, cause, gender, ethnicity, sports and body mass index. These regression models showed positive associations with non-operative management, higher educational level, being Dutch, sports participation and lower body mass index. Smoking and alcohol consumption had no predictive value.

Conclusions: Prior fitness, management and some behavioral aspects are prognostic factors of fitness.

Spinal cord injury, health and well-being; association between self-reports and objective measures

A. M. Lannem and M. Sørensen

Purpose: To investigate the association between objectively measured physiological fitness and subjective perceptions of exercise fitness, exercise mastery, and life satisfaction as experienced by physically active and physically inactive persons with longstanding Spinal Cord Injury (SCI).

Study design: A cross sectional study with both clinical examination and survey questionnaire.

Participants and methods: The sample consisted of 54 persons with SCI (ASIA A-C) injured before 1983. Measures of $\text{VO}_{2\text{peak}}$ (ml/kg/min) were performed with a graded arm crank ergometer, and lung capacity were measured by VC. Subjective perceptions were measured by Self Perceptions in Exercise Questionnaire (SPEQ) and Life Satisfaction Scale (LiSat).

Results: Median age was 47 (26–73) years, and median time since injury was 28 (22–47) years. Median exercise time pr. week was 200 minutes (0–900). The preliminary results indicated that both objectively measured aerobic capacity and perception of exercise mastery increased with exercise time pr. week. No correlation between perception of exercise fitness and minutes of exercise pr. week, or between aerobic capacity and perception of exercise fitness were detected. Aerobic capacity correlated with perception of exercise mastery ($r = 0.313$, $p = 0.023$), and with life satisfaction ($r = 0.378$, $p = 0.006$). Lung function correlated with perception of exercise mastery ($r = 0.314$, $p = 0.030$).

Conclusions: The strongest association between objectively measured physiological parameters and subjective self-perceptions were between aerobic capacity and life satisfaction, and between aerobic capacity and perception of exercise mastery. Perceived exercise fitness was not associated with objectively measured physiological parameters.

Evaluation of lung function and maximal oxygen uptake in spinal cord injured subjects at Sunnaas Rehabilitation Hospital: A comparison between two time periods

Wouda M. F., Lundgaard E., Strøm V.

Objectives: To evaluate if lung function and aerobic capacity of SCI patients, admitted to Sunnaas rehabilitation Hospital, have changed over the last two decades.

Subjects and methods: Persons with traumatic SCI (ASIA A and B), admitted to primary rehabilitation during the periods 1986–96 and 2000–06, were included in the study. Each patient performed two tests; as soon as mobilized in chair and at discharge. Lung function was evaluated by VC and FEV1, and aerobic capacity with maximal oxygen uptake (VO2max, l/min) during graded arm crank exercise test. T-tests were used to compare the two tests and to compare both time periods for the different injury levels (C5–C8, Th1–Th5 and Th6–Th12).

Results: Lung function improved for all injury levels in both time periods. No difference in VO2max was seen during 2000–06 for tetraplegics (0,7 (\pm 0,18) l/min versus (0,67 (\pm 0,36) l/min). In 1986–96 an increase in VO2max was seen. High-paraplegics showed an improvement in VO2max during the rehabilitation in both periods. Mid-paraplegics showed a decrease in VO2max during 2000–06 (1,15 (\pm 0,22) l/min and 1,12 (\pm 0,3) l/min), compared to an increase in 1986–96.

Conclusions: No differences are indicated between lung function during the time periods, but aerobic capacity seems to be generally lower during the last period.

Peripheral vascular changes after home-based passive cycling training in people with paraplegia

L. Ballaz; N. Fusco; A. Crétual; B. Langella; G. Leclaire; G. Egon; R. Brisson

Objectives: to evaluate the peripheral hemodynamic adaptations induced by Passive Leg Cycling Exercise (PLCE) training in people with paraplegia.

Design: Randomized-controlled trial (small cohort).

Participants/Methods: 14 subjects with paraplegia (ASIA: A-C) were included. The Control Group (CG, n=7) received their usual care and the Intervention Group (IG, n=7) performed 36 sessions of PLCE at home (self sufficiency). Before and after this training period, Doppler ultrasound were used to determine maximal (Vmax) and minimal (Vmin) blood flow velocity of the femoral artery, at rest and immediately after a 10 minutes session of PLCE. Mean blood flow velocity (Vmean) and a Velocity Index (VI), used as vascular resistance indicator ($VI = (V_{max} - V_{min}) / V_{max}$), were calculated for each conditions.

Results: After training the resting Vmean of the IG did not differ from the CG value (IG: 6.65 ± 2.9 cm. s⁻¹ vs. CG: 5.81 ± 2.25 cm. s⁻¹, P=0.14, unpaired t-test). In the IG, after training, Vmean and VI post PLCE were respectively higher and lower (P<0.05, paired t-test) than before, whereas no changes were observed in the CG.

Conclusions: After training we found a higher adaptability of the vascular system to PLCE than in non-trained subjects. This result suggests that PLCE training may lead to vascular adaptations and may be beneficial to these immobilized patients.

Tilt Table Studies (TTS) prior to mobilization of patients with Incomplete Spinal Cord Injury (SCI)

J E Weston, R A Dytor, W S El Masri

The injured spinal cord (SC) is physiologically unstable. Amongst many factors that can influence neurological outcome and cause further destabilization of the SC is posture. Verticalisation of patients has resulted in postural hypotension associated with neurological deterioration in some of our patients; both of which subsided when the patient returns to supine. At the MCSI we carry out TTS on patients with incomplete neurological impairment. This is a retrospective study of 263 TTS between 1991 and 2006. There were 211 Male, 53 Female. The levels were 179 cervical, 41 thoracic and 18 lumbar. Neurological deterioration on verticalisation occurred in 20 studies (7.6%). (18 Cervical, 2 Thoracic.) Postural hypotension without neurological deterioration but with nausea, vomiting, sweating and feeling faint occurred in 88 studies (73 cervical, 9 thoracic and 6 lumbar).

Conclusions: These findings suggest that close patient monitoring preferably with Tilt table studies is strongly advisable prior to mobilization of patients with incomplete SCI following trauma. The results of the TTS influence the patient's management as they mobilize. The rate of inclining, timing and intensity of rehabilitation are adjusted to be within the physiological tolerance of the patient.

Hand Management in patients with Cervical Spinal Cord Injury in 31 German Speaking Spinal Units

Lechner HE, Nix D

Purpose: The necessity of immobilizing paralyzed hands by splints or bandages to gain a tenodesis has been questioned (DiPasquale-Lehnerz 1994; Doll 1998). In all publications about hand management the fact is mentioned, that splinting paralyzed hands is common practise, although its effectiveness is not validated and that immobilization may cause contractures. We wanted to know: Are there still different hand management practises in the spinal units of the German Speaking Medical Society for Paraplegia (DMGP), in spite of the many discussions? And where are the differences?

Methods: All 31 occupational departments of spinal injury centres of the DMGP (25 German, 3 Austrian and 3 Swiss) received questionnaires to be completed by the OT (s) responsible for treating protocols of tetraplegic hands. We asked for application of different splints and bandages, passive movements, electrical muscle stimulation and possibilities for surgical interventions.

Results: About 900 patients with tetraplegia are treated per year during first rehabilitation in 29 of the 31 German Speaking centres. 40% of these patients get there hands immobilized up to 23h/day to gain a tenodesis. The hands of 20% of the patients are not splinted or less than 4h/day. 25% have access to surgical tendon transfers, 65% to treatment with electrical stimulation. 29 different forms of splints are used.

Conclusions: There is no consensus about hand management for tetraplegic patients in DMGP-Centres. Reasoning for regimes is mainly empirical. There is a need for randomized, controlled trials.

Patient performance and satisfaction after reconstruction of hand function in tetraplegia

J. Wangdell, A. Dahlgren, Å. Sand, J. Fridén

Aim: The purpose of this study was to define the most highly valued and requested ADL abilities and to determine how these ability needs were met by reconstructive hand surgery in tetraplegics.

Patients and methods: 32 individuals (20–72 years, 6 females, 26 males) with post-traumatic tetraplegia were assessed using COPM and analysed according to International Classification of Functioning (ICF) scale. Data were presented as median value before and 6 and 12 months after reconstructive hand surgery. Surgical procedures included reconstruction of grip (n=20 arms), thumb flexion (n=7 arms) and elbow extension (n=11).

Results: Performance for grip increased from 2 to 5.5 and 7 before and after 6 and 12 months postop, respectively. Corresponding change for thumb flexion was from 3 to 6 and 6, for elbow extension 3,5 and 6, respectively. Values for satisfaction were essentially the same as for performance. ICF categories "communication", "domestic life", and "recreation" demonstrated the highest rate changes of performance after grip reconstruction (increase $\times 5$). Individuals who underwent hand reconstructions of dominant side rated highest score for satisfaction and performance.

Conclusions: This study demonstrated that reconstructive hand surgery in individuals with tetraplegia improves not only performance during daily life activities but also perceived satisfaction.

Rehabilitation robotics with closed loop electrical muscle stimulation, a pilot study in SCI populat

A. Al-Khodairy, P. Métraiiller, R. Brodard, R. Clavel, R. Frischknecht

The MotionMaker™ is a new stationary test and training robot for the lower limbs combining two motorized hip-knee-ankle-foot orthoses with a closed loop electrical muscle stimulation system. We report the effect of a training with the MotionMaker™ on motor performance of chronic SCI persons 5–20 years after injury. Five paraplegic subjects, 25–52 years old, 4 with an incomplete lesion, 3 with spasticity, completed a functional electric stimulation (FES) assisted, robot guided leg training every second working day for 2 months. FES of selected muscles was superimposed on residual voluntary muscle action and modulated in real time so as to produce an isokinetic full-range leg press movement. No harmful incidents or drop-out were observed. The electroinduced force increased by 397% (n=5). The incomplete SCI patients reported an increased proprioceptive awareness of their muscles during electrically induced leg movements. Their voluntary force increased by 388% on their most affected leg and by 193% on the controlateral side. During the training sessions hypertonia of the spastic subjects, decreased by 1.9 points on the modified Ashword scale (n=3).

The MotionMaker™ seems to be a useful and well tolerated tool to improve motor function after SCI, whether in the acute or the chronic phase.

Incidence of smoking after spinal cord injury

I Chakraborty, B Gardner, J Kirkwood, S Walkers, C Nuttall

Aim: To establish to what extent, and why, the prevalence of smoking falls after spinal cord injury (SCI)

Methods: 219 consecutive SCI persons attending the spinal outpatient department of Stoke Mandeville Hospital, between September and November 2006 were asked to complete a questionnaire on their smoking habits pre and post injury.

Results: Of the 219 questionnaires, 199 were analysed. 151 were men. 61% had thoraco-lumbar and 39% had cervical injuries. 25% were ambulatory. Pre-injury 43% were smokers. 61% of cervical and 30% of the thoraco-lumbar groups stopped smoking. Discontinuation was commoner in the ambulatory (65%) than the non-ambulatory group (39%). Of the reasons for not recommencing smoking 27% were health related. Of those who recommenced after their injury, the main reasons given were stress (18%), boredom (15%), pleasure (15%) and habit (13%). 6.1% of the non-smokers pre-injury commenced smoking after injury. Strategies suggested by the patients to further reduce smoking include providing information on adverse health events associated with smoking (38%), employing smoking reduction techniques (patches/hypnosis/counselling) (13%), will power (11%), banning/increasing price of cigarettes (9%), engaging in a wider variety of life activities (6%) and restricting health facilities for smokers (3%)

Conclusions: Smoking remains an important adverse health lifestyle factor following SCI. Techniques for further reducing its prevalence are required.

References: Doll et al

GENERAL SESSION 3

Function and recovery

O44

Thrombophilia is associated with failure of heparin to prevent venous thromboembolism (VTE) in patients with acute traumatic spinal cord injury (ATSCI)

G. Zeilig, D. Rubin-Asher, A. Ratner, I. Asher, A. Zivelin, U. Seligson, A. Lubetsky

VTE in ASCI occurs in a substantial number of patients despite heparin prophylaxis. We examined the role of thrombophilia in thromboprophylaxis failure. This is a matched case-control study. Between 01/1996–05/2004 inpatients who developed a new, objectively confirmed, VTE episode despite prophylaxis were identified. Each was matched by gender, age, level and mechanism of injury with 2–3 controls. Participants were interviewed for VTE risk factors, tested for factor V Leiden (FVL), prothrombin G20210A, methylenetetrahydrofolate reductase C677T (MTHFR), lupus anticoagulants, and for homocysteine (Hcy) and factor VIII (FVIII) blood levels. 22 patients and 61 controls were ascertained. Gene alterations for MTHFR, FVL and PT, and Hcy and FVIII ≥ 2 SD above mean value were more common in patients compared to controls (77% vs. 49%, $p < 0.001$), as was a positive family history for VTE ($p < 0.001$). Body mass index, smoking status, severity of injury, presence of lupus anticoagulants and type of prophylaxis had no impact on VTE rate. A positive family history of VTE and various thrombophilia markers were significantly associated with failure to prevent VTE following ASCI. Testing for thrombophilia in ASCI patients and a more intense thromboprophylactic regimen seem desirable, but need to be verified in a prospective study.

Human embryonic stem cell-derived Oligodendrocyte Progenitors for the treatment of Spinal Cord Injury: Translation from Preclinical studies to clinical trials

E. Wirth, C. Priest, J. Lebkowski, R. Brandenberger, S. Cullen, A. Davies, J. Denham, E. Estigarribia, H. Keirstead, L. Jones, A. Majumdar, A. Natesan, R. Okamura, S. Powell, S. Thies, Y.

Multiple preclinical studies were performed over a period of several years to assess the efficacy and safety of human embryonic stem cell (hESC) -derived oligodendrocyte progenitors (OPC) in animal models of human spinal cord injury (SCI). Efficacy was assessed with respect to OPC-mediated improvement of locomotor function in rats that had received a contusion injury to the spinal cord at the T9–T10 thoracic level. Safety of intraspinal OPC grafts with respect to toxicology, tumorigenicity, and biodistribution was evaluated in several long-term pilot experiments, with monitoring up to one year. The preclinical efficacy studies suggest that OPC can improve locomotor ability in rats if the cells are implanted approximately 7 days after injury, but not if the delay before grafting is greater than 2 months. The pilot safety studies have revealed no OPC-related adverse events or tumors up to one year after implantation. Based on these encouraging preclinical data, a combined Phase I–II trial has been designed to test the safety of OPC in patients with subacute SCI. The trial will use an open-label, randomized, dose-escalation design in which subjects will receive either the usual standard of care or intraspinal injection of OPC between 7 and 14 days following injury.

Characteristics of sports related spinal cord injuries: Data from Northwest of England, 1999 through 2003

BN Kumar, P Silva, BM Soni

Purpose: To describe injury and outcome characteristics of individuals who sustained spinal cord injury (SCI) while engaging in sports and recreation activities in Northwest region of England.

Methods: Retrospective review of data on 36 patients admitted first time with SCI as direct result of sport from 1999 through 2003.

Results: 12.7% (36/283) patients had spinal cord injury caused by sports. 77% patients were men. The leading sports and recreational activities contributing to SCI were, shallow water diving (12), horse riding (7), cycling (6), rugby (4) and football (2). Median age at SCI based on sports demographics, football 24years (range 23–25), rugby 38 years (range15–59), cycling 43 years (24–52), horse riding 50 years (17–60) and diving 21 years (range17–61). Extent of Injury based on ASIA grade scale was A, C and E in 28% of patients, 11% were B and 6% had D. 78% patients sustained tetraplegia, 22% patients required full assisted ventilation on admission.

Conclusions: Cervical injuries were predominant in all sport activities. Usually young male patient is left with a life long disability. Awareness and measures to prevent and manage these common injuries with dire consequences are needed.

Trampoline accidents causing spinal cord injury

N Hussain, F Jepson, P Thumbikat, McClelland MR, Mathew KM

Ever since the introduction of trampolines in 1935, they have been known to cause injuries which can range from the trivial to more serious injuries that can result in disability and death. The American Paediatric Association advises against the unsupervised use of trampolines and in Britain both the RoSPA (Royal Society for Prevention of Accidents) and British Gymnastics recommend that all trampoline activity should be supervised by British Gymnastics affiliated trainers.

Trampolines have in recent years become more popular especially in areas where young adults congregate such as outdoor areas associated with pubs, clubs etc. Those trampolining under the influence of alcohol are at greater risk as they are less able to protect themselves in the event of a fall.

We report a series of three cases of tetraplegia resulting from trampoline related accidents in young men who had been drinking prior to using the trampoline. All three patients reported to our centre in a span of three months over the summer of 2006. Two patients were injured when they were unable to control their falls that resulted in hyperflexion injuries of the cervical spine while the third person fell from a trampoline into a pool and dislocated his cervical spine. The neurological deficit was complete in two cases and incomplete in one.

Trampoline is not a risk free sporting activity. There needs to be a greater awareness of the potential for injuries, especially if the trampolines are located where there is potential for its misuse or careless use as in pub gardens. There needs to be a greater effort in increasing the awareness among the general public of the likelihood for serious injuries if trampolines are inappropriately used without due care. Manufacturers should also play their part and highlight the seriousness of the risks involved in un-supervised use.

Outcomes in patients admitted to rehabilitation with spinal cord lesions following Multiple Sclerosis

J Ronen, V Bluvshstein, I Gelernter, A Catz

Purpose: Evaluate survival, neurological recovery, and length of stay in hospital (LOS) in patients with spinal cord lesions following multiple sclerosis (MS/SCL).

Methods: Data of 236 patients with MS/SCL were collected retrospectively and assessed using the Kaplan-Meier method, the Cox proportional hazard model, the change in Frankel grades, logistic regression, and ANOVA.

Results: Median age at lesion onset was 33.5 years and median survival was 29 years. Decade of rehabilitation ($p=0.0003$) and gender ($p=0.0695$) had a significant effect on mortality but not age, lesion severity, and level of lesion. Thirty percent of the 146 patients who had Frankel grades A, B, or C on admission achieved useful recovery to grades D or E. The severity of the MS/SCL had a significant effect on recovery. The mean LOS was 69.9days; it was significantly affected by lesion severity ($p=0.001$) and by the decade of rehabilitation ($p=0.001$), and decreased with time ($p=0.001$).

Conclusions: Patients with MS/SCL who were admitted for rehabilitation have relatively limited survival and recovery rates, but favorable enough to justify inpatient rehabilitation. Their LOS is probably a function of medical requirements and decreases with time.

MAIN TOPIC

Impact of SCI on the family

Impact of spinal cord injury on the family

M Kreuter

Among the many issues confronting a newly spinal cord injured person is apprehension about the impact of the disability on the family. Family life is disrupted during the period at the hospital. Couples managing an SCI have to make difficult, ongoing adjustments in their lives since the injury was something for which neither partner was prepared. The results from the Nordic study, including 532 SCI women, show that more than half (54%) of those married when the injury occurred had subsequently divorced and 39% of these women blamed the injury. At the time of the investigation, half of the SCI women were married (compared to two-thirds of the age-matched controls) and 96 SCI women had given birth to a child after injury. Our ongoing longitudinal study, with the aim to describe the impact of the SCI on the injured person and the immediate family from discharge up to 5 years after the injury, shows that hospital discharge is a very critical time for both the injured person and the family. The need for information about what is happening and what is expected to happen is essential as well as support from the staff both during the hospital stay and at discharge.

Health Status, Quality of Life and Strain in Carers during Community Reintegration after SCI

J Middleton, I Cameron, R Quirk, A De Wolf

Purpose: To evaluate the health status, quality of life and strain of family members or significant others, who provide informal care and support for people with SCI during community reintegration.

Methods: Carers (defined as a family member, partner or friend with regular contact with person with SCI providing unpaid personal, domestic and/or emotional support) were identified during person's acute SCI admission. Carers were assessed prospectively before person with SCI was discharged, at 6 weeks and 12 months post-discharge, with measures including the Medical Outcomes Study Short Form 36 (SF-36), the General Health Question 28 item version (GHQ-28) and Carer Strain Index (CSI).

Results: 44 carers participated, being predominantly female (88%), living with person with SCI (86%) as parent (37%) or spouse/de facto (44%) and majority of working age employed at time of person's SCI. Carers described feeling tired and worn out, being less socially active, experiencing greater problems with every day activities and work, feeling more nervous or depressed (with mean score of 45.9 ± 12.0 on SF-36 Mental Health Component; 30% psychological "caseness" on GHQ-28 six weeks after discharge), and reported substantial disruption to family life and routines.

Conclusions: Unpaid carers provide substantial assistance and demonstrate significant psychological strain, requiring greater attention and support.

Acknowledgement: The Community Participation Project, piloting a new model to promote community participation for people with traumatic spinal cord injury, is funded by the Motor Accidents Authority of NSW.

Severely disabled SCI person as an employer for a personal assistant

M. Koikkalainen, H. Alaranta

In Finland a severely disabled person has right to have a personal assistant. The duration of the service is agreed on with the social services of the home community, that covers the costs for employing the assistant. The SCI person should be the employer. Therefore there are many items, which are not clear for the newly disabled employer. The aim of the program was to develop the process of how to support the disabled person to become an employer. A total of 20 SCI patients took part of the developing process. The senior social worker counselled the patients in small groups using lectures and dialogue discussion. The specific brochures and pamphlets were prepared. The feedback report of the program was evaluated after half a year. By the structured questionnaire the effect of the counselling was evaluated. General impression was that counselling essentially raised the awareness of the search of the employee, the labour legislation how to make an employment contract, the rules of responsibilities and rights of both sides, and how to overcome disagreements. The program helped the counsellor more specifically to focus on lecturing and prepare brochures supporting the patient to be as good employer as possible.

Evolution of the Cervical Traumatic Spinal Cord injury at Elderly Subjects

A. Anghelescu, G. Onose, M. Lapadat, AS Mihaescu, D. Georgescu

Study design: Epidemiological retrospective analysis, focused on the subacute evolution of 292 new patients with cervical traumatic spinal cord injury (CSCI) at elderly (>65 years), admitted in the Rehabilitation Department, during 1995–2005.

Methods: The analyzed data were collected from the medical files.

Results: The ratio between the 206 males and 86 females was 2,4. The majority of the patients (74%) were from rural regions. Most of the CSCI happened during the agricultural work; etiology was dominated (74%) by falls from height (from cart, trees) but also by traffic accidents (19,5%).

Cervical vertebral lesions consisted in facet dislocation (bilateral in 32%, unilateral in 11% cases) or/and (associated) disk hernia (54%); about 37% patients had no radiological evidence of bone injury.

Conservative approach was indicated in 106 subjects (36%) vs. operated (64%). At admission 57,5% patients were totally dependent vs. 27,5% at discharge. Most of them (61%) went home, whereas 22% were admitted in nursing home. A mortality rate of 2% and miscellaneous medical complications (mainly asymptomatic urinary tract infections, bronchopneumonia) were noticed in our rehabilitation clinic.

Conclusions: Geriatric associated pathology, poor social conditions favored the incidence of CSCI. Comprehensive interdisciplinary approach, early admission and rehabilitation after spinal surgical stabilization, favored a better outcome and a low mortality rate.

GENERAL SESSION 4

SCI-Care and follow up

The future of spinal cord injury care: Results of an international workshop

Weeks, C.; Hultling, C.; Creasey, G.; Levi, R.; Wing, P

Introduction: Many clinicians feel that, despite an explosion in publications concerning SCI, improvement in care has slowed.

Methods: 19 clinicians from 5 countries participated in a 3-day workshop in Landsort, Sweden to discuss progress in the care of individuals with SCI. Led by a professional facilitator, each individual described his/her vision of SCI care in 2030. Small and full group sessions were used to develop a shared vision with a 25-year horizon, set priorities, and articulate a 5-year plan.

Results: Of 19 participants, 9 were women and three were people with SCI. 2 were in training, 6 had been in practice for fewer than 10 years. The group articulated a vision of a consolidated SCI community, and a globalized knowledge base creating a new model of care, empowerment and collaborative networking. To this end, small international working groups were established in the interest areas of prevention, acute management, rehabilitation, follow-up, research, accreditation, developing countries, stakeholder liaison, and communication. Specific individuals will lead these groups. Earliest steps include establishment of a website to facilitate further collaboration and selection of a steering team to oversee progress. Presentation at ISCoS is proposed as a way of inviting broader interest, support and participation in developing future plans.

Early acute management in adults with SCI: A clinical practice guideline for health-care providers

Wing PC, Stripling T, Thomas JP, for the Consortium for Spinal Cord Medicine

In an iterative 12-step process developed by the Consortium for Spinal Cord Medicine, a five-year literature search was undertaken for peer-reviewed scientific publications in English (or translation) relating to humans on topics applicable to the care of SCI within the first 72 hours. The topic explication includes all clinical issues of importance as the patient moves through the emergency, imaging, traumatology, surgical and intensive care units including preparatory rehabilitation necessary in the first few days. Psychosocial and ethical issues are addressed, as are the required levels of care. A 13-member panel appointed by the member organizations participating in the Consortium steering committee includes physicians from medical, surgical, intensive care and behavioural specialties as well as representatives of the nursing and physiotherapeutic professions. Using the independently-graded evidence base resulting from the search strategy as well as other selected references from the peer-reviewed literature the panel has drafted a clinical practice guideline for the early care of people with suspected or proven spinal cord injury. Recommendations are based where possible on available evidence; where this evidence is lacking an expert consensus has been provided. This guideline will bridge the care given by numerous clinicians in the first days in hospital.

Administrative and financial support provided by Paralyzed Veterans of America

Clinical pathways for spinal cord injury

F Schillebeeckx, L Van de Voorde, K Van Rie, K. Vanhaecht, K Peers,
C. Kiekens

Background/Aim: Clinical pathways for rehabilitation after spinal cord injury (SCI) were compared as a subproject by government order concerning the organisation and financing of musculoskeletal and neurological rehabilitation in Belgium and coordinated by the Belgian Health Care Knowledge Centre.

Study design/Approach: Scientific databases and grey literature were examined on clinical pathways and spinal cord injury. International experts were asked to inform us on their clinical pathways use. Search results were double checked and discussed within a peer review committee.

Results: Three clinical pathways for the acute phase and two rehabilitation pathways were found and analysed for nine predefined parameters (patient characteristics, delay after SCI, patient needs, conditions to start pathway, duration of phase, outcome tools, intensity and type of therapy and involved professionals). All three acute pathways described inclusion of multidisciplinary team and/or rehabilitation doctor and discharge planning within the first 24 hours. In none of the acute and rehabilitation pathways content and intensity of therapy were specified. Standardized outcome tools were only mentioned once.

Conclusions: It should be a future task of scientific societies to define the key interventions and a core set of outcome indicators which should be part of clinical pathways for SCI.

Evidence based medicine and spinal cord injury: A clinical case

AF Townson and the SCIRE research team

Background: Evidence-based medicine (EBM) is the integration of best research evidence with clinical expertise and patient values. Various clinical tools, including clinical practice guidelines and literature reviews, are available to assist clinicians in the practice of EBM.

Presentation: Using a short clinical case, this presentation will highlight the steps necessary for the practice of EBM in SCI:

- 1) The development of a clinical question;
- 2) The identification and critical appraisal of available literature;
- 3) The integration of available knowledge with our clinical expertise and the patient's unique situation.

Typically, step 2, the identification and critical appraisal of available literature, is the most difficult for time-challenged clinicians. The Spinal Cord Injury Rehab Evidence (SCIRE) project is a newly available systematic review of SCI rehabilitation literature. It provides a valuable synthesis of the literature which can be used to help clinicians integrate current research knowledge into their practice. Clinical application of the SCIRE project will be demonstrated through this case presentation.

Conclusions: Many of us already strive to practice EBM. Reviewing the resources available and the steps necessary to practice EBM will help make it an everyday reality in our clinical practices.

Pragmatics and recruitment issues in a phase II, randomized, controlled trial

Linda Jones

This presentation describes challenges encountered in recruitment and enrollment of individuals with acute SCI in a cellular based, randomized, controlled multi-center international trial for acute SCI.

A call center pre-screened interested subjects for basic inclusion criteria. Of 1819 pre-screened subjects, 55% did not meet study criteria. Primary reasons for ineligibility were time since injury > 14 days (53.4%), medically ineligible (23%) and not meeting MRI criteria (23%). Seventy five subjects who met the initial pre-screening criteria were enrolled in the trial. One third of these screen failed (SF) leaving 50 subjects in the trial. Sixty percent of SF subjects were transported

to the site via air ambulance versus 34% of randomized subjects. On average, subjects arrived at a trial center 8.73 days following injury, were randomized on day 11, and reached day 0 (day of injection or comparable in control group) on day 13.

The pragmatics associated with an acute SCI trial are daunting not only due to potentially limiting inclusion criteria, but also the "funnel" effect observed in such trials. In trials requiring enrollment within two weeks of injury, recruitment must occur in a tight timeline which can be challenging and potentially lead to higher rates of screen failure.

ICU and intermediate intensive care in high cervical injuries at Spinal injury unit in Göteborg Swed

Lena Rutberg, Bengt Skoog, Ann-Katrin Karlsson

The risk of respiratory complications in high SCI is huge. In order get a better knowledge of the need for intensive care and the treatment after ICU we have retrospectively analysed nine subjects treated due to high SCI during a period of two years.

Results: Level of injury ranged from C0 to C5 with two subjects suffering from a level of injury above C3, M/F: 8/1. Eight suffered from traumatic injuries and one had an ependymoma. Age at injury was 22 to 65, (mean 40,8). Two were referred directly to the ward. The mean stay at ICU for the rest of the group was 32 days. 7 subjects were referred with a tracheostomy and 4 of these could be decannulated later. The mean length before decannulation was 122 days (range 75–182). The reason for persistent tracheostomy was total or partial loss of diaphragmatic function.

Conclusions: The improved handling of acute high SCI possesses new demands on the skill of the SCI care. With a comprehensive care system it is possible to give even the very high SCI lesioned a good SCI care from the beginning.

Time course of respiratory function after spinal cord injury: A prospective cohort study

G. Mueller, S. de Groot, L. H. V. van der Woude, M. T. E. Hopman

Purpose: To better understand time courses of lung function and respiratory muscle strength impairments after spinal-cord injury (SCI) to allow better adjustment of therapeutic interventions.

Methods: This study was performed as a multi-center, prospective cohort study. Respiratory function was measured at first mobilization, at discharge from inpatient rehabilitation and one year after discharge. 109 subjects with an acute, motor complete SCI performed lung function measurements and 55 out of these performed additional respiratory muscle strength measurements. Time courses of respiratory function for different lesion level groups were assessed by multilevel regression analysis.

Results: Forced vital capacity, forced expiratory volume in 1s and maximal inspiratory muscle strength showed significant improvements during and 1 year after inpatient rehabilitation. Forced inspiratory volume in 1s, peak inspiratory flow, peak expiratory flow (PEF) and maximal expiratory muscle strength (Pemax) only increased significantly during inpatient rehabilitation, but not thereafter. Subjects with high tetraplegia showed the most severe impairments in all measured parameters.

Conclusions: Respiratory function increased during inpatient rehabilitation, but only few parameters further improved thereafter. A more consistent rehabilitation after-care regime may be required. Special attention should be given to the most affected parameters Pemax and PEF, and to subjects with high tetraplegia.

Telemedicine: a tool to improve spinal cord injury care in Southwest England?

A. Soopramanien, H. Pain, J. Esnouf, C. Wood, A. Stainthorpe, R. Prior

Introduction: Salisbury Spinal Centre participated in the first ever randomised control trial in telemedicine for follow-up of patients with spinal cord injury, also involving centres in Italy (Montecatone) and Brussels (CTR). Stanmore Spinal Centre (London) provided another UK site. The results are encouraging and point towards other fascinating uses of Telemedicine.

Methods: In UK 56 recently discharged patients were randomised into 2 groups and followed for 6 months. Both had normal outpatient follow-up. The trial group had Telemedicine sessions (scheduled and unscheduled). Outcome measures used standardised tools centred on cost/benefits, physical well-being, and quality of life before and after sessions.

Results: Mean age was 41.7 years, there were 5 males to 1 female, 22 tetraplegics to 34 paraplegics. Quality of life was significantly increased for the trial group ($p=0.034$). Cost benefit, information provision, level of support, ease of use, confidentiality ensured by encryption was highly rated. Patients felt that this technology was superior to the telephone as they could "see who they were talking to". Interviewers could pick up more clues from telemedicine.

Discussion and Conclusion: Telemedicine can help provide follow-up care. In addition technology will allow remote monitoring for advice and teaching before admission and after discharge.

Adults with Spina Bifida in the greater Stockholm region – follow-up study

Werhagen L, Westgren N, Gabrielsson H

Introduction: Spina bifida(SB) is a congenital non traumatic spinal cord injury often combined with hydrocephalus. The patients have both a physical and a cognitive dysfunction. Medical problems include paraparesis, spasticity, scoliosis, pressure ulcers and bladder/bowel issues. Psycho-social issues related to their multi-facetted disability are common.

Aim: To describe the frequency of medical problems and psycho-social situation (family, work) in a SB population considering age, gender and neurological classification (ASIA).

Methods: 77 consecutive patients with SB underwent follow-up. All patients were examined and classified according to neurological level, ASIA(A-E) and tested for spasticity. They were interviewed about presence of pain, medical complications during the last year and about their family situation/work.

Results: n= 77 39 males,38 females. Mean age =34 yrs (16–62), L1 was the most common neurological level, 15(19%) were ASIA A, 41(53%) had hydrocephalus. 8(10%) described NP, 5 (5%) spasticity, 23(30%) had scoliosis, 8(10%) had epilepsy, 39 (51%) present urological infections, 4 (5%) pressure ulcers, 31(40%) had been diagnosed with cognitive impairment, 25(33%) lived alone without families, 28 (36%) worked at least part-time.

Conclusion: The study shows that SB adults have medical problems and a complex disability. Neuropathic pain is a rare complication.

The Development of Spinal Cord Injury Programs and Services in Lithuania

W. Waring, A. Krisciunas, A. Juocevicius and T. Morkevicius

One of the successes in post Soviet Eastern Europe has been the development of Lithuanian rehabilitation and programs and services for its people with spinal cord injuries. Assistance from Western countries began in 1989 through the International Committee of Physicians for the Prevention of Nuclear War. In the Soviet era, disability was poorly addressed and rehabilitation as known in the West was nonexistent. The initial model for change was integrated consumerism where health care professionals and people with disabilities work together to address the social, medical, rehabilitation, legal and community aspects of spinal cord injury. Besides rehabilitation professional sharing their knowledge and expertise, an effort was made to always include people with disabilities. The first step was to introduce models of active and healthy and active people with disabilities and facilitate a positive attitude towards disabilities among health care professionals and Lithuanian with disabilities. The second step was to teach the basics of medical rehabilitation and services for people with disabilities. The third step was to start Lithuanian programs for people with disabilities. The fourth step, which is ongoing, is to Lithuania to develop its own programs for disabilities that fit in with their resources and their culture.

MAIN TOPIC

Coping Strategies

Coping with Spinal Cord Injuries: What Makes the Difference?

P Kennedy

Coping with Spinal Cord Injuries (SCI), is about enabling the person to sustain an integrated view of the self while constructing a new reality that is both hopeful and credible. This paper will review the key research into coping with spinal cord injuries. Drawing upon cross sectional, longitudinal qualitative and quantitative studies, the key strategies associated with positive and negative outcomes will be presented. Coping strategies used by partners of people with SCI will also be compared. Psychological models of coping will illustrate the key role in approach as opposed to avoidant coping strategies associated with adjustment. Strategies include denial, acceptance, social support and behavioural disengagement. A key issue remains in relation to the dispositional or situational nature of these coping strategies. Coping Effectiveness Training treatment strategies based on these findings will also be described. Preliminary findings of a multi-centre European study of appraisal, coping and adjustment will also be highlighted. The contribution of cognitive appraisal processes in adjustment as identified by a recent study using Interpretive Phenomenological Analysis will be detailed. The paper will finish with suggestions for future research to advance our understanding of the contribution of coping in adjustment.

A cross-national validation of the Spinal Cord Lesion-related coping strategies Questionnaire

M. L. Elfström, P. Kennedy, P. Lude, N. Taylor

This study investigated the psychometric performance of the SCL-related Coping Strategies Questionnaire (SCL CSQ) in four different countries (Austria, Germany, Switzerland, UK). It is, to our knowledge, the first cross-validation of a condition-related measure of SCL-related coping strategies. Questionnaires from 355 community residing persons with SCL were analysed with multi-trait/multi-item analysis. The Acceptance coping scale showed satisfactory psychometric qualities, whereas there were some problems in the Fighting spirit scale and greater problems in the Social reliance scale. In contrast to the Swedish developmental sample, Acceptance was used more in the four study countries. Consistent with the original sample, Acceptance and Fighting spirit coping correlated with fewer signs of emotional distress, persons lesioned 5 years or longer tended to report more Acceptance than the newly lesioned and coping strategies were mainly unrelated to neurological status. In conclusion, the English and German language versions of the Acceptance coping scale were valid and reliable, whereas some translated items in the Fighting spirit scale need to be revised. Translations of the Social reliance scale need to be thoroughly revised and retested. The results add further evidence to the literature on the stability of the link between adapting life priorities (i. e. Acceptance) and emotional well-being.

Describing mood, illness cognitions and well-being in a Dutch Spinal Cord Injured Population

M. M. Wollaars; M. W. M. Post; F. W. A. van Asbeck

Objectives: To describe mood, illness cognitions and overall well-being in a spinal cord injury (SCI) population, and to examine their interrelationships.

Study design: Mailed survey.

Methods: The Profile of Mood States (POMS) measured Depression, Anger, Fatigue, Tension and Vigour. Illness cognitions (Helplessness, Acceptance and Disease Benefits) were measured with the Illness Cognition Questionnaire (ICQ). Overall well-being was assessed with an Numerical Rating Scale.

Results: Of all respondents (N=279, response rate 49%), 63.5% was male, mean time post injury 11.8 years (SD 10.7), 57.4% was paraplegic and 63.3% had a traumatic injury. Mood scores were comparable to those of other diagnostic groups but showed mood disturbance compared to a general population. Well-being scores (6.7; SD 2.1) were moderately lower than in a general population (7.7; SD 1.65). Strong correlations were found between cognitions of helplessness and acceptance, mood scales and overall well-being. Controlled for demographic and SCI characteristics, POMS Depression ($\beta = -.39$, $p < .000$), Helplessness ($\beta = -.24$, $p < .000$) and Acceptance ($\beta = .17$, $p < .01$) were related to well-being (59.7% explained variance).

Conclusions: Well-being is independently related to depressive mood and illness cognitions. This suggests that modifying cognitions might improve well-being of persons with SCI.

Psychosocial aspects of traumatic spinal cord injury with onset during adolescence

Marika Augutis, Levi R, Asplund K, Berg-Kelly K.

Adolescence – onset traumatic spinal cord injury (adolSCI) presents unique challenges. In addition to the inherent consequences of this devastating injury, identity development is at its peak during adolescence. This added vulnerability affects both process and outcomes.

Objectives: Assessment of psycho-social impact of adolSCI, including factors that facilitate or impede readjustment.

Methods: Twenty-four of the 28 persons who sustained adolSCI in Sweden, 1985–1996 participated in the study. Semi-structured interviews were performed during 2002–2004, an average of 10 years post injury. Narratives were analyzed according to content analysis, and further interpreted utilizing an established theoretical framework.

Findings: Parents and peers were found to play a crucial role. Parents are important especially as advocates in interaction with health care providers. Peers play a key role as promoters of independence and identity development. Additionally, role models, school staff, and patient organizations are typically useful facilitators in the posttraumatic readjustment process.

Conclusions: AdolSCI requires a system of care that involves parents and peers, and that considers the crucial developmental issues of adolescence in order to achieve optimal rehabilitation outcomes.

GENERAL SESSION 5

Bowel function and Sexual Function

A randomised controlled trial of a stepwise protocol for bowel management after spinal cord injury

M. Coggrave, C. Norton, J. Wilson-Barnett

Aim: High quality evidence for interventions in bowel management after spinal cord injury (SCI) is lacking and bowel programmes are developed empirically. This randomised, controlled trial compared usual care with a stepwise protocol (Badiali 1997) to explore whether systematic use of less invasive interventions could reduce the need for more invasive interventions, such as manual evacuation, and improve bowel management outcomes in individuals with chronic SCI.

Methods: Sixty eight individuals were recruited (35 in intervention group), median age 47 years (range 24–73 years), median duration of injury 16 years (range 1–47 years). Bowel diaries were maintained for a maximum of 6 weeks. Measures of quality of life and preferences for different bowel care interventions were recorded.

Findings: The stepwise protocol did not improve bowel management outcomes; faecal incontinence was more frequent ($p=.04$) and the need for invasive interventions was not reduced ($p=.4$). Bowel care took longer in the intervention group though this did not reach statistical significance ($p=.08$).

Conclusions: The study findings support the need for manual evacuation in bowel management and provide evidence of acceptability of the technique to SCI individuals. The results are in contrast with previous studies in younger samples with shorter duration of injury.

Ref: Badiali, D., Bracci, F., Castellano, V., Corazziari, E., Fuoco, U., Habib, F., & Scivoletto, G. (1997) Sequential treatment of chronic constipation in paraplegic subjects. *Spinal Cord*, 35 2, 116–120.

Study funded by Action Medical Research grant number RTF1031

Physiopathology of constipation and fecal incontinence in motor incomplete spinal cord injury (SCI)

M. Vallès, J. Benito, J. Vidal, F. Mearin

Background: Abnormal bowel function is more serious in motor complete SCI but it is also present in motor incomplete patients.

Aim: To describe physiopathology of constipation and fecal incontinence in motor incomplete SCI.

Patients and Methods: 30 patients (73% men/ 27% women; mean age: 45 years) with chronic motor incomplete SCI (30% ASIA C/70% ASIA D) who complained of constipation (Rome II criteria) and/or fecal incontinence (Wexner Score) were studied. A personal structured interview, colonic transit time (CTT) quantification and anorectal manometry were performed.

Results: 83% of patients had constipation and 43% fecal incontinence with Wexner Score > 5. CTT was delayed in 32% of patients, in most cases left colon was implicated. In constipated patients an obstructive defecation with/without impaired rectal sensation was observed in 81%. The other 19% had a weak abdominal press with/without canal anal relaxation and impaired rectal sensation. All incontinent patients had absent or weak external anal sphincter (EAS) with/without impaired rectal sensation.

Conclusions: The most important physiopathological mechanism for constipation is obstructive defecation, and for fecal incontinence weak EAS, but other mechanisms are implicated (impaired rectal sensation, weak abdominal press). Delay in CTT is secondary to obstructive defecation.

Surgical options for the treatment of faecal incontinence in patients suffering from conus-cauda-syndrome

K. Gstaltner, H. Rosen, J. Hufgard, K. Schrei

Background: Among patients suffering from Conus-Cauda-Syndrome we can see a flaccid paresis of the sphincter which causes faecal incontinence, which means, unless it can be controlled with the help of laxatives and tampons, a dramatic limitation of the patient's quality of life. Therefore we are looking for surgical methods to increase the level of continence.

Methods: In case of the positively tested electrical sacral-nerve stimulation, we can engraft a stimulation-system. This provokes an upgrade of anal sensibility and sphincter-tonus. Consequently we can see a significant improvement of the level of continence. In case of a negative test, an artificial sphincter can be implanted.

Results: So far ten patients have been tested for electrical sacral nerve stimulation. Seven test results were positive. Four patients underwent the definitive implantation which resulted in continence. Two patients were eliminated from the procedure, one patient refused the implantation. Three tests failed. One of these patients received an artificial sphincter, which also resulted in continence.

Conclusions: In case of flaccid paresis of the anal sphincter the implantation of a sacral-nerve-stimulation-system or an artificial sphincter are two surgical options to increase the level of continence.

Vibratory ejaculation and home insemination in 140 spinal cord injured men and their partners

J. Sønksen, D. Löchner-Ernst, DA. Ohl

Objectives: To present the last 20 years' experience from penile vibratory stimulation (PVS) and vaginal self-insemination at home in SCI men and their partners.

Material and methods: A total of 140 SCI men and their healthy partners seeking treatment for infertility were included in this study. Ejaculation was induced by PVS and basic semen analysis was performed. Only men who obtained antegrade ejaculation by PVS and had motile sperm in the ejaculate were included. The couples were carefully instructed to perform PVS by themselves at home. The ejaculate was collected into a nonpermicidal container. A 10-mL syringe was then used to instill the ejaculate intravaginally.

Results: The median total motile sperm count was 29 millions (1–92). Overall, 57 of the 140 couples (41%) achieved 82 pregnancies with delivery of 73 healthy babies (71 singletons and 1 pair of twins). The median time to pregnancy was 1.9 years (0.5–8.2). A total of 10 abortions in 9 couples were noted. No complications from PVS and home insemination procedures were reported.

Conclusions: Based on the largest study to date PVS and vaginal self-insemination performed by a couple at home is a viable and inexpensive option for men with SCI with adequate semen parameters.

Prediction of Erectile Response with Sildenafil by the new '100 Erection Scale' in Persons with SCI

Lee BS., Lim MH., Chung HS., Kim BS.

Objectives: Recently, we developed a simple '100 Erection Scale (100ES)' to describe erectile function. This study was designed to identify the effectiveness of 100ES to predict the response of Sildenafil in persons with SCI.

Methods: 177 spinal cord injured persons were prescribed Sildenafil (starting with 50mg, upto 100mg). The median age was 36 years old (19–61), and the median time since injury was 14 months (3–336). The 100ES is a simple scale to describe the erectile function ('no erection'=0, 'as hard as before injury'=100). The satisfaction with Sildenafil was evaluated with 3 point scale (0=poor, 1=fair, 2=good).

Results: At base line, the 100ES of persons with UMN injury was 59.9 and that of LMN injury was 32.8 ($p=0.005$). In group with good satisfaction, the mean 100ES was 95.1 and the mean duration was 31.3 minute. Overall good satisfaction rate with Sildenafil was 62.1% (fair=16.4%, poor=21.5%). In group with 'baseline 100ES' was 0, the satisfaction rate with Sildenafil was 26%. And in groups with 'baseline 100ES' 1–20, 21–40, 41–60, 61–80 and 81–100, the satisfaction rate were 67, 71, 74, 77, and 84%.

Conclusions: The newly developed '100 Erection Scale' is a simple and good predictive scale for erectile function with Sildenafil in persons with SCI.

Self-triggered dorsal penile/clitoral nerve stimulation to treat neurogenic detrusor overactivity

E. Opisso, A. Borau, A. Rodríguez, N. J. M. Rijkhoff

Neurogenic detrusor overactivity (NDO) is a common consequence of several neurological disorders. It is characterized by involuntary bladder contractions at low volumes during the filling phase resulting in low bladder capacity and incontinence. It has been shown that event driven electrical stimulation of pudendal nerve afferents can be used to suppress the involuntary detrusor contractions and increase bladder capacity. The goal of this study was to investigate whether patients can sense the onset of bladder contraction and in turn can activate the stimulator. Three bladder fillings were carried out for each patient. The first without stimulation. The second with automatic-triggered stimulation, whenever detrusor pressure exceeded 10 cmH₂O. The third fill was conducted with patient-triggered stimulation by means of a button. Of 34 SCI patients recruited, 7 performed successfully the three fillings. Compared with filling 1, average bladder capacity in filling 2 and 3 was 156% and 160% higher. The study shows that self-triggered dorsal penile/clitoral nerve stimulation is as effective as automatic triggered stimulation. Self-triggered stimulation is thus feasible in selected patients.

Sexual life of males over 50 with spinal cord lesions of 20 or more years post-injury

Lombardi G., Macchiarella A., Celso M., Del Popolo G.

Background: To assess over the past year the sexual function and activity of spinal cord injured male patients over 50 with spinal lesions of 20 years minimum.

Methods: In 89 individuals demographics data, detailed sexual and medical ananmesis was taken. All completed the SF-36 questionnaire, and responded to questions 14 and 15 concerning overall sexual life in the International Index of Erectile Function.

Results: Subjects were stratified in 2 groups: 44 aged 51–60 and 55 over 60.38/44 individuals in the 1st and 41/55 in the 2nd reported good to excellent health. In the first group 34/44 reported sexual intercourse versus 13/55.29/55 in the 2nd reported only “slow sex” such as caressing one another. In the first group 29/44 referred to erectile dysfunction and 43/55 in the 2nd. 31/43 with erectile impairment in the 2nd group refused to start or had had low compliance to any pharmacological approaches for erectile dysfunction. In each group overall sexual satisfaction is statistically correlated to the duration of the relationship using a linear regression test ($p < 0.05$).

Conclusions: Median quality of life was high. The capacity for creating a long-lasting relationship is fundamental for overall sexual satisfaction, balancing any sexual impairment.

Sexual function and quality of life of traumatic SCI male Individuals

Heruti RJ., Pe'er-Arazy I., Ohry A.

Introduction: Spinal cord injury (SCI) produces problems that affect sexual function and has significant impact on quality of life (QoL). Thus, sexuality is an integral part of the rehabilitation process that is too often neglected. The purpose of this study was to examine some characteristics of SCI sexuality and to investigate the relation of those parameters to QoL and emotional distress.

Methods: 55 male subjects with traumatic SCI filled questionnaires regarding QoL, sexuality, emotional distress and social skills. We used LSQ, SCI QL-23, SCL 90, IIEF, and Sexual performance and health questionnaire.

Results: The decrease in sexual function is a major cause for QoL decline. Impaired sexual function affects physical and social functioning of more than half of the participants, while 9.1% mention it as the only disability. 30% suffer from severe erectile dysfunction and 72.7% report prominent decrease in orgasmic ability, but in spite of that subjects report of high libido and good overall satisfaction of sexual performance. There was high positive correlation between sexual performance and satisfaction to QoL parameters ($p < 0.05$). No correlation was found between the level of injury and sexual performance measures.

Conclusions: Despite the importance of sexual health, little attention is paid into sexual education of care-givers, mainly due to societal attitudes as well as lack of systematic knowledge. It is imperative that the multidisciplinary team will be fully educated on the important field of sexuality in SCI individuals, for better awareness and to help direct patients to the appropriate care needed.

MAIN TOPIC

Metabolism, Nutrition and Obesity

Current Thoughts on the Risk Factors for Coronary Heart Disease and Its Occurrence in Individuals with Spinal Cord Injury

William A. Bauman, M. D.

Individuals with SCI have an increased prevalence of abnormalities in carbohydrate and lipid metabolism because of immobilization and adverse changes in body composition, with increased adiposity and decreased muscle mass. They have been shown to have a higher frequency of insulin resistance and diabetes mellitus than able-bodied persons. Several reports have demonstrated that persons with SCI have low serum HDL cholesterol levels. An inverse relationship has been shown between serum HDL cholesterol values and abdominal circumference, and a direct relationship between serum triglycerides levels and abdominal circumference.

Persons with SCI have been reported to have premature coronary heart disease (CHD). By nuclear medicine imaging and recently by electron beam computerized tomography, it appears that those with SCI have a higher prevalence of CHD, even if matched with the able-bodied population for conventional risk factors. Knowledge of the relative risk of CHD in individuals with SCI would be important to determine appropriate intervention strategies. The conventional risk factors for CHD, as defined by the Third Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults [Adult Treatment Panel III (ATPIII)], were determined in a population of veterans with SCI in order to assign risk to determine target LDL cholesterol levels for therapeutic intervention. The potential limitations of ATP III guidelines when applied to the SCI population will be discussed. The appropriateness of classification of patients with SCI as having the metabolic syndrome will be considered, along with the usefulness of this designation for therapy.

Cardiovascular disease risk in persons with long standing Spinal Cord Injury

A. Graham, S. Charlifue, HL. Frankel, MA. Jamous, G. Savic, B. Soni, S. Vaidyanathan

Aim: To estimate cardiovascular disease (CVD) risk in persons with long standing spinal cord injury (SCI) according to Joint British Societies Cardiovascular Risk Prediction Charts for Primary Prevention*.

Methods: The sample consisted of 70 participants of the 2006 follow-up of the Ageing with SCI Study. CVD risk was estimated based on gender, age, total cholesterol/HDL ratio, systolic blood pressure and smoking status. The three risk groups were: low (<10% risk of developing CVD in next 10 years), moderate (10–20% risk) and high (>20% risk).

Results: All participants were injured more than 35 years ago. Seven were excluded from analysis because of existing coronary heart diseases or diabetes. The mean age for the remaining 63 participants was 63.2 years (range 50–78), 50 were male, 28 had cervical lesions, 28 thoracic and seven lumbar. Eleven were in the low CVD risk group, 36 in the moderate and 16 in the high risk group. Controlling for age and gender, the risk was lower for those with tetraplegia than paraplegia ($p<0.05$), mainly due to lower resting blood pressure ($p<0.01$).

Conclusions: The majority of participants were in the moderately increased CVD risk group. The lower risk for persons with tetraplegia may underestimate the “actual” risk.

Acknowledgements: Supported by Stoke Mandeville Hospital Charitable Fund, UK and Southport and Ormskirk Hospital Spinal Injuries Centre Endowment Fund.

*Reference: J Hum Hypertens 2004; 18: 139–85.

Glucose tolerance in women with Spinal Cord Injury

Y. Chen, B. Gower, AB. Jackson

Objectives: to examine oral glucose tolerance in women with spinal cord injury (SCI), as compared with women without disabling conditions.

Methods: 19 healthy women with chronic SCI (6 tetraplegic and 7 complete injuries) and 22 age-race-body mass index-matched able-bodied (AB) women received a 3-hour oral glucose tolerance test (OGTT) and dual-energy X-ray absorptiometry for body adiposity assessment.

Results: women with SCI had significantly lower lean mass than the AB group (mean+standard error: 40.6+1.8 vs 45.5+1.7 kg, $p=0.05$). After adjusting for total lean mass, the SCI group had significantly higher serum glucose and insulin levels at several time points during the OGTT. The total areas under the glucose and insulin response curves were also significantly greater in SCI than AB groups (glucose: 397.2+18.7 vs 338.8+17.3, $p=0.03$; insulin: 231.3+21.0 vs 166.4+19.4, $p=0.03$). The diagnosis of impaired glucose tolerance was 2 times more common in the SCI than AB groups, but not statistically significantly (47.4% vs 22.7%, $p=0.10$).

Conclusions: The study findings would suggest an early screening of impaired glucose tolerance or insulin resistance in women with SCI. Further research is indicated for specific strategies in the prevention of diabetes and related medical conditions in this patient population.

Intermuscular thigh fat mass and insulin sensitivity in athletes with Spinal Cord Injury

MC. Mojtahedi, RJ. Valentine, SÁ. Arngrímsson, EM. Evans

This study aimed to explore the impact of high-level physical training in individuals with spinal cord injury (SCI) on body composition and insulin action.

Fourteen (7 female; time since injury mean \pm SD: 16.5 \pm 5.7yrs; 8 complete, 6 incomplete) paraplegic athletes from the University of Illinois athletic teams were compared to 16 (8 female) age-matched (22.2 \pm 3.4yrs) and similar BMI (23.3 \pm 3.3kg/m²) sedentary able-bodied (AB) controls. Body composition was measured with DXA, and thigh muscle area (TMA) and thigh intermuscular adipose tissue area (IMAT) with MRI. Insulin sensitivity index (ISI) was calculated from glucose and insulin responses to a 2h oral glucose tolerance test.

SCI athletes had lower fat mass ($p=0.012$), lower lean mass ($p=0.019$), but no difference in percentage body fat (25.1 \pm 7.0, 25.9 \pm 7.0; $p=0.76$). TMA was lower in SCI ($p<0.001$) and IMAT relative to TMA was higher ($p=0.002$). SCI had a trend for greater ISI (4.0 \pm 1.3 vs. 3.1 \pm 1.4; $p=0.073$), which was impacted controlling for IMAT ($p<0.001$) and IMAT/TMA ($p=0.058$). ISI was correlated with fat mass in whole group ($r=-0.67$, $p<0.001$) and with IMAT in SCI and AB ($r=-0.62$, $r=-0.56$; $p<0.05$) but not with IMAT/TMA (whole group: $r=-0.12$, $p=0.52$).

IMAT appears to impact insulin sensitivity, which can be improved by high-level physical training in SCI.

The relationship between physical capacity and lipid profile in persons with Spinal Cord Injury

**S. de Groot, A. J. Dallmeijer, M. W. M. Post, E. L. D. Angenot,
L. H. V. van der Woude**

Purpose: Physical capacity is a modifiable lifestyle factor and seems to have a positive effect on lipid profiles. Therefore, the purpose of this study was to determine the relationship between physical capacity and lipid profile in persons with spinal cord injury (SCI) during and 1-year after rehabilitation.

Methods: In a Dutch multi-center prospective cohort study, the longitudinal relationship between lipid profiles (total cholesterol (TC), HDL, LDL and triglycerides (TG)) and physical capacity (peak power output (PO_{peak}), peak oxygen uptake (VO_{2peak}), and muscle strength) of 206 subjects with SCI (78 with tetraplegia) was investigated during inpatient rehabilitation, and 1-year after discharge. A correction was made for the possible confounding variables age, body mass index, gender, lesion level and completeness.

Results: Muscle strength showed a significant and favorable relationship with HDL, TG, TC/HDL and LDL/HDL. In contrast, PO_{peak} and VO_{2 peak} did not show any relationship with any of the lipid profile outcome measures.

Conclusions: More favorable lipid profiles were seen in people with a higher muscle strength. However, lipid profile did not seem to relate to the aerobic capacity of persons with a SCI during and a year after clinical rehabilitation.

Energy expenditure during FES-Cycling in trained paraplegic subjects

C. Perret, H. Berry, K. Hunt, N. Donaldson, T. H. Kakebeeke

Purpose: To calculate substrate utilisation during a 60min high intensity FES-cycle training session at home in FES-trained paraplegic subjects in order to determine how much FES-cycling is necessary to reach the generally recommended weekly exercise caloric expenditures of 1200 to 2200kcal.

Methods: One female and seven male paraplegic subjects (ASIA A; lesion level Th3–Th9; at least two years post injury; age: 43 ± 7 years; height: 176 ± 8 cm; weight: 74 ± 7 kg) completed a 60min FES-cycle training session at home at the highest workload possible. Oxygen consumption and carbon dioxide output was measured breath by breath with a metabolic cart during the whole training session to calculate energy expenditure by means of indirect calorimetry.

Results: Mean total carbohydrate and fat oxidation were $0.82 \pm 0.59 \text{g} \cdot \text{min}^{-1}$ and $0.14 \pm 0.14 \text{g} \cdot \text{min}^{-1}$ resulting in a mean total energy expenditure of $288 \pm 104 \text{kcal} \cdot \text{h}^{-1}$ (range 156 to 473 $\text{kcal} \cdot \text{h}^{-1}$) FES-cycling.

Conclusions: By stimulating the large paralysed leg muscle group of paraplegic subjects it seems possible to reach the recommended weekly exercise caloric expenditures in order to induce striking health benefits. Between 4 and 8 hours of intensive FES-cycling exercise per week are necessary for this purpose.

Leg Skeletal muscle mass measured by partial body potassium counting versus leg lean mass by DXA in SCI

AM. Spungen, LM. Ramirez, S. Swaby, P. Asselin, L. Wielopolski, WA. Bauman

Background: Partial body potassium (PBK) counting is a viable method for determining skeletal muscle mass in the limbs. In conjunction with BNL, a PBK counter was designed to accommodate persons with SCI and built for direct measurement of leg skeletal muscle mass (SMPBK).

Methods: A prospective study comparing a direct method of measuring leg SMPBK, with an indirect method, dual energy x-ray absorptiometry (DXA) for leg lean tissue mass (LMDXA) was performed in 24 healthy male subjects [12 SCI (4-tetra, 8-pa); 12 controls].

Results: In SCI, leg SMPBK and leg LMDXA were lower than in the controls (10.5 ± 3.6 vs. 17.5 ± 3.4 kg, $P < 0.0001$ and 17.0 ± 4.1 vs. 19.8 ± 3.0 kg, $P = 0.06$). Within both groups, leg SMPBK was lower than leg LMDXA by -6.5 ± 4.1 kg ($P < 0.0002$) and -2.4 ± 3.5 kg ($P < 0.05$), respectively. This difference between methods was significantly larger in the SCI group than in the control group ($P = 0.01$). For the total group, leg SMPBK correlated mildly with leg LMDXA ($R = 0.54$, $P = 0.005$).

Conclusions: PBK discriminated to a greater extent between the groups than did DXA, suggesting that direct measurement may improve leg skeletal muscle mass measurements.

GLP-2 and bone resorption in Spinal Cord Injury

D. B. Henriksen, I. B. Gotschalk, M. Larsen, B. Hartmann, F. Biering-Sørensen

Background: Significant decline in bone mineral density (BMD) has been documented in SCI patients. Recent studies suggest that bone remodeling is regulated by the gastrointestinal peptide, glucagon-like peptide-2 (GLP-2). GLP-2 is released after food intake, coinciding with an acute decline in bone resorption rate. Postprandial regulation of bone resorption has been found to be impaired in SCI patients with complete injury whereas patients with incomplete injury showed a normal response.

Purpose: To investigate the effect on bone remodelling after subcutaneous injection with GLP-2 in 12 patients with SCI.

Methods: A randomised, single blinded, placebo controlled, crossover study administering a single injection of 1.6 mg of GLP-2 or placebo. Bone remodelling was assessed by biochemical bone markers (s-CTX & s-OC).

Results: Injection of GLP-2 resulted in an acute and significant ($P < 0.001$) reduction in bone resorption for all SCI patients as compared to the placebo treatment regardless of the injury severity. Furthermore, the area under the curve (AUC 0-6h) for the 6-hour profile of s-CTX was significantly different from placebo ($P = 0.01$) for GLP-2 treatment. Bone formation was unaffected by treatment with GLP-2.

Conclusions: These results raise the prospects of a novel treatment modality that reduces bone resorption, but does not affect bone formation.

Early Use of Weekly Alendronate in Spinal Cord Injury

Acland, R. H., Marshall, K. A.

We present results of a study recently conducted at the Burwood Spinal Unit. This was a prospective, randomised, double-blind, placebo controlled study assessing the effect on bone loss in acute SCI patients. Oral alendronate 70mg or placebo was administered once weekly within 7 days of acute injury for a period of 12 months, with follow-up through to 18 months. Bone mineral density data was collected from 30 subjects using DEXA scanning at baseline, 3, 6, 9, 12 and 18 months post SCI. Urine and blood calcium flux was also assessed.

Outcome data revealed:

- Alendronate was well tolerated
- Bone density was maintained and sustained to 18 months post SCI.
- Urinary Ca++ excretion was decreased.
- There was no difference in SCI recovery.
- There was no difference in reported pain.
- There was a reduced incidence of syringomyelia.
- There was no development of heterotrophic ossification (HO) in the active group.
- There was no urinary tract stone formation with either group.

There appears to be merit in using the bisphosphonate, alendronate, early in the management of SCI. Reduction of early onset osteoporosis has been demonstrated. The question remains as to whether this translates to benefit regarding fractures, stone formation or HO. Has alendronate a specific CNS effect that maybe of benefit?

Further longer-term surveillance needs to be conducted.

Anaemia in early and chronic spinal cord injury: A role for hormonal factors?

R. Marshall, JM. Clark

Background: Haematological profiles are described in order to begin to explore whether impaired erythropoietin (Epo) hormone production, hormonal efficiency or CFU-E responses to stimulation contribute to risk for anaemia after SCI.

Design: Prospective, controlled study

Subjects & Methods: Hospitalised adult patients, acute SCI (ASCI), vertebral fracture controls (<three weeks), or chronic SCI (CSCI) >1 year (Stage 3–4 pressure sores) were eligible. A complete blood count (CBC) was performed at arrival (CSCI) or three weeks (ASCI, CON).

Results: Seventy-two patients, 38 ASCI (34 males, 22 ASIAAB), 30 CSCI (28 male ASIAAB, 9+2 years), controls (CON, 4 males, ASIAE) participated. ASCI groups received MPSS, anti-coagulants and concomitant medications.

| ASCI-AB | ASCI-CD | CSCI-AB | CON-E | |
|-------------------------------------|------------|----------|-------------|-------------|
| Age (yrs) | 28+12 | 31+11 | 40+7 | 29+14 |
| Hb (g. L-1) | 110+9 ä | 124+10 | 123+6.3 | 147+11** |
| RBC (x 10 ¹² . L) | 3.7+0.02 ä | 4.2+0.03 | 4.54+0.2 | 5.3+0.7** |
| MCHC (g. L-1) | 313+9 ä | 332+10 | 323.5+21.5 | 332+15 |
| PCV (L. L-1) | 0.35+0.02 | 0.36+0.3 | 0.38 + 0.02 | 0.44+0.4*** |
| ä ASCI-AB vs. ASCI-CD; *SCI vs. CON | | | | |

Conclusion: Further study of Epo levels and responses to recombinant human erythropoietin may clarify whether Epo production in the kidney, variables such as MPSS that may reduce Epo efficiency or erythroid cell hyporesponsiveness to hormonal stimulation contribute to SCI morbidity and mortality patterns.

Effect of menopause on bone strength in the lower extremities of women with chronic SCI

A. Frotzler, C. Perret, C. Ruckli, M. Berger, P. Eser

Purpose: To investigate the effect of menopause on bone mineral density and geometry by comparing bone parameters in the paralysed legs of pre- and post-menopausal women with chronic SCI.

Methods: Ten pre-menopausal and eight post-menopausal women with complete traumatic SCI and with a lesion duration of at least eight years were recruited. Tibial and femoral bone parameters were measured by means of peripheral quantitative computed tomography. In the epiphyses, total and trabecular bone mineral density (BMD), bone cross-sectional area (CSA) and mass were measured. In the diaphyses, cortical BMD, mass, cortical and total CSA as well as cortical thickness were determined.

Results: At the tibia, we found significantly higher trabecular ($p = 0.016$) and lower cortical BMD ($p = 0.003$) in the post-menopausal group. In contrast, no statistically significant differences were found in the femoral bone parameters between the two groups.

Conclusions: Except for the tibial trabecular and cortical BMD, bone strength in the lower extremities of women with a chronic SCI seems not to be affected by menopause. Our results suggest that the immobilisation-induced bone loss occurring within the first few years after SCI overrules the effect of menopause on bone strength.

GENERAL SESSION 6

Bladder function

Recovery of spontaneous micturition related to level and degree of injury

Karlsson AK., Pettersson K., Asplund P., Berrum-Svennung I., Jonsson O.

Spinal cord injury is neurologically evaluated by motor and sensory status. Some patients may have a sequele in motor and sensory function but still recover normal control of micturition. We have found that 28% of a sample of 240 recovered normal control of micturition. The distribution according to level and completeness of injury was analysed.

Methods: A retrospective database containing neuro-uological data from 240 SCI patients treated at our SCI Unit was evaluated.

Results: 68 patients recovered spontaneous micturition. Level of injury: C: 35, Th: 11, L: 22. Completeness of injury (in relation degree of injury to total group): ASIA A: 1 (1%), ASIA B: 2 (9%), ASIA C: 10 (20%) and ASIA D: 53 (38%). The likelihood to recover normal control of micturition was highest in the cervical ASIA D (86%) compared to Th: 47% and L: 53%.

Conclusions: Degree of injury predicts to some degree the autonomic and somatic dysfunction affecting urinary tract following SCI. Cervical injuries regain to a higher degree normal control of micturition. The motor and sensory status needs to be expanded to also include autonomic dysfunction.

Outcome of cystectomy for bladder cancer in spinal cord injury – can it be improved?

J. Reynard, S. Beuker, P. Cheetham, T. Meagher

We report the outcome of 18 cystectomies done for bladder cancer in spinal cord injured patients over a 30 year period in a single spinal unit (14 male, 4 female). Mean age was 48 years (range 28–62). 50% were paraplegic and 50% tetraplegic. 7 patients (40%) were managed by long-term suprapubic catheters and 11 (60%) by non-catheter methods.

The time interval between injury and diagnosis of bladder cancer ranged from 10–42 years (mean 25 years). The time interval between onset of symptoms (usually haematuria) or surveillance cystoscopy and subsequent cystectomy averaged 11 weeks.

Of the 11 patients who died of advanced bladder cancer post-cystectomy (60% of the total), all had either T3 or T4 squamous cell or anaplastic cancer. Of the 7 patients (40%) who were still alive at the time of review (average disease free survival 9.5 years, range 3–18), final pathological stage was either G3T1 or G2T2 transitional cell cancer.

Patients with SCI and squamous cell cancer of the bladder always have incurable disease at presentation. Median survival post-cystectomy is just 5 months. Their disease is probably incurable by the time of symptom onset and the potential for earlier cystectomy to effect cure is limited.

Long term follow-up study of bladder management of the spinal cord injured under the care of a specialised centre (Urodynamic studies)

Chong T., Wang D., El-Masry WS.

Long term follow-up study of bladder management of the spinal cord injured under the care of a specialised centre (Urodynamic studies)

Purpose: One hundred and fifty one SCI patients were studied to assess safety of reflex voiding bladder without routine urodynamic studies but with regular clinical follow up and urodynamics when indicated

Patients and Method: This is a retrospective study with a mean follow-up of 19 years. Patients are divided into the following groups.

| | |
|-------------|---|
| Group One | Never had urodynamics since injury |
| Group Two | Had urodynamics but no UUTL |
| Subgroup A | Reflex voiding only without previous outlet surgery |
| Subgroup B | Reflex voiding with outlet surgery |
| Subgroup C | Other methods of voiding/drainage |
| Group Three | UUTL diagnosed before or after urodynamics |
| Subgroup A | UUTL developed early during first hospitalisation |
| Subgroup B | UUTL developed after discharge |

Results:

1. Seventy three percent of patients had normal upper urinary tract without routine urodynamics. Seventeen percent of them never had urodynamics while 56% had urodynamics which was not done as a routine but for symptoms related to OAB or DSD.
2. Eleven percent of patients were found to have UUTL during first hospitalisation.
3. Only 16% of patients developed UUTL after discharge.

Conclusions: Non-routine urodynamics is relative safe with low UUTL.

Long-term results of sacral root stimulation for neurogenic bladder in spinal injuries

A. Rodríguez, A. Borau, J.L. Gago, E. Opisso, L. Ledesma, J. Benito

Objectives: The goal of this paper was to evaluate the results of treatment of neurogenic bladder dysfunction in spinal cord injury (SCI) by sacral posterior root rhizotomy and anterior sacral roots electrical stimulation (SARS) in a Long-Term Follow-up retrospective study.

Methods: Between 1990 and 2004 in a total of 100 patients (50 men and 50 women) with spinal cord lesions (22 cervical, 73 thoracic and 5 lumbar) and urological problems due to hyperreflexia of the bladder, a posterior sacral root rhizotomy was performed and a SARS was implanted using Barcelona technique in 32 cases and extradural technique in 68 patients. In 80 cases the spinal cord injury was complete and in 20 was incomplete.

Results: Complete continence was achieved in 91 of the 100 patients (91%). A significant increase in bladder capacity was attained in all patients. Residual urine and incidence of urinary tract infections significantly decreased. In the group of patients with incomplete spinal lesions no significant changes in neurological exploration were found after extradural rhizotomy.

Conclusions: SARS produces excellent results with limited complications in terms of restoration and bladder evacuation in patients with SCI. In our experience this technique provides a treatment of choice for refractory incontinence in complete and selected incomplete spinal injuries.

Dimercaptosuccinic Acid (DMSA) scan Vs. Magnetic Resonance Imaging (MRI) in detection of upper urinary tract infection in spinal cord injured patients

MC. Uthappa, B. Singhal, M. Dattani, P. Murphy, T. Meagher

Background: Patients with Spinal cord injury are at increased risk of renal tract infection because of impaired bladder emptying. Pyelonephritis is a common cause of pyrexia in SCI and is frequently a clinical diagnosis. DMSA is the most sensitive method of detecting pyelonephritis but carries a burden of ionising radiation. We compare MRI to evaluate if it offers the same sensitivity without radiation.

Aim: To compare the above imaging modalities in diagnosis of upper urinary tract infections in SCI patients.

Patient Selection: 15 patients with symptoms of urinary tract infection with clinical suspicion of Acute Pyelonephritis were included.

Methods: The DMSA and MRI scan was performed in a single visit to the radiology department in majority of the patients. The DMSA scan protocol was to inject 80MBq Technetium DMSA. A single head Gamma camera with high resolution was used. The MRI images were obtained with 1.5 T Siemens symphony MRI scanner. Once the region was localized pre contrast images were obtained with fast inversion recovery sequence and /or T2-weighted fast spin echo sequence. Focal area of reduced uptake seen in two images indicated pyelonephritis on the DMSA Scan. On the MRI images pyelonephritis was diagnosed when there was an area of medium/high signal intensity in the renal cortex, which contrasts the low signal intensity in the renal cortex, which contrasted the low signal intensity of the normal cortical tissue on fast inversion recovery.

Results: Two consultant radiologists looked into the images independently and blind to the result of other investigation in the same patient. In 13 out of 15 patients MRI picked up features of pyelonephritis conclusively, which was also confirmed with DMSA SCAN.

Efficacy of repeat detrusror injections of botulinum A toxin in neurogenic bladder overactivity

B. Perrouin-Verbe, A. Chenet, L. Le Normand, JJ. Labat, M. Lefort, JF. Mathé

Purpose: Toxin injections are an effective treatment for the overactive bladder. Repeat injections are not well documented. The objective of this study is to evaluate the efficacy on continence of repeat injections of toxin A to the detrusror in patients with neurologic overactive bladders.

Materials and methods: Patients receiving 300 UI injections of Botox[®] are retrospectively studied. The clinical data are continence, duration of the absence of incontinence, anticholinergic dosage changes or pad use and patient satisfaction. Urodynamic data analyzed are maximum cystometric capacity, bladder contraction and detrusror pressure during contraction. Data are analyzed using Wilcoxon and Kruskal-Wallis tests.

Results-Discussion: 42 patients (30 men, 12 women) are included. Pathologies are traumatic spinal cord, multiple sclerosis or varied etiologies of myelopathy. Patients received one to six injections. The mean duration of efficacy is six months. There is no significant difference between successive injections. Anticholinergic drugs are stopped in 43% of patients and pad use in 48% of them. 80% of the patients are satisfied. Bladder contraction disappears in 70% of patients. The mean maximal cystometric capacity increase is 144 ml.

Conclusions: Repeat toxin injection to the detrusror stays an active therapy on clinical and urodynamic data. The duration of efficacy on the continence is maintained during consecutive injections.

Grosse J, Kramer G, Stohrer M. Success of repeat detrusror injections of botulinum a toxin in patients with severe neurogenic detrusror overactivity and incontinence. Eur Urol 2005;47 (5): 653–9.

Botulinum toxine (BTXA): How many patients with neurogenic detrusor overactivity become really dry?

H. Madersbacher, T. Berger, G. Kiss

Aim: The aim of this retrospective study is to clarify the issue, how many patients after BTXA therapy really gain continence between catheterizations and do not need any pads afterwards.

Methods: 25 pts. (12 f/13 m), age 19–70 ys. (ave 45 ys.), with urinary incontinence due to neurogenic detrusor overactivity despite intermittent catheterization (IC) and anticholinergics were treated with BTXA between 5/00 and 12/05; number of applications/pt 1–6 times (mean 1,9); 49 interventions at all, standard dosage 400 U Botox®, injected into 40 sites of the bladder wall. Continence was defined when no pads/condom urinals were needed in daily life and was evaluated 2 weeks postop. and then regularly every 3 months.

Results: 72% of the pts. (9 f / 9 m) with altogether 36 interventions (mean 2,2) became continent for min. 3–max. 32 months, (mean 7,6). 2 of these pts. were continent only in combination with anticholinergics. In 2 further pts. with 7 interventions at all only 5 interventions were successful. In 20% of the pts. (1 f / 4 m) with 6 interventions (12%) at all continence was not achieved.

Conclusions: Anticholinergics and IC are the standard treatment in patients with neurogenic detrusor overactivity in case of unbalanced voiding and urinary incontinence. If anticholinergics fail, BTXA injection into the detrusor is the second choice. However there exist only a few data about how many pts. treated with BTXA became really dry. Our study shows that intradetrusorial BTXA in a high dosage (400U) can stop urinary incontinence in most of the pts. (72%) completely, if IC is performed. This rate of continence is higher than previously reported (1) probably because of the higher dosage of BTXA.

References: (1) Schurch et al., J Urol. 2005 Jul; 174 (1); 196–200

Trends in emptying of neurogenic bladder – did anything change in the last 30 years?

Wiedenhöfer B., Rahner K., Möhring K., Gerner HJ., Akbar M.

Introduction: To investigate the changes in the use of different techniques of bladder emptying in spinal cord-injured and myelodysplastic patients.

Methods: This was a retrospective study with 1869 spinal cord-injured (SCI) patients and myelodysplastic patients (MDP) who were treated in our hospital from 1995–2005. The following data were included: age, gender, level of spinal cord lesion, year of occurrence of spinal cord injury, technique of emptying the bladder (clean intermittent catheterization (CIC), suprapubic catheter (SPC), etc.), urinary tract infection and changes in the technique of bladder emptying.

Results: A total of 1869 patients (1209% and 660Š; 1379 SCI patients (73.8%) and 490 MDP (26.2%)) were included in the study. The patients were paraplegic in 69% and quadriplegic in 31%. Reason of spinal cord lesion: trauma (53.5%), infection (5.4%), tumour (6.9%), and myelomeningocele (26.2%). Bladder emptying: CIC- (55.9%), SPC- (17.3%), Crede_L_fs method (CM) – (16.7%), diaper and urinalkondom (3.7%), Brindley stimulator (1.4%). Bladder emptying (year of occurrence of spinal cord lesion): <1975: CIC- (34.5%), SPC- (12.5%), CM- (34.2%); 1976–1985: CIC- (59.4%), SPC- (5.3%), CM- (25%); 1986–1995: CIC- (64.9%), SPC- (9.2%), CM- (16.6%); 1996–2000: CIC- (61.2%), SPC- (22.8%), CM- (7.3%); 2001–2005: CIC- (55.8%), SPC- (43.5%), CM- (5.5%).

Conclusions: Patients who developed a spinal cord injury before 1995 still use alternative techniques of bladder emptying in a high percentage.

Bladder volume decreases with time after injury. Management affects outcome?

Pettersson K., Jonsson O., Berrum-Svennung I., Asplund P., Karlsson AK.

Morbidity and mortality related to renal dysfunction has decreased. However, some threats still exist. Data from neurourological investigations in 250 patients treated at the SCI Unit in Göteborg have been collected in a database. The cystometries were analysed. Does maximal intravesical pressure and volume change over time and if so; is this change modifiable by treatment?

Methods: Baseline cystometry 3–4 months post injury was compared to a second investigation 1–2 years later in a group of 83 SCI. The majority emptied their bladder by clean intermittent catheterisation (CIC) and a paired comparison could be made in 43 individuals.

Results: Maximal volume decreased significantly (mean: 578 ml (CI: 524–632) to 455 ml (CI: 404–506) **). In a paired comparison of the CIC group we found a decrease in volume (632 ml (CI: 558–706) to 526 ml (CI: 449–603) *. In the group who changed regime we found a decrease in volume (538 ml (CI: 449–627) to 390 ml (CI: 318–462) **. There was no difference in volume between the two groups at baseline but a significant difference at second investigation, $p < 0,01$.

Conclusions: Maximal intravesical volume decreased over time. Practising CIC seems to exert a positive influence on intravesical volume over time.

SYMPOSIUM 1

Prevention of spinal cord injury

Epidemiology and Programmes for Prevention of Spinal Injuries in India

H Singh Chhabra

The exact incidence of spinal injuries in India is not known. Even though National Sample Surveys (NSS) and the National Census have been held, data for spinal injuries has not been collected. Pilot studies have estimated the incidence as around 20 per million population. The male / female ratio in various studies has varied from 13.5:1 to 2.96:1. The most prevalent age group was 20–29 followed by 30–39.

Mode of injuries have been attributed to fall from height (from unprotected terrace, trees, electricity pole, construction site, overloaded bullock carts / tractors etc) in 24 to 55 percent cases and road traffic accident in 12.8 to 67 percent cases in different studies. Various other reported causes have been sports injury (4%), fall of weight on back (4%), burial under mud while digging (6%), assault (3%) and fall into well (2%). Non traumatic causes of spinal injury accounted for 9.3% to as high as 74% of cases in various series. Dorsolumbar spine injuries resulting in paraplegia are more common than cervical spine injuries.

In the neighbouring countries of Bangladesh and Nepal, fall from heights is the most common mode of injury accounting for 43% and 75% of patients respectively. Falling while carrying heavy weight on head and traffic accidents account for 20% and 18% of patients in Bangladesh.

The variance in different studies may represent different trends in various parts of India (Urban vs rural, North vs south vs East vs West) as well as changing trends with time. A study has revealed that the number of injuries have increased by 270% in India in the last two decades of last century whereas the report of Surface Transport Ministry revealed a four fold increase in death and injury cases between 1970 – 90. India's vehicular population is 1% of global share whereas the share of road accidents is 6%. This has been ascribed to multiple reasons like increase in number of vehicles on roads. Poor roads, bad traffic management and rapid urbanization. Increase in workplace accidents in India has been due to mechanization in agriculture and industry and induction of semiskilled / unskilled workers. According to a report, 31% of injuries have been ascribed to agricultural accidents which have been on the increase.

Broad approaches for prevention programmes include infrastructure development and environmental modifications, legislation and community education. All programmes should be planned keeping in mind that the vast majority of the population (72.2%) lives in rural areas and that most of the incidents take place at home (as revealed by the National Sample survey). Even though there has been a major endeavour to improve the quality of roads and manage the traffic, a lot still needs to be achieved. There are various legislations for injury prevention but, proper implementation and enforcement needs to be done. Since most of the incidents take place at home or in the unorganized sector, the role of community awareness programmes may be of utmost importance.

There are various law to ensure occupational safety and prevent work place accidents. "The Factories Act" of 1948, "The Mines Act" of 1952, "the Plantation Labour Act" of 1951, "The Motor Transport Workers Act" of 1961 and "The Contract Labour (Regulation and Abolition) Act" of 1970 cover various areas for health and safety of workers.

The epidemiology and existing as well as proposed prevention programmes would be discussed at depth in the presentation.

SCI in New Zealand; Incidence, Cause and Prevention

R H Acland

The incidence of SCI in NZ is approximately 25/million population/yr. This includes both traumatic and medical causes, the latter accounting for about 20%. New Zealand has a population of 4 million and is served by two Spinal Rehabilitation Units. One Unit provides more comprehensive care for all types of spinal injury not just cord damage.

Motor vehicle (car) crashes remain the major cause of SCI in NZ, however the incidence from this cause is diminishing. Last year, we had the lowest mortality from motor vehicle crashes in 43 years. Reasons for this include possibly safer cars (see SUVs), less drink driving and safer driving practices (see tourists).

However over the last few decades, the incidence of SCI has not changed significantly in New Zealand. Falls, particularly in the older age groups and the increasing popularity of higher risk recreational pursuits (cycling, horseriding, snowboarding) are maintaining the current incidence. Climate change may possibly be affecting some of these causes.

New Zealand has a unique comprehensive no fault accident insurance scheme, the Accident Compensation Corporation (ACC), which covers the care of all persons (including tourists) who injure themselves, no matter what the situation. It has been postulated that this provides 'some security' to individuals when participating in 'at risk activities'! The ACC has an important mandate to promote injury prevention especially in regard to serious injury. The NZ Rugby Union has also developed some important injury prevention strategies (RugbySmart). Sadly in the last 2 seasons there has been an increase in the incidence of rugby neck injuries.

Details of the current NZ injury prevention strategies will be highlighted in my presentation.

Do we have all the pieces? Assembling the SCA prevention puzzle in South Africa

Robert Campbell

Reported estimates of the incidence of spinal cord injuries (SCI) in South Africa have varied widely, as have the relative frequencies of aetiologies. Eclipsed by conditions which are perceived to be more pressing (HIV, Malaria, TB & Malnutrition) campaigns to prevent SCI are fragmented, inconsistent and unaudited.

3 Regional studies have shown that violence and crime is consistently the leading cause of traumatic SCI, with road accidents in second position, followed by falls and other causes – with sports (including rugby and horse riding) being most uncommon. Over 20% of SCI is non-traumatic.

SCI due to violence results most commonly from gunshot wound and stabbing. The attacker is often well-known; alcohol is almost always involved, while robbery is rarely a motive. These apparently purposeless acts of violence are not reported to the police in the majority of cases.

SCI due to road accidents is commonly linked to speeding and reckless driving; it is related to alcohol use and to overloading of vehicles. Most accidents happen after dark and involve older vehicles of doubtful road worthiness. Failing road surfaces also play a role, while individuals with SCI were almost never wearing seat belts.

Between 2001 & 2006 133 serious rugby injuries were reported – of these 29 individuals died. The overwhelming majority of the remaining reported cases had SCI. The frequency of injuries again varies considerably across the provinces, as does the rate of reporting. Most injuries happen in early season, during informal games between untrained players, refereed by “casual” referees in rural settings and in the latter part of the game. The tackle is the most dangerous part of the game.

Pieces of the South African SCI prevention puzzle are missing, those pieces we have reflect a confusing and complex picture, set on a complex background. In this setting, illiteracy, infrastructural inadequacies, remoteness of rural settlements as well as unrelated and competing political and economic agendas demand creative and non-traditional prevention campaigns.

Spinal Cord Injury in Victoria, Australia: Incidence, cause and prevention

Douglas J. Brown

The incidence of traumatic spinal cord injury in Australia is 12–13 new cases per million population – figures are not available for non-traumatic spinal cord paralysis, but the incidence is thought to be of a similar order. Traumatic spinal cord injury is treated in comprehensive spinal cord units in the major capital cities barring Tasmania, whose spinal cord injured (SCI) patients are transferred to the Victorian Spinal Cord Service (VSCS) in Melbourne, Victoria. Road traffic accidents (RTAs) remain the biggest single cause of spinal cord injury. In Victoria extensive efforts have been undertaken to reduce the deaths and injuries from this cause beginning with the introduction of compulsory seat belts in 1970. This was a world first and has been complemented by a series of laws and educational programs to reduce the death rate from over 1000 cases/ million people/year in 1970 to less than 400 per year in 1996. The low rate has been maintained for some years now. Along with this decline in the death rate there has been a decline in all other major injuries from road traffic accidents. The number of new SCI patient from RTAs has fallen from about 60/year to 25–30/year. In addition the government has undertaken extensive work to improve road design and deal with “black spots” where accidents are common. There has also been considerable improvement in the safety of cars over the last 40 years. This multi-pronged approach has paid dividends.

While it may be thought that the decline in the incidence of SCI is due to legislative initiatives by government, it would appear that public education regarding responsibility for one’s own health and well being has played a more important role. Thus there have been extensive campaigns to promote protection from strong sun in order to reduce the incidence of malignant melanoma and other skin cancers and there has been a major campaign to reduce smoking and smoking related diseases. These campaigns have been successful with falls in the incidence of skin cancer and in the number of people who smoke.

The VSCS has been active in promoting prevention through radio, television and in newspapers. In addition to RTAs, the VSCS has had a strong focus on reducing water related injuries, particularly diving into shallow water. This has seen the number of new cases fall from an average of 8–10 (maximum 15) per year to 3–5, despite a rise in the catchment population of approximately 1 million to 5.5 million people. Eight years ago there was a large number of drownings in inland waterways and in the sea. This provoked the state government to fund an ongoing water safety program in which the VSCS plays an active part. With the extensive drought we are currently experiencing, water levels in rivers, dams and creeks are extremely low and the Minister of Health recently joined me and one of our new patients in a newspaper and television water safety promotion. Prevention is high on the government’s agenda.

There has been a change in people’s attitude. They have responded to the various encouragements to be responsible for their own personal health and safety. This has led to the decline in road traffic accidents, skin cancer, smoking and quadriplegia from diving into shallow water. Public education is the key factor in reducing the incidence of disease in the community. While legislation and improvements in engineering can play a part in some areas such as RTAs, and have enormous publicity value, they cannot be applied in areas not amenable to such approaches, e.g. diving into shallow water. It is unlikely that education regarding personal responsibility is going to be successful if only one risk area of life is tackled. Thus prevention programs to prevent spinal cord injury should be part of a total community approach to better health.

Without a cure, prevention is our best management strategy.

Spinal Cord Injury in the Nordic Countries; Incidence, Cause and Prevention

Sigrún Knútsdóttir

Introduction: Spinal cord injuries in the Nordic countries reflect similar values, safety regulations and legislation. However there are some differences. The incidence of traumatic SCI is 10 – 15/million population/year in all the Nordic countries except in Iceland where the incidence has increased to 24/million/year during the first 6 years of this century. An increasing number of SCI patients are below 16 years and over 67 years.

Causes: Motor Vehicle accidents (MVA) is the cause in 35–50% of cases. In Sweden roughly half of MVA are motorcycle accidents. In the rest of the Nordic countries they are between 15–20%. The Nordic countries have by far the lowest incidence in the world of paediatric SCI due to MVA. Falls are the second most common cause of SCI.

Work related accidents, mainly in the constructing industry, represent 5–20% of SCI mainly because of falls, but also caused by heavy objects that strike the person. SCI in Sport and leisure activities have increased. Diving into shallow water has been one of the most common causes of SCI in sport and leisure, being 5–12% of all SCI except in Iceland where this is rare. Horse riding accidents are increasing, especially in Iceland. Skiing, snowboarding and snow mobiling cause several SCI each year. Other sports such as kite surfing, paragliding and mountain biking are increasingly the cause of SCIs, though the numbers are small. Violence is very uncommon as the cause of SCI in the Nordic countries.

Prevention: The main emphasis has been on prevention of traffic accidents in all the Nordic countries. Safety regulations and legislation are in place on the use of seat belts, drinking and driving, speed limits, special seats for children in cars and helmets for children when cycling and skiing. Road construction and elimination of “black spots” has been emphasised and the safety design of cars is also important. There are strict regulations about safety in the workplace. Emphasis has been on preventive actions against diving into shallow water.

There is still a lot to be done in relation to prevention. International classification on the causes of SCI and more detailed statistics are needed. One of the most important factors to prevent SCI is to influence the attitude of the public so that people take more responsibility for their own health and safety.

Traffic accident prevention

Fin Biering-Sørensen

What are effective public road safety campaigns?

1. A part of a national road safety action plan!
E.g. Danish road safety action plan 2001–2012: 40 % reduction from 2001 to 2012: Main intervention areas: Speeding, drunk driving, bicycles, junctions, seat belts, children, young and elderly people
Responsible: National, regional and local authorities, private companies, the individual citizen
2. Cost effectiveness to reduce number of killed and injured!
Targets: Seat belts, drunk driving, black spots, speeding, street lighting
3. Combined with other measures!
Information, road engineering, police enforcement
4. Developed and produced systematically!
The campaign process: Analysis, strategy, concept, realization, evaluation
5. Based on a long term strategy – minimum three years!
6. Produced and conducted by a professional independent communication institution in cooperation with road safety research institutions
7. Designed to act at a national, regional and local level
National level: Tell and show (National mass media)
Regional level: Tell and show (Regional mass media)
Local level: Involve (Posters along the roads, events, demonstrations, dialogue)
8. Able to be and are evaluated!
9. Sufficient economic funding
Government subsidies – Regional and local subsidies – Sponsors

Acknowledgement: Thanks to The Danish Road Safety Council for providing the material.

Workshop in Spinal Cord Injury (SCI) Prevention

SCI and Work – Peter Wing

Although the quantity of published data describing the incidence of work related SCI is small, there are some articles providing a useful level of detail about how these injuries are sustained. Most series detailing the epidemiology of SCI record that about 8–15% of all cases of SCI are work-related. The external causes of injury for work-related SCI are similar to those in larger series – falls, being struck, road crashes either as the occupant of a vehicle or as an unprotected road user, and a number of less frequent causes. The effect of these injuries can be devastating and may deprive those affected of their means of employment and sometimes, as in the case of agricultural workers, their family home. Even in the most developed countries, workers' compensation coverage is incomplete.

SCI is infrequent in comparison to some other injury patterns. A larger body of literature exists describing trends in the incidence of all kinds of serious injury in the work force and offers lessons for those of us interested in injury prevention, for example, severe injury rates in the workforce have been analyzed by occupational category or work task. One study showed that the association between work injuries and youth may be related as much to the specific types of work undertaken by young people as to the youth itself; this is clearly important in determining preventive approaches.

Injury prevention cost-effectiveness may also be better demonstrated by including SCI with other injury patterns, e.g. in assessing the effectiveness of Rollover protection strategies for farm tractors. A brief review will describe trends in work related injury, and particularly those relating to the spine and spinal cord.

Strategies to Prevent Spinal Cord Injury from Rugby Football

James Middleton

Rugby union and rugby league are competitive team contact sports played at school and club levels recreationally, and at national and international levels professionally. Various studies examining trends in incidence rates of rugby code-related neck injuries resulting in permanent paralysis over the last 15 to 20 years have shown significant differences between countries. Scrummaging in rugby union and tackling, particularly with “gang” tackles, in rugby league remain the leading causes of tetraplegia. Actions taken by authorities to change laws of the game (eg. “depowering” scrum) have been successful in reducing injuries in some jurisdictions.

Effective injury prevention involves a multi-strategic approach, with a range of potential countermeasures including:

- pre-participation screening;
- physical conditioning;
- skill training in correct techniques for scrummaging, rucks and mauls, and tackling;
- coach accreditation with regular peer review;
- rule modification and/or enforcement by referees;
- training of first aiders/trainers to employ spinal precautions;
- consideration of necessity to limit body weight in under age divisions;
- determination of appropriate stage of physical maturation and skill development for adolescents to transfer from age-modified to adult version of rules.

Discussion will also highlight the importance of improved data collection and injury surveillance systems, as well as further biomechanical research, to identify mechanisms, risks and potential intervention strategies.

Spinal Injuries among Horseback Riders in Iceland; what measures can be taken?

Thorir B. Kolbeinsson

Several serious accidents among horseback riders in Iceland in 2006 have caused general concern and discussion among the public and especially among the riders themselves. In response, the board of The Icelandic Association of Riding Clubs (Landssamband hestamannafélaga), a federation of 47 clubs with more than 10.000 members, appointed a safety committee. Its aim was to evaluate this situation and come forward with suggestions on how to respond to the situation. The ground work and the first measures of the committee are described as well as preliminary suggestions.

SYMPOSIUM 2

**Use of electrical stimulation in paraplegics with long-term
denervated degenerated muscles (DDM)**

S10

The European R&D Project RISE – Use of electrical stimulation to restore standing in paraplegics with long-term denervated degenerated muscles (DDM)

Winfried Mayr, Helmut Kern

RISE was funded by the European Community within the 5th Framework Program. The consortium included 13 European partner institutions from Austria, United Kingdom, Italy, Slovenia, Germany and Iceland and additional six subcontractors from Austria and Germany. Nine out of the nineteen were spinal cord injury centres. The project started with November 1, 2001 and ended with May 31, 2006.

Within RISE a novel clinical rehabilitation method for patients suffering from long-term flaccid paraplegia with no chance of recovery of the nervous system, was developed. It restores their muscle fibres and mass, muscle function and thus their ability to rise and maintain a standing posture. Based on the results of animal experiments on rabbit and pig and initial clinical trials the associated technology is developed and finally an application for modification of EU-standards was part of the project. One basic intension was to provide European industry with a novel product family to support a broad clinical application of the method that addresses the needs of about twenty new patients per million EU inhabitants per year. In addition to an appropriate stimulation equipment for home based training, suitable measurement equipment to support patient supervision by dedicated outpatient clinics was developed, to monitor the biomechanical and electrophysiological muscle conditions.

Stimulation of long-term denervated lower hind limb muscles in the rabbit

JC Jarvis, Z Ashley, S Salmons

Purpose: To investigate the response of muscle to stimulation several months after injury in long-term denervated rabbit muscle.

Methods: After selective denervation of the motor branches of the left common peroneal nerve, a telemetric stimulation system allowed us to deliver adjustable stimulation to the denervated muscles. In a terminal procedure the muscles were characterised physiologically then removed for analysis.

One group underwent denervation alone up to 51 weeks. Other groups were stimulated after 10 or 39 weeks of denervation, for 2, 6 or 10 weeks.

Results:

1. Denervated muscles showed atrophy, fibrosis and disruption of ultrastructure, but little necrosis and/or regeneration. Rabbit muscles therefore differ from rat muscles – which undergo necrosis within a few months of denervation – rather, they resemble human muscles in the first year post-injury.
2. Weight and CSA of stimulated muscles was almost normal. The histological appearance showed a substantial improvement (Figure 1).
3. Stimulation increased force-generating capacity, but not commensurate with the increase in mass. Denervated muscles were slow with or without stimulation. This loss of functionality could be related to ultrastructural abnormalities, interfering with excitation-contraction coupling.

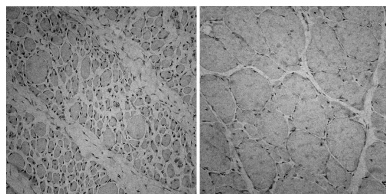


Figure 1. Rabbit TA muscles. Left: denervated for 10 weeks. Right: denervated for 10 weeks then stimulated for 10 weeks.

Conclusions: Contractile activity induced by daily electrical stimulation cannot reverse all the deleterious effects of denervation. There is, however, improvement in the volume and quality of the muscle and a substantial recovery in force-generating ability.

Stimulation equipment for FES of denervated muscles in experiment and clinical application

Winfried Mayr, Christian Hofer, Manfred Bijak, Hermann Lanmueller, Dietmar Rafolt, Hans Stoehr, Ewald Unger

Traditional functional electrical stimulation (FES) targets neural structures and indirect control of muscle contraction. The recent EU FP5 project RISE has demonstrated the feasibility and effectiveness of the novel application FES of denervated muscles.

The main difference between nerve and direct muscle stimulation is the required impulse width of the applied stimuli. Nerves are stimulated with less than 1 ms, muscles with 30 to 200 ms at comparable intensity levels. The resulting charge per impulse and average electrical power levels are critical in applications of both surface electrode based and implantable stimulation systems.

In non-invasive systems up to 30 mC of impulse charge and 25 W of power may occur. To minimize the risk of skin damage a large contact surface and holohedral current distribution are essential in design and handling of the electrodes. Stimulators must guarantee charge balance and zero DC at the outputs and must include all thinkable safety monitoring, operation and handling features to avoid failures in daily home based routine treatment. A suitable dual-channel system was developed in RISE and successfully tested in a patient study for a period of more than 2 years.

Implanted systems are not yet developed to a level that justifies

Restoring the Denervated Human Muscle by Functional Electrical Stimulation: Clinical Results of the European Research Project RISE

Michael Vogelaer, Claudia Forstner, Michaela Mödlin, Christian Hofer, Winfried Mayr, Helmut Kern and members of the RISE study group

The aim of the EU project RISE was to restore and maintain denervated human muscles in patients with total denervation of their lower limbs due to a complete conus – cauda lesion.

By using an adapted stimulation protocol with increasing number of stimuli per day, thus gradually increasing the amount of the muscle activity per day, we were able to improve the condition of the permanently denervated muscles.

The electrically induced isometric knee extension torque increased from almost zero (0.7 Nm) at the beginning up to 10.4 Nm after 2 years of FES in patients which had been paralysed for more than 3 years. This was confirmed by measuring the muscle cross sectional area with computed tomography (CT) of the thigh, showing an increase in m. quadriceps area of 25.5% in absolute values from 27.46 cm² up to 34.47 cm². With this improvement, 25% of the participants were able to perform stand up exercises in parallel bars. An improved cosmetical appearance of the thigh was an additional effect which was highly appreciated by the patients.

Overall, the above mentioned factors are an important contribution to prevent secondary diseases like decubital ulcers in patients with permanent denervation of all the muscles in their lower extremities.

S14

The Icelandic experience on FES of denervated muscles – including patient demonstration

Páll E. Ingvarsson, Þórður Helgason, Sigrún Knútsdóttir, Vilborg Guðmundsdóttir, Paolo Gargiulo and Stefán Yngvason

Material: The results of the Icelandic subgroup of 3/20 participants in the RISE study will be described, with one patient demonstration. The three patients, aged between 24 and 50 yrs, all had a complete lower motor neurone injury at levels between Th:X and L:I; they started their elctrostimulation treatment 9, 48 and 92 months after their injury, respectively.

Results: The most recent injury (9 months prior to inclusion into the study) had the best initial and 1-year results, but force response to electrical stimulation decreased during 2nd year of stimulation due to lack of compliance to treatment regime. By the second patient, who started treatment 4 years after his injury, moderate compliance and a thick subcutaneous fat layer probably both contributed to modest improvement. In patient no. 3, who was included 7 1/2 years after his injury, severely atrophic and denervated muscles gave negligible responses at inclusion, but an excellent compliance to the treatment regime resulted in gradually increased muscle volume, muscle force, and skin thickness.

Discussion: Time from injury to start of stimulation was, as anticipated, a key predictor of response, particularly at inclusion into the RISE study. These three patient examples highlight the importance of compliance in achieving any results.

Myogenesis in denervated human muscle and FES-induced muscle recovery in chronic flaccid paraplegia

U. Carraro, H. Kern

In long-term denervation of rodent muscles repeated cycles of myofiber regeneration occur. We recently shown that this also apply to human muscle (1). Enrollment in the EU Project RISE, biopsy harvesting, and follow-up of paraplegics with complete lower motor neuron lesion were performed at the Wilhelminenspital, Vienna, Austria (2). Muscle biopsies were analysed by light and electron microscopy in Padova, Italy. The human denervated muscles present severe atrophy, adipocytes and connective tissue (denervated degenerated muscle, DDM). Monoclonals against embryonic myosin show that regenerative events are present from 1- to 37-year post-spinal cord injury. In 2-year FES-trained muscles regenerative events are present, but at a lower rate than in DDM (myofiber per cryosection unit area: 0.8 ± 1.3 in FES vs. 2.3 ± 2.3 in DDM, mean \pm SD, $p = 0,011$). After FES the muscles present large round myofibers. The average diameter went from 15.4 to 27.0, a 76% increase after two years of FES. We conclude that the Vienna protocol of FES for paraplegic muscles is safe and effective. Much better cosmetic appearance and muscle cushioning effects are granted.

[1] Carraro U, et al. Artificial Organs, 2005; 29(3):187–191.

[2] Kern H, et al. J Neuropathol Exp Neurol, 2004; 63 (9), 919–931.

Supported by EU Commission Shared Cost Project RISE (Contract n. QLG5-CT-2001–02191) and Italian Ministry of University PRIN Project Contract n. 2004061452–002.

Test- and measurement equipment for functional assessment of denervated muscles

Dietmar Rafolt, Eugen Gallasch, Winfried Mayr

One part of the EU-project RISE was to develop biomechanical methods to evaluate the effect of FES training of denervated degenerated thigh muscles.

During electrical stimulation of Quadriceps muscles co-contractions of the hamstrings result in a reduced torque output of a FES activated knee-extension measured by a conventional dynamometer. According to approved manual methods (palpation of the muscle belly, joint movement) to assess the contraction we developed objective methods to address the Quadriceps solely.

Palpation: As the transversal muscle stiffness reflects the force generation in the muscle a computer controlled sensor-actuator system palpates the belly. Performing ramp force profiles (0-3N) the measured displacement of the skin shows typical compliance curves for biological tissues.

Pendulum test: a PC-controlled manipulandum was connected to the knee joint and programmed to elicit gravity induced leg oscillations. Frequency and decay of the oscillations reflect the FES affected stiffness and viscosity of the muscle.

Patella Tendometry: Twitch contractions due to single FES-pulses recorded at the patella tendon reflects the force output of the quadriceps without superposition of the hamstrings activity. Moreover dynamic properties (velocity of the force development) are measured.

In 24 subjects measurements were performed before, after 1 and 2 Years respectively of FES training.

Bone Density Distribution (BDD) and a Monitoring Method in Spinal Cord Injured (SCI) Patients with Denervated and Degenerated Muscles (DDM) treated with Electrical Stimulation (ES)

T. Helgason, J. L. Palsdottir, F. Johannesdottir, P. Gargiulo, P. E. Ingvarsson, S. Knutsdottir, V. Gudmundsdottir, S. Yngvason

Purpose: Investigate changes in BDD in SCI patients with DDM in the thigh. Furthermore to develop a method to measure mechanical properties of the knee joint muscles in the same patients.

Methods: In the frame of the RISE project¹ and with the aim to reverse muscle degeneration three patients were treated with electrical stimulation for up to one hour for each muscle, once a day, six days a week for eight months. A quantitative spiral computer tomography (QCT)² was made in regular time intervals of four months. The CT data was then analysed by grouping the volume elements having a density value in a specific interval of Hounsfield Units (HU). These distributions were compared for data gathered at the beginning and the end of the treatment period. Furthermore video based measurements were done on oscillations of the about the knee joint. The purpose was to test if the system could be described by a second order differential equation (DE).

Results: In the four lower density intervals the total amount of bone tissue did not change. In the next highest interval a reduction and in the highest interval an increase was detected. Furthermore an increase is detected in areas where the strain is expected from the muscle contraction whereas in other areas either no changes or even a decrease is detected. Results also show that the parameters of the DE correlate with muscle force and cross sectional area of the muscles.

Conclusions: Bone remodelling takes place in patients with DDM. It correlates with areas where strain is expected from muscle contraction suggesting an ES induction. The video based measuring method is adequate for monitoring electrical stimulation therapy of DDM.

1. Kern H, Hofer C, Mödlin M, Forstner C, Mayr W, Richter W. Functional electrical stimulation (FES) of long-term denervated muscles in humans: clinical observations and laboratory findings. *Basic Appl Myol* 2002;12:291–9.
2. Helgason T, Gargiulo P, Jóhannesdóttir F, Ingvarsson P, Knútsdóttir S, Gudmundsdóttir V, Yngvason S. Monitoring Muscle Growth and Tissue Changes Induced by Electrical Stimulation of Denervated Degenerated Muscles with CT and Stereolithographic 3D Modeling. *Artificial Organs* 29(6): 440–443

Segmentation of muscle bellies: Monitoring of denervated degenerated muscle growth influenced by FES

Poulo Gargiulo

Propose: Develop a method to reconstruct muscle bellies from paraplegic patients with fully denervated and degenerated muscles (DDM) in the lower extremities and use it to monitor muscle changes and growth induced by FES.

Method: In the frame of the EU-funded RISE project [1], spiral Computer Tomography (CT) is taken every four months on the Icelandic subgroup of three patients with a complete spinal cord injury of flaccid type [2]. Spiral CT from the hip joint down to the knee joint is used to gather 3D data on the upper leg tissue. These scanner data are processed with special 3D Image processing and editing tool. Automatic and semi automatic image processing methodologies are used to correlate different tissue properties into 3D geometry of bones, muscles, arteries and veins. Advanced segmentation methodology was developed to segment single muscle bellies and its 3D representation; allowing complete and accurate comparison in term of volume, shapes and density during the therapy.

Results: Volume growth in the muscle beneath the electrodes (M2 on the histogram), no remarkable changes in the muscle close to the stimulation (M3) and ongoing degeneration in all the other muscles bellies.

Conclusion: FES stops muscle degeneration and promotes muscle growth in the regions where it is applied.

1. Kern H, Hofer C, Mödlin M, Forstner C, Mayr W, Richter W. Functional electrical stimulation (FES) of long-term denervated muscles in humans: clinical observations and laboratory findings. *Basic Appl Myol* 2002;12:291–9.
2. Helgason T, Gargiulo P, Jóhannesdóttir F, Ingvarsson, P, Knútsdóttir S, Guðmundsdóttir V, Yngvason S. Monitoring Muscle Growth and Tissue Changes Induced by Electrical Stimulation of Denervated Degenerated Muscles with CT and Stereolithographic 3D Modeling. *Artificial Organs* 29(6):440–443

WORKSHOPS

W1

International Spinal Cord Injury Data Sets. What have we done?

Presented by Fin Biering-Sørensen on behalf of everyone involved

The executive committee for the International Spinal Cord Injury (SCI) Standards and Data Sets has established procedures for developing, approving and publishing new International SCI Data Sets.

The Core Data Set was the first to be published.

Well into the approval procedure are the International SCI Urological Data Sets: Lower Urinary Tract Function Basic Data Set, Urodynamics Basic Data Set, Urinary Tract Imagine Basic Data Set. For approval are also the International SCI Basic Pain Data Set, Basic Bowel Data Set, and Extended Bowel Data Set.

Working groups are engaged in the development of International Basic SCI Vertebral Injury and Basic SCI Spinal Surgery Data Sets, as well as a Basic SCI Data Set on Non-traumatic spinal cord lesions, and SCI Data Sets for Assessing Community Participation Following SCI and Quality of Life Following SCI. In addition a SCI prevention module using the International Classification of External Causes of Injury (ICECI-WHO) is under development.

Finally are working groups on sexual function under creation.

We are open to have more working groups established according to the procedures laid down by the executive committee for the International SCI Standards and Data Sets.

International Classification of External Causes of Injury (ICECI). Toward an International SCI prevention module

Raymond Cripps, Bonne Lee, Fin Biering-Sorensen, Peter Wing, Robert Campbell, Dajue Wang, Juliette Stander, Debbi Long, Rick Ledema

In response to the development of the International Spinal Cord Injury Core Data Set, an SCI prevention module was proposed to provide a coding structure suitable for describing world-wide spinal cord injury event narratives. The SCI prevention module will use the International Classification of External Causes of Injury (ICECI-WHO) if it is found to be suitable for international spinal cord injury prevention purposes. The ICECI is designed specifically as a system of classifications to enable systematic description of how injuries occur, and is designed to be used internationally for injury prevention. ISCoS has recently been recognised by the ICECI-WHO as a partner organisation towards the further development of this coding structure. The results of a pilot study undertaken by clinicians in five countries using a purpose-built ICECI coding application and a validated set of gold standard ICECI coded narratives will be presented. The presentation will explore initial impressions of face validity, linguistic and cultural barriers to interpretation and coding of spinal cord injury narratives, and their impressions of the ICECI code structure, classification items, injury narratives and the use of the computer based training program.

The International Spinal Cord Injury data set: Vertebral column injury and Spinal Surgical procedures modules

Marcel Dvorak, Alex Vaccaro, Michael Fehlings, Eyal Itshayek, Peter Wing

As with the other modules for this project, a basic data set has been developed to record the presence or absence of an observable spinal column injury. It thus also allows the documentation of spinal cord injury without evidence of fracture. Vertebral fractures and other significant displacements (subluxation or dislocation) compromising stability are often classified with respect to decisions for surgical or conservative care. Key to the International Data standards will be classification concepts embedded in the European systems and those being developed through the North American Spine Trauma Study Group. The basic set has been modified to reflect comments received after presentation of earlier iterations.

Another working group (Dr Ruth Marshall, lead) will address spinal comorbidities and non-traumatic causes of SCI. Fields in this area will include congenital or developmental anomalies, degenerative disease, infection, neoplasm and other processes weakening bone.

A separate basic data set will record the performance of any procedure, and document in simple terms the basic nature of the procedure and the approach – eg decompression, stabilization and timing. Additional data sets will allow more detailed recording of the degree of resection, the type of implant used, and/or the use of bone graft materials. Complications will be considered.

The same iterative process being used for the other modules yields a minimum set of basic questions that can easily be used in any hospital setting to record the data for people with spinal cord injuries, with optional and more detailed modules to meet the needs eg of spine surgeons. Progress with these will be presented.

W4

Non-traumatic Spinal Cord Injury – towards an agreed classification

Ruth Marshall, Raymond Cripps, Peter New

An agreed classification remains difficult. Underlying aetiology remains the simplest solution with iatrogenic remaining a special group, which does not fit neatly into the traumatic or non-traumatic group. When surveyed in 2006 most respondents indicated that spinal cord damage that occurred during or as a result of surgery should be classified as “non-traumatic” even though an “E” code may be included and iatrogenic injury may be preventable. Thus the NTSCI classification divides into Congenital and Acquired with “acquired” including iatrogenic, degenerative, neoplastic etc.

A suggested classification will be provided.

W5

Urological Data Sets

Presented by Jean-Jaques Wyndaele

Update will be shortly presented on 2 topics related to urology:

1. the lower urinary tract function basic data set
2. the urodynamic data set

The working group consists of:

Fin Biering-Sørensen representing The International Spinal Cord Injury Data Sets Executive Committee

Michael Craggs, representing the European Urological Association (EAU)

Michael Kennelly, representing the American Spinal Injury Association (ASIA)

Erik Schick, representing the International Continence Society (ICS)

Jean-Jacques Wyndaele, representing the International Spinal Cord Society (ISCoS)

W6

Bowel function basic data set

Klaus Krogh, Steven Stiens, Inder Perakash, Fin Biering-Sørensen

Background: Data Sets for Spinal Cord Injury (SCI) are being developed in order to standardize the collection and reporting of information on various aspects of SCI.

Aim: To develop a Bowel Function Basic Data Set for use among individuals with SCI.

Methods: An expert group of doctors with clinical and research experience within the field of bowel dysfunction after SCI met in Copenhagen, Denmark November 2006. Consensus was obtained about a preliminary Bowel Function Basic Data Set.

Results: A 12 item Bowel Function Basic Data Set is proposed. Items included in the Data Set are: Date of data collection, Gastrointestinal or anal sphincter dysfunction unrelated to SCI, Surgical procedures on the gastrointestinal tract, Awareness of the need to defecate, Defecation method and bowel care procedures, Average time required for defecation, Frequency of defecation, Frequency of fecal incontinence, Need to wear a pad or plug, Medication affecting bowel function, Use of oral laxatives, and Perianal problems.

Discussion: Minor details still need to be agreed upon within the group before the draft is submitted to the Executive Committee of the SCI Standards and Data Sets. In a number of settings the information within the proposed Basic Data Set will be supplemented by a 24 item Bowel Function Extended Data Set currently under construction.

Update on pain data set

Eva Widerström-Noga, Fin Biering-Sørensen, Thomas Bryce, Diana D Cardenas, Nanna B Finnerup, Mark P Jensen, J Scott Richards, Philip Siddall

Persistent pain following spinal cord injury (SCI) is a global problem that significantly impacts on quality of life. However, despite a high prevalence of chronic SCI-related pain, a standardized way of collecting data concerning pain is lacking. Therefore, the purpose of the SCI Basic Pain Data Set (BPDS) is to standardize the collection and reporting of pain in the SCI population. Specifically, the BPDS contains a minimal amount of clinically relevant information concerning pain that can be collected in the daily practice by health care professionals with expertise in SCI. In order to best reflect the multidimensionality of pain and to be consistent with other working groups, it includes variables from three primary domains (i.e., pain severity, physical, and emotional impact). Specifically, the BPDS is designed to evaluate the different types of pain that an individual with SCI experiences. Since the majority of persons with SCI and pain have more than one pain problem, the three worst pain problems are detailed with respect to location and type of pain (i.e., neuropathic, nociceptive) relative to the level of injury. For each pain, pain intensity, temporal pattern of pain and pain interference with daily activities, mood and sleep are recorded.

W8

Data sets for assessing community participation following Spinal Cord Injury

Susan Charlifue, Marcel Post

The desired goal of medical and psychosocial rehabilitation for people with spinal cord injury is returning individuals to their communities and enabling them to fully participate in life, work and social activities. Although important as a rehabilitation goal, the absence of social participation is the least often measured of all rehabilitation outcomes. Several instruments have been developed to capture community integration and participation in order to better assess successful outcomes of rehabilitation, but there has been very little testing and validation of the instruments across countries and cultures. Another difficulty is the perceived overlap between activities (what a person does/can do on an individual level) and participation (what a person does/can do within a societal context). Development of a data set to capture societal participation necessitates a thorough review of existing measures, identifying concepts that are unique to these instruments and combining them into a single, brief yet comprehensive instrument that is culturally and geographically neutral. This presentation focuses on the areas of participation that are anticipated to be included in the core participation data set, as well as more specific issues that will comprise participation modules.

Data sets for assessing quality of life following Spinal Cord Injury

Susan Charlifue, Marcel Post

There is little agreement on which tools are best suited and sensitive enough to assess quality of life (QOL) for people with spinal cord injuries (SCI). In order to develop a module as part of the International Spinal Cord Injury Data Set that is acceptable and appropriate across cultures, input from individuals and organizations with expertise in SCI psychosocial issues, as well as from individuals with SCI themselves is needed. This process can identify key factors that contribute to and define QOL in order to facilitate comparisons of psychosocial issues across studies of SCI outcomes. Options to identify and develop this data set include asking individuals with SCI to respond to various measures of QOL to determine which they find easiest and most relevant and utilizing the International Classification of Function, Disability and Health framework to identify the relevant data items for people with SCI. The goal of this process is to yield a minimum set of basic questions that can easily be used in any rehabilitation or community setting to assess QOL for people with SCI. Additional future modules will be developed to address additional QOL issues, such as depression and social support, in greater detail.

Evaluation of different perspectives on problems experienced by individuals with SCI: report of the project 'Development of ICF Core Sets for Spinal Cord Injury (SCI)'

Gerold Stucki, Susan Charlifue, Marieke Wollaars, Anne Sinnott, Monika Scheuringer

Purpose: The objective of this workshop is to report on the progress of the project 'Development of ICF Core Sets for SCI'. This project is a cooperation between the ICF Research Branch of the World Health Organization (WHO) Collaboration Centre of the Family of International Classifications (DIMDI, Germany), the CAS (Classification, Assessment and Surveys) team, the DAR (Disability and Rehabilitation) team at WHO, the International Spinal Cord Society (ISCoS), the International Society for Physical and Rehabilitation Medicine (ISPRM) and partner institutions across the world.

Methods: The project consists of four worldwide studies conducted from 2006 to 2007 with an International Consensus Conference to be held in November 2007. Subsequent field testing will be necessary to validate this first version of ICF Core Sets for SCI.

Results: Since 2006 four world-wide studies have been conducted to identify ICF categories relevant for SCI: (I) an Empirical Study, (II) a Systematic Review of measures used in SCI research, (III) an Expert Survey involving health professionals worldwide, and (IV) Focus Groups with persons with SCI.

Conclusion: As in any scientific endeavor, there are uncertainties that have to be resolved during the process.

The preliminary studies will provide the necessary information to guide decisions on (a) which type of ICF Core Sets for SCI to proceed with, and (b) necessary stratification by a number of variables of the ISCoS Core Data Set.

Identification of common problems in functioning of individuals with Spinal Cord Injury using the International Classification of Functioning, Disability and Health (ICF)

Susan Charlifue, Monika Scheuringer, Michael Baumberger, Rob Campbell, Apichana Kovindha, Haim Ring, Anne Sinnott, Gerold Stucki

Purpose: The objective of this international study is to describe functioning and health of individuals with Spinal Cord Injury (SCI) and to identify the most common problems using the International Classification of Functioning, Disability and Health (ICF). The specific aims within the project 'ICF Core Set development for SCI' are (1) to identify candidate categories for the ICF Core Sets for SCI for the early post-acute situation and the ICF Core Set for chronic SCI, respectively, and (2) to examine whether ICF categories unique for individuals who differ in the completeness or in the neurological level of SCI exists.

Methods: This multi-centre study was a cross-sectional survey in samples of individuals with SCI. 264 second level categories of the ICF were used to collect information on patients' problems.

Results: The median age in the sample was 42,6 years, 22,2% of the patients were female. 54,9% of the subjects had a complete SCI; 56,3% were paraplegics. 56,8% of the patients were in the chronic situation. 186 ICF categories could be identified as candidate categories for the ICF Core Sets for SCI for the early post-acute situation. 122 ICF categories belong to Part 1 of the ICF including the components Body Functions, Body Structures, and Activities and Participation. 64 ICF categories belong to Part 2 of the ICF including the Environmental Factors. 191 ICF categories could be identified as candidate categories for the ICF Core Sets for the chronic SCI. 127 ICF categories belong to Part 1 of the ICF and 64 to Part 2. 182 ICF categories were common for both, the early post-acute and the chronic situation. 4 ICF categories were identified as unique for the early post-acute situation and 9 ICF categories were identified as unique for the chronic situation. 9 ICF categories could be identified as unique for individuals with incomplete SCI, 8 ICF categories as unique for individuals with complete SCI, 1 ICF category as unique for paraplegics, and 16 ICF categories as unique for tetraplegics.

Conclusions: This study is a first step towards the development of ICF Core Sets for individuals with SCI and provides the information to guide decisions on which type of ICF Core Sets for SCI to proceed with.

Identification of problems in functioning related to Spinal Cord Injury from the individuals' perspective: an international focus group study

Anne Sinnott, Monika Scheuringer, Susie Charlifue, Apichana Kovindha, Hansjörg Lüthi, Manuel Zwecker, Vernon Sack, Michaela Coenen, Alarcos Cieza

Purpose: The objective of this qualitative study was to explore the aspects of functioning and health relevant to individuals with Spinal Cord Injury (SCI) using the focus group technique. The specific aim within the project 'ICF Core Set development for SCI' is to identify candidate categories for the ICF Core Sets for SCI for the early post-acute situation and the ICF Core Set for chronic SCI, respectively.

Methods: We used six open-ended questions asking for the problems of individuals on body functions and body structures, activities and participation. In addition, the individuals were asked about environmental factors and personal factors affecting their every-day life. The focus groups were digitally recorded and transcribed verbatim. The meaning condensation procedure was used to identify the meaningful concepts contained in the focus groups. In a next step, the meaningful concepts were linked to categories of the International Classification of Functioning, Disability and Health (ICF) according to established linking rules.

Results: 298 out of the 1.454 ICF categories could be identified as candidate categories for the ICF Core Sets for SCI for the early post-acute situation. 230 ICF categories belong to Part 1 of the ICF including the components Body Functions, Body Structures, and Activities and Participation. 68 ICF categories belong to Part 2 of the ICF including the Environmental Factors. 349 out of the 1.454 ICF categories could be identified as candidate categories for the ICF Core Sets for the chronic SCI. 243 ICF categories belong to Part 1 of the ICF and 106 to Part 2. 217 ICF categories were common for both, the early post-acute and the chronic situation. 81 ICF categories were identified as unique for the early post-acute situation and 132 ICF categories were identified as unique for the chronic situation.

Conclusions: Focus groups are a useful method to identify relevant aspects of functioning and health from the individuals' perspective. This study is a first step towards the development of ICF Core Sets for individuals with SCI and provides the information to guide decisions on which type of ICF Core Sets for SCI to proceed with.

W13

Identification of relevant aspects of functioning in individuals with Spinal Cord Injury from the health professional perspective: an international Expert Survey

Monika Scheuringer, Christine Boldt, Inge Eriks, Szilvia Geyh, Alexandra Rauch, Alarcos Cieza

Purpose: The objective of the Expert Survey was to identify problems in functioning relevant to individuals with Spinal Cord Injury (SCI) from the health professional perspective. The specific aim within the project 'ICF Core Set development for SCI' is to identify candidate categories for the ICF Core Sets for SCI for the early post-acute situation and the ICF Core Set for chronic SCI, respectively.

Methods: A worldwide internet survey including samples of nurses, social workers, physical therapists, occupational therapists, physicians, and psychologists with expertise in the treatment of people with SCI. We used open-ended questions asking for the problems experienced by individuals with SCI and for environmental factors and personal factors affecting the every-day life of individuals with SCI. The participants' answers were linked to the categories of the ICF using standardized linkage rules.

Results: From the 243 randomly selected health professionals, 51.4% of them participated in the expert survey. The median age of the participants was 40.0 years, 62,7% were female. The median number of years of professional experience was 16.0. 337 out of the 1.454 ICF categories could be identified as candidate categories for the ICF Core Sets for SCI for the early post-acute situation. 283 ICF categories belong to Part 1 of the ICF including the components Body Functions, Body Structures, and Activities and Participation. 54 ICF categories belong to Part 2 of the ICF including the Environmental Factors. 371 out of the 1.454 ICF categories could be identified as candidate categories for the ICF Core Sets for the chronic SCI. 307 ICF categories belong to Part 1 of the ICF and 64 to Part 2. 285 ICF categories were common for both, the early post-acute and the chronic situation. 52 ICF categories were identified as unique for the early post-acute situation and 86 ICF categories were identified as unique for the chronic situation.

Conclusions: This study is a first step towards the development of ICF Core Sets for individuals with SCI and indicates a need to develop different ICF Core Sets for individuals with SCI in the early post-acute situation and in the chronic situation, respectively.

W14

Systematic review of parameters reported in published studies focusing on Spinal Cord Injury

Marieke Wollaars, Monika Scheuringer, Marcel W Post, Szilvia Geyh

Purpose: The objective of the systematic literature review is to identify parameters reported in published studies focusing on spinal cord injury (SCI), and to identify and quantify the concepts contained in these parameters using the ICF as a reference.

Methods: Electronic searches of Medline, EMBASE, PsycINFO, and CINAHL from 2000 to 2005 were carried out. In a first step, the abstracts of a random sample of the retrieved studies were checked. In a second step, data on the reported parameters and certain characteristics of the included studies were extracted. In a third step, the parameters and their underlying concepts were specified. These concepts were then linked to categories of the International Classification of Functioning, Disability and Health (ICF) using standardized linkage rules.

Results: From the 6.681 abstracts retrieved, 2.204 were randomly selected (32.9%). 254 of these selected studies met the inclusion criteria (11.5%). In a next step, 1.997 different parameters were retrieved. The specification of the concepts contained in these parameters and the linking of these concepts to ICF categories is under way.

Conclusions: This study will show whether the ICF provides a valuable reference to identify and quantify the concepts of parameters reported in studies focusing on SCI. Our results may indicate a need to define and to agree on 'what should be measured' in SCI research to allow for a comparison of patient populations.

Spinal Cord Stimulation to Restore Cough in Patients with Spinal Cord Injury

Anthony F. DiMarco, Krzysztof Kowalski, Robert Geertman, Dana Hromyak

Objective: To evaluate the capacity of lower thoracic spinal cord stimulation (SCS) to produce large positive airway pressures and high peak expiratory flow rates to generate an effective cough mechanism in spinal cord injured patients.

Methods: In 4 tetraplegic patients, three disc electrodes were positioned on the dorsal epidural surface of the spinal cord at the T9, T11, and L1 levels, and connected to an implanted radiofrequency receiver. SCS was applied by activating an external transmitter. Measurements of airway pressure and expiratory flow were made during SCS to assess the force of expiratory muscle contraction.

Results: Mean maximum airway pressure generation and mean peak flow rates during spontaneous efforts were 19 ± 2 cmH₂O and 1.2 ± 0.3 L/s, respectively. During SCS at TLC, maximum positive airway pressure generation at the T9, T11 and L1 levels alone, in separate trials, were 76 ± 26 cmH₂O (range: 26-114), 80 ± 31 cmH₂O (range: 18-160) and 81 ± 28 cmH₂O (range: 38-134), respectively ($p < 0.001$ compared to spontaneous efforts). SCS applied with a 2 lead system, T9 plus either T11 or L1, resulted in maximum pressures and flows of 108 ± 37 cmH₂O (range 27-208) and 5.8 ± 1.9 L/s (range: 1.4-10.0), respectively. Addition of a third lead did not result in further increases in pressure generation or flow rates. Each subject experienced greater ease in raising secretions with use of SCS. Caregiver support to facilitate secretion clearance was either significantly reduced or completely eliminated.

Conclusion: Functional electrical spinal cord stimulation may provide a new useful method to restore an effective cough mechanism and possibly reduce the morbidity and mortality associated with respiratory tract infections in patients with spinal cord injury.

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Current Status of the Diaphragm Pacing Stimulation System and the Experience of the First European Implantation Site in Iceland

Raymond P. Onders; Margret Oddsdottir; Pall Ingvarsson

Purpose: Patients with high spinal cord injury (SCI) face death or life with mechanical ventilation. Ventilators, although life-saving, are inconvenient, associated with significant risks and the ability to provide home ventilators can be limited. This workshop will outline the overall results of the diaphragm pacing stimulation (DPS) system and highlight the experience of the first European site's utilization of the technology.

Methods: In a prospective trial, patients undergo outpatient laparoscopic diaphragm motor point mapping with electrode implantations. Stimulus/output characteristics of each electrode are determined and diaphragm conditioning is initiated to wean the patients off of their ventilators

Results: Over 40 patients have been implanted with a 97% success rate in providing ventilation with the DPS system. In 2006, two patients in Iceland were involved in horse back riding accidents that left them dependent on mechanical ventilation and both underwent implantation of the DPS in May of 2007. There was no difference in surgical times or morbidity in comparing the patients implanted in Iceland with the patients implanted at the lead site in Cleveland confirming the reproducibility of the surgical technique. In reviewing all long term results, age and time from injury directly affects conditioning time to achieve 4 continuous hours with DPS from less than 1 week for 18 to 20 year olds on a ventilator for less than one year to 14 weeks for 40 to 50 year olds on ventilators for great than 5 years. Additional findings of DPS use include: reduction of airway pressure decreasing risks of barotrauma; conversion of fast twitch glycolytic (IIb) to functional slow twitch oxidative muscle (I) fibers; increased diaphragm muscle thickness; improved posterior lobe lung ventilation with over 60% reduction in secretions and need for suctioning.

Conclusions: The DPS system has 97% success rate and should replace the ventilator for SCI patients. The DPS system can be implanted at new sites with no difference in the surgical results and outcomes. The DPS system is low risk and removable so that earlier implantation could decrease the high rate of early ventilator associated pneumonia through posterior lobe ventilation.

Restoration of Bladder, Bowel and Sexual Function in SCI with FES

Graham H. Creasey

Most patients with spinal cord injury have intact sacral nerves which can be activated electrically to restore function. Nerves damaged by conus medullaris or cauda equina lesions may however be unresponsive to electrical stimulation.

Bladder Function: Bladder contraction can be produced by stimulating sacral nerves or nerve roots; this typically produces contraction of the external sphincter also, but brief bursts of stimulation can cause bladder contraction to peak when the sphincter is not being activated, allowing voiding. A stimulator based on this principle has been implanted in over 3000 patients, producing micturition with low residual volumes, reducing urinary tract infection and catheterization. Implantation is usually combined with posterior sacral rhizotomy which abolishes reflex contractions of the bladder and increases bladder capacity, improving continence and reducing the risk of back pressure to the kidneys. Rhizotomy also abolishes reflex sphincter contraction, aiding voiding, and prevents autonomic dysreflexia associated with bladder contraction. However, it also abolishes reflex erection and reflex ejaculation, and this has limited the widespread use of the technique, although erection and seminal emission can often be restored by other methods.

Bowel Function: Stimulation of the sacral nerves increases peristalsis in the lower bowel, reducing constipation, and an intermittent pattern of stimulation can produce defaecation in some patients. Studies in both Europe and the USA have indicated that this form of management can substantially reduce the long-term costs of bladder and bowel management after spinal cord injury.

Sexual Function: Erection can be produced by stimulating the S2 nerve roots continuously, using the above implant. Seminal emission ("electroejaculation") can be produced by stimulating the seminal vesicles with a rectal probe, under brief general anesthetic if necessary.

Availability: The Finetech-Brindley Bladder Controller (known in the USA as the Vocare System) has been commercially available in Britain since 1982 from Finetech Medical Ltd (w) and is currently used in over 20 countries. It received approval from the Food and Drug Administration in 1998 as a Humanitarian Use Device and was marketed commercially by NeuroControl Corporation between 1998 and 2001. Electroejaculation equipment is available in the USA from Dalzell USA Medical Systems (dalzellusamedsys. home. att. net).

Disclosure: The author has no financial relationship with any of the commercial devices or companies described in this presentation.

Restoration of walking after incomplete paraplegia with FES

Ronald J. Triolo

Motor incomplete injuries represent one of the largest and fastest growing segments of the SCI population. While advanced rehabilitative interventions such as body weight supported and robotic assisted treadmill training show promise for improving walking ability after incomplete SCI, individuals who do not respond to such innovative treatments still require assistance to achieve continuous ambulation for clinically relevant distances and velocities. Activating a small number of key muscles that would otherwise remain weak or functionally paralyzed after incomplete SCI with electrical stimulation and appropriately timing their contractions with the gait cycle can provide the step-to-step assistance required to allow non-ambulatory individuals to become household or community level ambulators. Although FES can provide individuals with partial paralysis with the ability to walk independently, the inherent variability of the population requires a highly customized approach to the application and use of electrical stimulation. Furthermore, coordinating the actions of electrical stimulation with intact volitional movement becomes increasingly important. These and other issues related to FES-assisted ambulation after incomplete SCI will be illustrated in this session by the presentation of two case histories of individuals with C7 ASIA C and D injuries. Both individuals remained non-ambulatory after aggressive preparatory therapy involving robotic-assisted body weight supported treadmill or overground gait training. Each received a customized FES system consisting of intramuscular electrodes and an eight-channel implanted stimulator-receiver. The muscles targeted for implantation were selected for each individual based on their primary gait deficits and confirmed with surface stimulation prior to implant surgery. One system was implemented bilaterally to assist swing phase and knee stability in stance with FES while the individual timed the volitional contraction of his hip extensors to the stimulation pattern. The second was implemented unilaterally to power both stance and swing on the more impaired side while the individual stepped voluntarily with the contralateral limb. Both individuals were able to achieve independent ambulation in a rolling walker for distances in excess of 300 meters with the implanted FES systems. Work to coordinate stimulation with volitional function and trigger patterns of FES based on the EMG signals from muscles under voluntary control is ongoing.

Restoration of Hand Function in Spinal Cord Injury with an Implanted Neuroprosthesis

**Hoyen HA., Kilgore KL., Bryden AM., Hart RL., Keith MW.,
Montague FW., Sams CJ., Peckham PH.**

Restoration of hand function remains a top priority for individuals with mid-cervical level spinal cord injury. A second generation neuroprosthesis for upper extremity function in spinal cord injury has been deployed. The primary goals of the second generation neuroprosthesis include: fewer external components; proximal muscle control (triceps stimulation); expanded hand control (finger intrinsics and extension); and improved methods control mechanisms. This system can also be utilized for injury levels higher or lower than C5/C6. The system consists of an implanted device capable of stimulating twelve different paralyzed muscles and simultaneously recording the myoelectric signal (MES) from two different muscles that are under voluntary control by the subject. The MES is then used for system and hand grasp control.

Sixteen second generation neuroprosthetic systems have been implanted in twelve spinal cord injured subjects for hand-arm control, including the first three subjects to have bilateral neuroprosthetic devices and the first individual with high tetraplegia (ASIA C2 incomplete) to receive an implanted neuroprosthesis for arm and hand function. Subjects are able to successfully use the myoelectric signal from their extensor carpi radialis longus (C6) or brachioradialis (C5) for proportional control of hand grasp opening and closing. Myoelectric signals from trapezius, platysma and auricularis posterior muscles have also been used. As myoelectric control in neuroprostheses allows considerable flexibility in the control algorithms, each system is customized to the patient needs. Patient satisfaction has been improved with the elimination of an externally mounted control source.

All subjects have demonstrated improved functional abilities in activities of daily living, including tasks such as eating, drinking, writing, embroidery and throwing a ball. With bilateral systems, subjects are able to perform activities such as using a fork and knife to cut food, using two hands to screw and unscrew a lid on a jar, and brushing hair while blow-drying.

Recent updates in Functional Electrical Stimulation research restoration of trunk stability using FES

Ronald J. Triolo, Ph. D.

Trunk instability is one of the primary contributing factors to upper extremity injury and painful chronic health problems after paralysis. Sitting for prolonged periods of time in postures that place the lumbar spine in kyphosis and tilt the pelvis posteriorly can lead to frequent pressure sores, restrict respiratory volumes, and compromise the ability to perform essential transfers or propel a manual wheelchair. Lack of trunk control compromises the ability to manipulate objects and can increase the potential for rotator cuff injury. For these reasons, trunk stability has been identified as one of the highest priorities for motor system recovery in individuals with SCI1. Contractions of the otherwise paralyzed trunk and hip muscles elicited by electrical stimulation can stiffen the torso, control the attitude of the pelvis, modify interface pressures and improve respiration. Preliminary studies suggest that bilateral activation of the paraspinal muscles can reduce posterior pelvic tilt and shift bimanual workspace individuals forward and upward to allow seated individuals to manipulate heavier objects greater distances from the body than without FES2. Significant variations in seated posture may also be possible by appropriately modulating stimulation3. This session reviews the current status and research directions for controlling seated posture with electrical stimulation, and presents a detailed case study of an individual who received an implanted FES system for trunk control more than 11 years after a C4/5 ASIA A injury. Intramuscular electrodes were inserted bilaterally into the gluteus maximus and at the L1 and T12 spinal roots to activate the lumbar erector spinae and quadratus lumborum. With FES, pre-existing spinal concavity and lumbar kyphosis decreased by 40%, and the more erect posture improved forced expiratory volumes and vital capacities by as much as 20%. The individual is able to return to upright sitting from a fully flexed position with the assistance of FES and can more efficiently complete simulated ADLs, including reaching and turning in bed, with the additional trunk stability afforded by electrical stimulation.

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From the emergency room to the delivery room – Effects of SCI on sexual function and management in the sexual rehabilitation clinic

Rafi J Heruti, MD, Master in PM&R, Certified sexual therapist

Sexuality is a broad concept including sexual drives and behaviors, which are influenced by personal, societal, and cultural factors. Sexual function is an essential form of communication, which all people are worthy of. Spinal Cord Injury (SCI) has demonstrable impact on sexuality and must be taken into account when dealing with rehabilitative approaches to clients with SCI. Physical sexual dysfunctions, partner relationship, social life, bladder management, physical well-being relationship to partner, ability to move and mental well-being, aspects of sexual desire and body image – all significantly impact quality of life and have correlation to satisfaction with sexual life.

In this presentation basic medical informative background about sexuality in the individual with SCI is given. The physiological processes of the sexual response are reviewed with this regard. The subject of male infertility after SCI is discussed, including advances in treatment modalities in this field. Urinary leakage, spasticity and positioning problems were the medical problems most significantly interfering with partner-related sexual activity.

In conclusion, sexual counseling has to become an integral part of rehabilitation. It has been found that the rehabilitation process is more efficient when attention is given to the sexual aspects of SCI, beside the physical one. The goals and approach of successful sexual rehabilitation and the therapeutic options are given.

W22

The European Spinal Cord Injury Federation

Daniel Joggi

Dr Daniel Joggi, President of ESCIF, will present the newly-founded federation, its members and organisation, its vision and mission. Dr Joggi will consider the future role of ESCIF as a unified voice for all people in Europe living with a spinal cord injury and the implications of this for social and health issues.

Following the presentation, the audience will be invited to ask questions and to discuss the issues raised.

W23

Acute care and primary rehabilitation in ESCIF member countries

Jane Horsewell

One of the opportunities afforded by the creation of ESCIF is the relative ease with which information about member organisations and countries can be gathered, collated and compared. Jane Horsewell, Vice President of ESCIF, will present the results of the first information-gathering project carried out by the Federation. Using a questionnaire survey and follow-up discussion workshops, the aim of the project is to identify the differences in care and rehabilitation in ESCIF member countries and to analyse how these impact the perceived quality of care.

Time will be allowed for questions and comments following the presentation

W24

Nutrition and wellbeing – the users' perspective

Daniel Joggi, Jane Horsewell

One of the main themes of ESCIF members' congress to be held at the Manfred Sauer Foundation in April 2007 is the way in which diet and nutrition can contribute to the physical and mental wellbeing of people living with SCI. Here we will present the conclusions of the discussions.

Translating SCI repair strategies to human application: What information does a clinician or patient require to make an informed decision to participate in a clinical trial?

J. Steeves, M. Craggs, A. Curt, M. Fehlings

We live in an era where there is rapidly expanding interest and activity in clinical trials involving subjects with spinal cord injury (SCI). What experimental interventions are likely to succeed? What are the valid paths for the translation of discoveries? What are the most appropriate and effective designs for SCI trials? How many subjects are needed for each type of trial and each trial phase? What are the appropriate outcome measures for each clinical target?

The speakers at this workshop/symposium will present the relevant background information that has been learned from previous trials. They will also discuss their experiences with current trials and invite the audience to share their wisdom and experiences in an interactive forum. Dr. Steeves will chair the session and provide an overview of the preclinical status of several experimental therapeutic strategies. Dr. Craggs will focus on urological function and dysfunction after SCI. Dr. Fehlings will summarize interventions for SCI which involve an invasive (surgical) approach. Dr. Curt will discuss the strengths and weakness of relevant “functional” outcome measures. The issues are complex and one approach will not satisfy all needs.

Urological function and dysfunction after SCI

Michael Craggs

The impact of lower urinary tract dysfunction on quality of life can be devastating. For people with a spinal cord injury it is seen as one of the most important problems to be resolved, invariably requiring long-term care and management.

Spinal pathways to and from the brain are essential for coordinated control of the lower urinary tract. Following spinal cord injury, not only do these modulatory pathways become disconnected leading to sensory loss of bladder fullness and impaired volitional control of continence and voiding but aberrant sacral reflexes emerge, resulting in high bladder pressures (detrusor hyperreflexia) exacerbated by urethral sphincter dysynergia and incontinence. Left untreated such problems can seriously compromise renal function.

Routine assessment of patients with spinal cord injury relies on subjective clinical measurement using the ASIA classification and Impairment Score. These are not always consistently rated and neither do they assess autonomic function. However, recent somato-sensory and somato-motor testing, together with urodynamics, is introducing more objective neurophysiological measures for evaluating urological dysfunction in spinal cord injury. Such measures of somato-visceral reflexes appear to be well correlated with the standard neurological assessment of injury.

Through a comprehensive knowledge of the neurophysiological mechanisms controlling the bladder and sphincters we can hope to develop more reliable and sensitive diagnostic tools to assess the outcome of new therapeutic interventions for treating urological dysfunction following spinal cord injury. Any possibilities for functional restoration, whether by promoting natural recovery with neuroprotection, tapping into cortical plasticity, implanting novel devices to stimulate residual neural pathways, or ultimately developing a “cure” through functional neural repair, will require sensitive assessment tools to measure any improvements in autonomic neural function. Targeting specific cerebro-spinal and sacral segmental pathways for functional restoration may be the key to success. This talk will summarise those neurophysiological tests which could help us to identify the foci for future therapeutic interventions.

Interventions for SCI, which involve an invasive (surgical) approach

Michael G. Fehlings

The pathophysiology of spinal cord injury involves an initial primary mechanical insult which is followed by a series of secondary injury offense which include ongoing compression, ischemia, inflammation, glutamatergic excitotoxicity, oxidative cell injury and apoptosis. The development of a glial scar and the presence of various intrinsic inhibitory molecules including No-No and Rho further limit the endogenous repair, which occurs after a spinal cord injury. Moreover, the presence of the blood spinal cord barrier and the potential systemic toxicity of many neuroprotective in regenerative strategies makes it clear that direct surgical approaches to the spine and spinal cord play a key role in therapeutic strategies for spinal cord injury.

The current talk will focus on the STASCIS clinical trial, which is examining the role and timing of early surgical decompression for spinal cord injury. There is emerging evidence that early intervention within the first 24 hours after an acute spinal cord injury may be associated with improved neurological outcomes. There is growing interest in the use of pharmacological, protein based and cellular based strategies for promoting repair and regeneration after spinal cord injury. In this talk, the results of the Cethrin clinical trial examining the use of recombinant protein, which inhibits rho, will be summarized. Further potential trials involving the use of anti no-go based strategies and cellular based approach will also be briefly discussed.

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Assessing the Proof of Mechanism and Relevance to Functional Outcome

Armin Curt

Functional recovery after a lesion within the central nervous system (CNS) can be attributed to compensation, neuronal plasticity and regeneration. The relative impact of these mechanisms after a human spinal cord injury (SCI) should be distinguished when evaluating clinical and functional recovery in acute traumatic SCI subjects. Applying neurological (sensorimotor deficits), functional (activities of daily living and ambulatory capacity) and spinal conductivity (motor- and somato-sensory evoked potentials) measures during the course of acute SCI builds a framework to gain insights into the influence of these domains for clinical recovery. It could be shown in a prospective multi-center study (n=144) of the EMSCI study group that all complete SCI (cSCI) subjects improved in activities of daily living even when remaining completely paralysed. Incomplete SCI (iSCI) subjects showed a greater functional and neurological recovery compared to cSCI subjects. In both, cSCI and iSCI functional recovery was not related to an improvement of spinal conductivity as reflected in unchanged latencies of the evoked potentials. Consequently, compensation is significantly involved in functional recovery in both cSCI and iSCI. In line with animal studies, spinal conductivity of damaged spinal tracts remained unchanged. The greater functional recovery in iSCI is assumed to be mainly due to neuronal plasticity. Therefore, also in clinical trials the proof on concept should be one of the targets besides the interest in safety and efficacy.

Experiences with patient-relative seminar

M.M. Nefling, H. Aagaard

Background: In 2003 we developed a patient-relative-seminar at the Clinic for Spinal Cord Injuries, Rigshospitalet, Denmark for all our in-patients and their relatives in order to give them knowledge about the physical, psychological and social aspects of having a spinal cord injury. The overall goal is to support the patient (and relatives) in becoming experts in their new life-long situation and give them the opportunity to be responsible for their own rehabilitation.

Aim: The aim of this paper is to demonstrate the model we have developed in order to exchange knowledge and experiences with other spinal cord injury units.

Topics at the seminar:

- The rehabilitation
- Anatomy/physiology
- Bowl/bladder
- Spasticity
- Pain
- Psychological reactions
- Sexuality
- Pressure ulcers, prevention
- Aids and appliances for disabled
- The social security system
- Nutrition
- Physical activity
- Social activity
- What can “the Patient-organisation of SCI” offer.

Discussion: This kind of seminar is part of the rehabilitation at the Clinic for Spinal Cord Injury. It is an ongoing process to improve the seminar each time. We have been using evaluation questionnaires and interviews among the patients and relatives to develop the seminar.

Among others our goal in the future are to:

- Address the special needs of relative and develop a seminar for the relatives only.
- Use role models even more
- Collect experiences from other SCI-centres.

W30

Course in communication, identity, self perception and sexuality for physically challenged women

M. Morken, T. B. Mathiassen, Y. Dolonen, S. Tornaas, K. Saether

Course in communication, identity, self perception and sexuality for physically challenged women by the Coping and Learning Centre (CLC) at Sunnaas Hospital H. F.

Purpose: Contribute to awareness regarding communication of own situation. Maintain a healthy sexuality and increase sexual satisfaction. Focus on body image and self perceptions. Help to mobilize the individual's own resources. Peer support and learning from each others experiences.

Methods: The program was developed together with four participants from the Spinal Cord- and the Myelomeningocele Association, psychiatric nurse, psychologist and special pedagogue from CLC. Results from the evaluation are used to improve the seminar continuously.

Evaluation: The participants realised that they had the same complexes and fears as non physical challenged women. The course lasted one day, but all the participants suggested that we arranged it over two days instead, to have more time on each subject. All participants emphasised the value of meeting others with similar challenges. Helpful and interesting to discuss topics which usually are taboo and to get acquainted with different vibrators and others sexual devices.

Recommendations: Include new injuries. The group suggest that the course will last over two days and become an annual event. Also include a part about parenting.

Health promotion in spinal cord rehabilitation: A patient's education manual for the aging spinal cord population. A model

K Wahman, R Levi

Purpose: To decrease and/or delay the occurrence of age-related morbidity and mortality in persons with long-standing spinal cord injuries (SCI).

Methods: A patient education manual has been developed for this particular group of patients. The manual describes seven organ systems from the following perspective; the normal aging process; specific problems regarding the aging SCI population; especially notable symptoms; and self-care programs for avoiding and/or treating complications. The book also includes a strength-training and stretching program. Finally, one section deals with coping strategies related to the aging process. The manual can be used both in groups and for individual treatment. The manual is given to each patient in conjunction with a clinic visit for annual health-check-ups.

Results: The manual has been in use since October 2006. Thus, no systematic evaluation has yet been possible. Our primary impression, however, is that the manual facilitates patient education.

Conclusions: A new pedagogical tool has been developed focusing on age-related problems and secondary complications due to SCI.

Health promotion in spinal cord rehabilitation: “food, health and motivation” a new patient education module

A-C Lagerström, R Levi

Few health promotional programs aimed at persons with SCI are available, in spite of diet- and lifestyle associated problems in this group. Obesity, diabetes and cardiovascular disease, in particular, are widely reported to become increasingly prevalent among persons ageing with SCI. In addition to adverse metabolic effects, obesity increase musculoskeletal strain on the upper extremities and limits essential activities of daily living.

Purpose: To promote optimal nutrition and thus prevent and treat problems associated with improper diet.

Methods: A patient education module, “Food, health and motivation”, has been developed as a component of a health promotion program for persons with SCI. The module is based on modifications of nutritional recommendations for the general population, and includes methods for behavioural change. Within the module, discussions are encouraged.

Results: The program has been implemented in clinical practice at our centre since 2003. No systematic evaluation has yet been done but our impression is that the program facilitates beneficial behavioural change.

Conclusions: A new module for patient education and health promotion has been developed and will be presented.

Negotiating Identity. A Qualitative Study of How Spinal Cord Injury Patients recreate Meaning during

S. Angel

Purpose: to understand what makes the patient move on after a traumatic injury and how health professionals may support the patient in the rehabilitation process.

Background: most patients do get on with life, but for all it is a tremendous challenge.

Material and method: a longitudinal, qualitative design and is conducted within a Ricoeurian narrative tradition. The result build on data from one of the 12 persons we followed during the first year after a traumatic spinal cord injury, with field observations and repeated interviews, 6 times. Data is interpreted through an iterative process.

Findings:

- There seems to be a close connection between the negotiation of the patient's existential life and normal daily life experiences.
- Initially after the spinal cord injury the identity seems to be disturbed but still not changed
- The identity seems to be under pressure because of the need to conform to the social role

Conclusion: negotiating the identity seems to be a gradually process according to the social role of disabled where relationships to other people can be the pressure that initiates the loss of the known identity.

POSTERS

Metabolism, nutrition and obesity

Nutritional status among Spinal Cord Injured patients in Landspítali University Hospital

Ólöf Sigríður Indriðadóttir, Dóróthea Bergs, Ingibjörg Gunnarsdóttir

Purpose: The aim of this study was to investigate nutritional status among spinal cord injured inpatients and outpatients taking part in the follow-up program after discharge and to gather information on patients attitude towards nutrition.

Method: Nutritional status in SCI patients ($n = 9$) was evaluated using full nutritional assessment. Full nutritional assessment included measurements of weight and height (body mass index), serum albumin and prealbumin, total lymphocyte count, triceps skinfold thickness, mid-arm muscle circumference and area and information on weight changes (gain or loss). A weighted food record was performed for estimation of energy and nutrient intake. The Harris-Benedict equation was used to estimate basal energy expenditure. A questionnaire was used to collect data about food and food habits as well as attitude towards nutrition of spinal cord injured patients.

Results: Mean energy intake for inpatients was 1709 kcal/day, equal to -17,5% of basal energy expenditure, and 1415 kcal/day for outpatients, equal to -31,1% of basal energy expenditure. Six of nine patients resulted in weight gaining. The results show that even if excessive energy intake exists among patients their requirements for micronutrients and fiber still go unfulfilled.

Conclusion: Energy expenditure is highly overestimated and food consumption among participants is extensive compared to recommendations.

P2

An Audit of Lower Limb Amputation following Spinal Cord Injury

Dr. Allison Graham

Spinal cord patients share many risk factors with those with diabetes mellitus for foot morbidity. There has been widespread education given to those with diabetes regarding foot care but although skin care education is provided to those with SCI an increasing number were requiring amputation due to severe foot pathology. A retrospective review of the database from 1973–2003 was performed revealing 21 patients who had limb amputation. 24 amputations were performed in total, 19 patients had lower limbs amputated. male: female ratio was 16: 3.8 of the 24 amputations were performed within 1 month of onset of sci paralysis due to initial trauma or vascular insult at time of injury. 3 of the 19 patients had pre-existing diabetes mellitus at time of amputation. 7 patients were smokers. 12/19 patients had transfemoral amputations and 4/19 transtibial. All patients presented with infected necrotic ulceration of the skin. The epidemiology of amputation after SCI is different from the UK general amputee population. General health improved following amputation in the SCI group but 14/19 presented later with pressure ulceration including sacral sores. Further investigation of the peripheral vascular system is necessary to distinguish ulceration due solely to pressure or those secondary to acquired vascular disease. All new and review patients receive education specifically on footcare in addition to pressure relief management.

Cardiovascular diseases prevention in patients with Spinal Cord Injury

T. Erjavec, R. Šavrin

Aim: The aim of the study was to determine conventional risk factors for cardiovascular diseases in patients after spinal cord injury and to present a program of their prevention.

Methods and patients: The study included 103 subjects with spinal cord injury. The average age after injury was 18.5 years (6 to 33 years), 32% of them were women and 14.5% were tetraplegic. The average age was 48.6 years (23 to 77 years). Half-day workshops were organized in regional clubs of the Paraplegic Association of the Republic of Slovenia. The members learnt about the classic risk factors for cardiovascular diseases. Their blood pressure, blood glucose level and cholesterol level in the capillary blood were measured and the BMI was calculated. Smokers and non-active patients were registered. The ankle-brachial (AB) index was calculated in those subjects who had more than 20% risk of cardiovascular diseases in the following 10 years. The results were discussed and instructions on healthy lifestyle were given. The patients at risk were sent with the result to see their general practitioners for further treatment.

Results: In 47.2% of the subjects, the blood pressure was higher than 140/90 mmHg. About one half of them were hypertensive patients. In 18.9% of the subjects, the blood glucose level was within the range of disturbance of glucose metabolism; in 47.6%, the cholesterol level was higher than 5 mmol/l; 22.3% were smokers and 23% of them were regularly active. Out of the 73% of overweight patients, 21.5% had the BMI more than 30. Three or more risk factors threatened 20.9% of the subjects. In those, the AB index was calculated. In 53.8% the AB index was higher than 1.3; in and 15.4% the index was lower than 0.7.

Conclusions: The disturbances in glucose metabolism are the most common risk factors in subjects after spinal cord injury. The other parameters are similar to those in the general population of Slovenia. The present study group was also found to include a large percentage of overweight subjects. Diabetes mellitus is an independent risk factor for cardiovascular diseases; therefore special attention has to be paid to preventive activity. The authors also believe that healthy lifestyle with physical activity and healthy nutrition should be regularly included as one of the goals of rehabilitation programs.

P4

The Metabolic Syndrome (Disorders): Polytherapy Management Outcome In 92 Male Spinal injury Patients

S. Madan, H. Margaret, I. Perakash

In spinal injured persons due to muscle paralysis there is early onset of insulin resistance syndrome and type 2 Diabetes. In a special clinic in SCI service, patients were evaluated and managed to correct metabolic disorders with specific medications apart from life style change, diet and exercise. The objective being to prevent or delay atherosclerosis. Mean age of the patients was $60.3 \pm \text{years}$. They were all males. Average follow up was 43 ± 20.2 months

Results: Significant drop in total serum cholesterol, LDL, cholesterol/HDL ratio, triglycerides, Hb-A_{1c} (%), and significant rise in HDL were recorded.

Conclusions: SCI patients being at high risk for type 2 Diabetes and limited potential for exercise and higher incidence of smoking mandates an aggressive management with specific medications to normalise metabolic disorders and thus reduce the incidence of Diabetes and its secondary complications

P5

Serum Testosterone, Free Testosterone and 25 OH VitaminD3 Levels in Male Spinal Cord Injury Patients

B. Celik, B. Erhan, N. Caglar, B. Gunduz, N. Ince

The aim of the study was to evaluate the levels of testosterone, free testosterone, 25 OH vitamin D3 levels in male people with spinal cord injury (SCI) and their correlation with bone mineral density, bone markers and time since injury.

Sixteen male people with SCI (mean age \pm SD; 39.13 \pm 12.88) were included in the study. Medical history was taken and neurologic examination, ASIA-IMSOP evaluation, routine laboratory work were performed. Serum total testosterone, CTx, osteocalcin were measured by chemiluminescent microparticle immunoassay and free testosterone by radioimmunoassay.

The level of the injury was cervical in 50% (8 patients), thoracic in 31% (5 patients), lumbar in 19% (3 patients). Seven patients were classified as ASIA A, 1 as ASIA B, 7 as ASIA C and 1 as ASIA D Serum mean testosterone, free testosterone, 25 OH vitamin D3, CTx and osteocalcin levels were respectively 562 \pm 211.34 ng/dl (age-dependent normal value), 13.66 \pm 4.10pg/ml (12.00–30.00), 13.78 \pm 5.78ng/ml (10–40), 1.02 \pm 0.47ng/ml (0.01–6.00), 30.50 \pm 13.38ng/ml (age-dependent normal value). A significant negative correlation between 25 OH vitamin D3 and time since injury was found. ($p<0.05$) As the time since injury increases the concentration of 25 OH vitamin D3 in serum decreases.

In conclusion, long-standing SCI could be associated with decreased 25 OH vitamin D3 levels.

P6

Validation of the Turkish version of the Spinal Cord Independence Measure II

Kesiktaş N., Muslumanoglu L., Ozatalay G., Paker N., Sencan S., Issever H.

Although the Functional Independence Measure (FIM), the most often used disability scale in our country, studies reported that it has low sensitivity to changes in the functions. To counter this problem for our daily practice, we evaluated literatures and took permissions of developer of Spinal Cord Independence Measure II (SCIM-II). The present study examined the reliability and validity of the SCIM II in Turkish. SCIM II was translated into Turkish using forward-backward methodology. Two groups of patients (age range 18–50) were administered to the study. Twenty subjects with Spinal cord injuries (SCI) were interviewed and observed during the participation of a thesis for test-to-test reliability of SCIM II by a physician. 98 SCI were recruited of organizations and rehabilitation centers list and construct validity was tested by association with demographic and clinical characteristics and by fit of data to the Rasch model among these subjects. Correlations between SCIM II and FIM were documented. SCIM II was found reliable and valid. A high correlation was found between the total scores of the FIM and SCIM II ($p < 0.0001$). Adaptation of SCIM II in Turkish was found reliable and valid. Scale is suitable for routine clinical use in our culture.

POSTERS

Late Complications

Ageing with Spinal Cord injury Complications Identified

Firas Sarhan

It is important to define the characteristics of both natural and secondary ageing as an individual experience. the rate of functional decline in body systems due to ageing varies from one person to another, depending on genetics, level f injury, type of injury, life style, and general state of health

Methodology: retrospective study examining patients medical notes, records of 25 patients reviewed, data collected from medical records included: age, level f injury, type f injury, time since injury, complications of spinal cord injury which resulted in readmission to a spinal centre for further treatment and management

Results: several complications identified related to aging and spinal cord injury there problems could be categorised under the following headings complications of the musculoskeletal, gastrointestinal e. g. constipation, cardiovascular e. g. autonomic dysreflexia, respiratory e. g. chest infection, integumentary e. g. pressure ulcers, genitourinary e. g. urinary tract infections systems and psychological issues are identified.

Conclusions: it is important to outline that this study focused on the physical, medical changes and complications of aging with Spinal cord injury, further studies needed to examine changes to social roles, socioeconomic and personal support problems in order to demonstrate a fully comprehensive understanding of ageing and spinal cord injury

P8

Long-term Outcomes of Adults with Pediatric-onset Spinal Cord Injuries as a Function of Neurological

LC Vogel, CJ Anderson, KM Chlan, RR Betz, CM McDonald

Objectives: Identify adult outcomes of pediatric-onset SCI as a function of neurological impairment.

Design: Cross-sectional follow-up questionnaire

Participants/methods: Subjects sustained SCI at 18 years or younger, interviewed at age 24 years or older. A telephone interview included a structured questionnaire and standardized measures, including Craig Handicap Assessment and Reporting Technique (CHART), Short-Form 12 measure of perceived health quality of life, and the Satisfaction with Life Scale (SWLS).

Results: 353 participants, mean age of injury 14 years and mean age at interview 27 years (24–37); 64% male, 44% with paraplegia. Patients were grouped into 4 categories based on neurologic level and ASIA impairment score: C1-4 ABC (n=54), C5-8 ABC (n=123), T1-6 ABC (n=53), T7-L5 ABC (n=86). Significant differences were found among the groups for employment ($p=.016$), independent living ($p=.022$), and CHART subscales of physical independence ($p<.001$) and occupation ($p=.015$). SWLS scores trended toward significance ($p=.059$), with increasing satisfaction as severity decreased. Employment ranged from 46% in the C1-4 group to 70% in the paraplegia groups. Independent living ranged from 48% in the C1-4 group to 72% in the T7-L5 group. Two medical complications showed significant differences across groups: severe urinary tract infections ($p=.004$) and wrist pain ($p<.001$).

Conclusions: Adult outcomes of pediatric-onset SCI and their associated factors vary by neurological impairment.

P9

Effect of alendronate on bone mineral density in patients with Spinal Cord Injury: A 3 year prospective study

B Hansen, JEB Jensen, F Biering-Soerensen

Objective: To evaluate the effect of alendronate on bone mineral density (BMD) in chronic spinal cord injury (SCI) patients with an osteoporotic fracture.

Methods: 20 SCI patients with an osteoporotic fracture in the lower limb were enrolled. The patients started treatment with the bisphosphonate alendronate 10 mg/day and had a DXA scan at start, 1, 2 and 3 years after. BMD and Z-scores at the hip were measured.

Results: 12 patients completed the study for 2 years. They had an increase in Z-score, but with no significance (0.24 ± 0.44 , $p < 0.102$). There were an increase in BMD, femoral neck (0.02 ± 0.05 , $p < 0.183$), trochanter (0.008 ± 0.05 , $p < 0.56$) and Wards triangle (0.05 ± 0.09 , $p < 0.078$) 5 patients completed the study for 3 years. They had an increase in all measurements but without significance. Z-score, hip, (0.31 ± 0.45 , $p < 0.20$), BMD, femoral neck (0.02 ± 0.05 , $p < 0.39$), trochanter (0.02 ± 0.05 , $p < 0.44$) and Wards triangle (0.09 ± 0.13 , $p < 0.2$)

Conclusion: Treatment with alendronate increases the bone mass at the hip in patients with SCI and this indicates reduced fracture risk in the future.

P10

SCI – complications and consequences in daily living; changes over time in a regional population

H Forsaeus, L Granér, C Norrbrink Budh, P Åkerlund

Aim: To assess changes and consequences of spinal cord injury (SCI) over time.

Methods: A multidisciplinary interview based on a problem-inventory questionnaire was conducted 1997–98 with a follow-up beginning in March 2006. Sixty of eighty individuals with SCI injured between 1963 and 1996 living in the county of Dalarna participated in the 1997–1998 survey. Estimated number of participants in the follow-up is 46. The individuals were asked if they considered the complications and consequences in daily life caused by SCI as being a problem. The questionnaire included demographic data, vocational status, financial aid, arm/hand dysfunction, ADL-functional level, personal assistance, transportation, life satisfaction, other medical non-SCI-related diagnoses, etc. The interview resulted in a rehabilitation-plan for the individual. A detailed inventory of bladder, bowel and skin-management was added to the follow-up.

Results: Halfway through the present survey the collected data so far indicates that SCI can result in changes over a long time post-injury. For example; indication of an increase in reported problems with pressure sores and sexual dysfunction, while reported problems with spasticity and bowel dysfunction seem to have decreased, are noticed. The results and analysis/discussion of the complete survey will be presented in June 2007.

P11

Quality of life and emotional distress among SCI individuals

Ohry A, Heruti RJ

Introduction: Spinal Cord Injury (SCI) has significant impact on quality of life (QoL). The purpose of this study was to investigate the relations between QoL and emotional distress among spinal cord injured.

Methods: 55 male subjects with traumatic SCI filled questionnaires regarding QoL, emotional distress and social skills. We used LSQ, SCI QL-23, health questionnaire and SCL 90.

Results: 78.1% of participants reported of high QoL and 23.6% have even rated it with the highest grade – 100, whilst none graded it – 0. Decrease in sexual activity is a major cause for QoL decline. 80% do not suffer from depression or emotional distress. There was a negative correlation between the QoL and the severity of emotional distress ($p < 0.01$), and between physical and social activity, emotional distress and depression ($p < 0.01$). Positive health perception and satisfying social relations were found to have significant impact on the emotional status.

Conclusions: The amount of emotional distress and feeling of depression is expressed by the QoL questionnaire as well as in the emotional distress questionnaire. A significant correlation was observed between the physical and mental components. It is important to evaluate QoL and emotional distress measures among individuals with SCI and the provide appropriate support according to the findings.

P12

Computer & internet use by individuals post Spinal Cord Injury

AM Jette, N Goodman, BL Houlihan, S Williams

The Internet has the potential to become an important treatment method post Spinal Cord Injury (SCI). We studied computer and Internet usage by 2926 individuals, utilizing the US National Spinal Cord Injury Model Systems database. In 2004, information was added to the database on computer & Internet use. Results revealed that 69.2% of participants used a computer. Of users, 13.2% utilized assistive devices for computer access. Among computer users, 65% accessed the Internet. Of the Internet users, 47.5% used the Internet 5–7 days per week. The most frequent use for Internet was e-mail (58.8%) and shopping sites (42.7%), followed by health sites (39.7%), online games (29.3%), employment (24.9%), and chat rooms (10.0%). There was no statistically significant difference in Internet use by level of neurological injury ($p=.67$) nor by gender ($p=.15$). 72.4% of whites were Internet users, as compared to 39.8% of blacks ($p<.0001$). The percentage of registry members using the Internet significantly increased with education level ($p<.0001$): from 14.1% of people with up to 8th grade to over 90% among those with a college degree or above. We believe the Internet has considerable potential as a treatment tool to prevent and/or treat secondary conditions post SCI.

P13

Regular Follow-Up of Spinal Cord Injured individuals in Iceland

S. Gardarsdóttir, S. Knútsdóttir, M. Kjartansdóttir

Introduction: In the fall of 1999, a regular Follow-up for SCI individuals in Iceland was started at the Rehabilitation Department of Landspítali University Hospital. The purpose of the follow-up is to evaluate and treat complications and prevent them by advising the patients. The program lasts for 2 days where the patient is evaluated by a multidisciplinary team. A questionnaire developed by the Nordic Spinal Cord Injury Council is used in the evaluation.

Purpose: To evaluate the benefit of the Follow-up from 1999–2006 and what were the main problems found.

Subjects and methods: In 1999 letters were sent to all 99 individuals surviving traumatic SCI that were on the SCI register of the Rehabilitation Department and were living in Iceland, inviting them to participate in the Follow-up program. Seventy two individuals have participated in the program. A retrospective study design was used.

Results: The main problems found were: Pain, bladder and bowel problems, pressure sores, contractures, bad sitting postures and a need of new technical aids.

Conclusions: The Follow-up has shown its benefit by finding problems and preventing further complications. Most of the patients have expressed their satisfaction with the Follow-up and wanted to continue to come regularly.

The Value of Ultrasonographic Measurement in Compartment Neuropathy at Paraplegic Patients

Min-Cheol Joo, Moon-Young Lee, Se-Eung No, Tae-Jin Kim, Chung-Yong Yang, Yong-Il Shin

Objectives: The purpose of this study was to determine the relationship between the electrodiagnostic study and ultrasonographic findings of the upper extremity compartment neuropathy in spinal cord injured (SCI) patients.

Methods: Seventeen patients, thirty four hands with SCI below second thoracic cord level were evaluated. Patients with endocrine disease or peripheral polyneuropathy were excluded. Physical examination, electrodiagnostic study and ultrasonography were performed on both upper extremities. According to the electrodiagnostic study, patients were classified into neuropathic and non-neuropathic group. As ultrasonographic examination, median nerve was evaluated at wrist and ulnar nerve was evaluated at elbow level. The cross-sectional area of median nerve at the level of the pisiform bone of the proximal carpal tunnel were measured. We measured the ratio of the minimal and maximal diameter of ulnar nerve among the tip of medial epicondyle to the elbow joint level, proximal and distal two centimeters level from it. Between two groups, we compare the ultrasonographic finding, active daily living (ADL) time and pain rating scale.

Results: The mean age of the 17 patients were 44.1 ± 12.4 years, and mean duration of the SCI were 103.2 ± 74.5 months. According to the electrodiagnostic study, carpal tunnel syndrome was seen 7 patients, 9 extremities (41.8%) and ulnar nerve neuropathy at elbow level was seen 5 patients, 6 extremities (29.4%). In total, upper extremity compartment neuropathies were observed in 10 patients, 13 extremities (38.2%). There were significant difference between neuropathic and non-neuropathic group in ADL time (neuropathic: 3.1 ± 2.4 hrs, non-neuropathic: 7.43 ± 4.65 hrs, $p < 0.05$) and in pain rating scale (neuropathic: 4.1 ± 1.3 , non-neuropathic: 1.6 ± 1.5 , $p < 0.05$). A significant differences were found between the two groups in the ratio of the minimal and maximal diameter of ulnar nerve (neuropathic: $163.3 \pm 44.3\%$, non-neuropathic: $107.4 \pm 47.4\%$, $p < 0.05$) and in the cross-sectional area of the median nerve (neuropathic: $12.33 \pm 0.03 \text{ } \mu\text{m}^2$, non-neuropathic: $7.1 \pm 0.01 \text{ } \mu\text{m}^2$, $p < 0.05$).

Conclusions: The prevalence of carpal tunnel syndrome and ulnar neuropathy at elbow level at SCI patients were 41.8% and 29.4%. At neuropathic group, the pain rating scale was higher and ADL time was shorter than non-neuropathic group. Ultrasonography was useful screening test for the diagnosis of compartment neuropathy at spinal cord injured patients.

P15

The effect of acupuncture like TENS in the treatment neuropathic pain

E. Coskun, B. Erhan, B. Gunduz, E. Lakse

Objectives: The aim of the study was to investigate effect of acupuncture like low frequency Transcutaneous Electrical Nerve Stimulation (TENS) application for the treatment of neuropathic pain in spinal cord injured (SCI) patients.

Methods: 33 SCI patients with neuropathic pain, were included in the study. History, duration, localization and characteristics of the pain were recorded. Visual analogue scale (VAS) was used to investigate the effect of TENS 4 times during the day. All patients took only amitriptilin 10 mg/day for neuropathic pain. Patients were randomly assigned to study and control groups. Patients in study group were treated with 30 minutes acupuncture like TENS for 12 days while the others in the placebo group with sham TENS.

Results: The mean age of the patients was 36, $55 \pm 9,86$ years. Out of 33 patients 7 were tetraplegia and 26 were paraplegia. 23 patients were complete while 10 patients were incomplete injuries. Two groups were similar with respect to age, gender, duration, level or severity of injury. In low frequency TENS treatment group, a statistically meaningful decrease was observed at VAS values, however, such an effect was not evident in the control group. There were no evident side effects of TENS.

Conclusions: This study revealed that for treatment of neuropathic pain of SCI patients, Acupuncture like low frequency TENS application is effective.

P16

Chronic painful non-union of 9th and 10th RIB fractures: A case report

C. A. Thiyagarajan, D. Newton, M. Murali-Krishnan, A. Graham

We report an unusual cause of chronic musculoskeletal pain in a spinal cord injured man and the significant immediate pain relief achieved by surgical intervention. A 45 year old man who had a sudden onset of paraplegia of T9 ASIA A due to T8/T9 disc prolapse in 2004 complained of localized, constant pain in his innervated area of left lower thoracic ribs for the past 18 months. The pain was treated with NSAIDs, Opiates and intercostals nerve block. Pain relief with intercostal block was transient. A three dimensional CT of his thoracic cage revealed non union of 10th and 11th left ribs. Bone scan revealed solitary focal area of increased activity at the site of the 10th rib fracture. Pre-operative pain assessment with Visual Analogue Scale (VAS) was 8.5/10. Both un united fractured portion of the ribs were excised. One week and three weeks post-operatively, he scored "0" (no pain). Rib fractures unite with ease despite constant thoracic motion. Symptomatic non-union of a fractured 'typical' rib in spinal cord injured individuals has not been reported previously. Our patient did not respond to non-operative treatment and required surgical intervention to alleviate symptoms. We recommend excision of rib for symptomatic non-union of a 'typical' rib if non-operative measures fail.

The role of Magnetic Resonance Angiography in non-healing wounds after Spinal Cord Injury

Graham A, Uthappa V, Forde C.

Skin ulceration following SCI results in significant morbidity and mortality. An audit of patients requiring amputation of lower limbs as part of overall management of infected wounds revealed significant late-stage peripheral vascular disease. Could this be detected and treated earlier in this patient group to improve wound healing and avoid amputation. Magnetic Resonance imaging (MRI) is established for assessment of ulcers and Magnetic Resonance angiography is known to provide non-invasive, accurate and reliable evaluation of the arterial vasculature. Would this provide useful in the longterm SCI population and if so were any amenable to percutaneous transfemoral angioplasty? Patients were recruited for Magnetic resonance angiography if they had SCI of ASIA A-D, had pressure ulcer of Grade 3 or 4 (EPUAP Classification) non-healing with standard wound care management. 13 patients were recruited. 10 male: 3 female. The average age of the patients reviewed was 54.5 years (range 35–66 years). Length of time with SCI=23.5 years (range 4–46 years). 3 patients could not enter the MRI scanner due to pacemakers and contractures. 6 patients had significant vascular disease deemed amenable to angioplasty +/- stenting. 2 patients died prior to this being performed due to sepsis and coronary artery disease. 3 patients had angioplasty of (1) right iliac vessels, (2) superficial femoral artery and (3) right proximal popliteal- performed twice over 6 month interval. Improvement in wound healing was observed in all these cases with no further surgical intervention necessary. In 1 patient despite good initial technical dilatation of common iliac arteries he deteriorated with lower limb sepsis and required bilateral above knee amputation. In one patient no lesion amenable to angiography was seen on the leg with ulceration but posterior tibial artery occlusion was seen on the clinically normal leg. This small group identifies the need to be aware of peripheral vascular disease as an additional risk factor to pressure ulcer formation in SCI long term health problems and if considered early, angiography and angioplasty can be used to improve wound healing and salvage limbs.

P18

Pressure ulcer assessment instruments for the spinal cord unit: A review

F. W. van Asbeck, M. S. van Lis, M. W. Post

Study design: review.

Objectives: To examine which pressure ulcer assessment instrument is the best to use in a medical unit specialised in spinal cord injury rehabilitation.

Methods: Article retrieval with database PubMed until 2006. Inclusion criteria were: articles written in English, MeSH terms "pressure ulcer" AND "wound healing" OR "severity of illness index" OR "reproducibility of results" OR "sensitivity and specificity". We also included relevant articles from the literature list of the included articles. Exclusion criteria were: staging scales or articles without clinimetric properties of an instrument. The instruments described in more than one population were evaluated for their validity, reliability, clinical practicality and responsiveness.

Results: None of the 11 instruments we have found has been fully described regarding its clinimetric properties. Clinimetric information is most complete and promising for two surface measures: 'tracings with planimetry' and 'ruler length and width'.

Conclusions: Further study of the clinimetric properties of pressure ulcer assessment instruments must be done before the best instrument can be selected. So far, the 'ruler length and width' method appears most practical, although its feasibility to evaluate the healing process of stage III and IV pressure ulcers is unclear.

P19

Understanding and reproducing clinical improvement: video ethnography of a spinal pressure-area clinic

BB Lee, D Long & R Iedema

This paper presents an analysis of an outpatient multidisciplinary pressure area clinic which managed to reduce postoperative LOS from an average of 264 days to 56 days. In order to explain these clinical outcomes, video ethnography and anthropological review of clinic processes, physical space and communication channels was undertaken over a ten month period. This included filming of clinical interactions with anthropological observation and secondary ethnographic review of edited footage by a team of clinicians and social scientists. This project attempted to describe, understand and then suggest ways in which this successful program could be systematised in a sustainable manner. This paper will outline an ethnographic map of the clinic including interactions between the physical architecture and clinical, organizational and communication processes.

Iedema, R., Long, D., Forsyth, R., & Lee, BB. (2006). Visibilising Clinical Work: Video Ethnography in the Contemporary Hospital. *Health Sociology Review*, 15 (2).

Rectum perforation during transanal irrigation (TAI) – Case report

J. Bing, P. Berggreen, G. M. V. Olsen, F. Biering-Sørensen

19 years old contracted complete spinal cord lesion (T3, ASIA Impairment Scale A) after a traffic accident. Discharged in wheelchair independent with all daily activities, emptying her bowel voluntarily using oral laxative. Over years the emptying became more difficult and took more than two hours three times a week. She managed the procedure all by herself with reflex stimulation after the initial use of clysmas. At the age of 54 she wanted to try the Persteen Anal Irrigation system (Coloplast A/S, Kokkedal, Denmark). She went through the procedure with a nurse one time. The next time she performed the TAI by herself without difficulty, although she found blood on the irrigation catheter, which was thought to be due to her haemorrhoids. No other symptoms or signs. Two hours later she started shivering with a temperature at 38.3°C with normal BT. Anal inspection showed haemorrhoids with no visible blood prolapsing from the anus, but a spoonful fresh blood was found. She was started on oral ciprofloxacin. After two hours the temperature rose, BT fell to 65/45, and the pulse rate increased from 99/min. to 125/min. She was transferred to a gastroenterological surgical department. At rectal exploration the haemorrhoids and active bleeding from above was confirmed. Treatment with intravenous antibiotics was started, and an abdominal X-ray gave no suspicion of free air in the abdomen. Sigmoidoscopy showed the bleeding had stopped, and 3–5 cm oral to the dentate line a 1 x 1 cm transmural circular lesion was found. The following morning she was unaffected but a little tired. A colon X-ray with water contrast showed a perforation of approximately 2 x ½ cm, no further propagation of the lesion was found. The third day she could manage herself, and she was discharged on the sixth day on oral antibiotics. After this incidence she was not interested in using TAI and came back to her usual way of bowel emptying.

Conclusions: Even in experienced individuals who are properly trained, TAI can cause rectal perforation, which always have to be born in mind.

P21

The influence and the benefit of colonhydrotherapy (CHT) in patients with SCI

Ahoniemi Eija

Objective: To describe the influence and benefit of CHT among SCI-patients with severe faecal incontinence, constipation and abdominal pain. The problems of bowel dysfunction in SCI-patients have a marked impact on activities of daily living. Bowel dysfunction due to segmental delayed colonic transit.

Methods: The study included 10 tetraplegics and 9 paraplegics (4 female, 15 male, ASIA A13, B2, C2, D2). CHT was given in every second day 3–5 times for the patients, mostly 5 times. The single therapy time was 45 minutes. Subjective data collected 2–4 months after therapy through structured telephone interview including general problems of bowel function, methods of defecation and toileting.

Results: Of these 19 SCI patients, 17 were interviewed. Eleven patients had abdominal pain releasing, decreased constipation and better subjective satisfaction. The positive effect of CHT lasted 2–6 months. CHT did not effect on the toileting procedure, use of laxatives or bowel evacuation management. Six patients did not notice any effect due to CHT.

Conclusion: Clinical consideration from this study is valuable and useful, but further investigation is needed in this field.

P22

Is transanal irrigation really effective in congenital as acquired spinal cord lesions?

G. Mosiello, M. Lamartina, C. Pilati, T. Redaelli, F. Battaglini, P. Buffa, G. Lamberti, M. DeGennaro

Introduction: Patients with spinal cord lesions (SCL) have commonly neurogenic bowel dysfunction (NBD). Transanal irrigation (TI) demonstrated to be effective in adult patients with SCL mainly for faecal incontinence. This study was realized to evaluate the effects of TI on Quality of life (QoL) and NBD symptoms in adults with SB vs SCL. Material and methods 12 SB patients with severe NBD (Group A), mean age 22.6 years were enrolled in this multicentric study: As control group we considered 14 traumatic spinal cord injury (SCI) patients, mean age 35.3 years (Group B). The lesions were sensory complete respectively in 75% (A) and 92,9% (B), mobility impaired in 41.7% (A) and 100% (B), hands functionality was normal in all. Constipation was the most predominant symptom. TI was performed using (TI) Peristeen system (Coloplast A/S, Denmark). All patients were evaluated, before and after 3 weeks treatment, using a questionnaire too.

Results: Symptoms during and after evacuation, leakage or incontinence ameliorated in 66.5% and 64.2% respectively, QOL was referred as improved by 75% and 57.1%.

Conclusions: TI has same effectiveness in patients with SB and SCI reducing symptoms NBD and improving QOL.

P23

Risk factors for and outcomes of PCNL in spinal cord injured patients

J Reynard, P Cheetham, S Beuker, T Meagher, R Bodley

From 1988–2006 we carried out 71 PCNLs (percutaneous nephrolithotomies) in 58 spinal cord injured patients. Mean age was 55 years (range 22–80); 38 (65%) paraplegics; 98% Frankel A; 43 males (75%). 78% of patients were managed by a single method of bladder management. 22% changed bladder management at some stage post-injury. No patient was managed by ISC (intermittent self catheterisation) over the long-term. 13 patients (22%) required redo-PCNL, on average 5.5 years after first PCNL. Of these 11 (85%) were managed over the long-term by suprapubic catheterisation and 2 without. This compares with 23 of 45 patients (51%) not requiring redo-PCNL. Risk of stone formation necessitating PCNL relative to bladder management method is difficult to determine with this dataset, partly because of variable methods of bladder management in a proportion of patients and because of difficulty in determining method of bladder management in SCI patients not requiring PCNL. However, risk of requiring redo PCNL seems to be greater in those patients managed by long-term suprapubic catheterisation. This may relate to chronic bacterial colonisation of the urinary tract in the chronically catheterised patient. ISC may protect against the development of upper tract stone disease requiring PCNL.

P24

Spinal Cord Injury (SCI) – the follow up problem of kidney function

P Åkerlund, L Larsson, L Granér

Aim: To find laboratory follow-up-methods of kidney function in an SCI-population – methods that are easy and still good enough.

Background: The follow up of the miction and the kidney function is important in SCI-patients. The paralysis gives both miction problems, risk of reflux and risk of urinary tract infections. Some clearance- and X-ray methods are also bothersome for the patients.

Method: Serum cystatin C is a new marker of glomerular filtration rate (GFR) independent of muscle mass and gender, for which S-creatinine is dependent. In a SCIpopulation we have especially compared S-kreatinine and Cystatine-C, which both are easy analysed. We have compared these methods to iohexol-clearance, GFR and renogram-data. Preliminary data indicates that serum Cystatine C is a better marker then S-creatinine. Cystatine C is good enough in routine follow up if GFR >25–30. We will discuss the usefulness of these different methods.

Renal function as judged from GFR and IPV in SCI patients

O. Jonsson, P. Asplund, A. -K. Karlsson, K. Pettersson, I. Berrum Svennung

Previously renal failure was the leading cause of death in SCI patients. With a good treatment of the urinary tract including proper emptying regimes the incidence of renal failure is today very low. In our SCI unit we have performed a structured follow-up programme for more than 20 years including cystometry, intravenous pyelography and glomerular filtration rate (GFR) estimation by chrom-EDTA or iohexol clearance. We here report our results concerning renal function.

Patients: 165 consecutive patients with spinal cord injury were examined with respect to the upper urinary tract within 6 months after damage. A second and a third examination were performed 12 and 24 months after damage. At first examination 71 patients had cervical lesions, 60 thoracic and 34 lumbal and sacral lesions. The corresponding figures after one and two years were 42, 40, 18 and 20, 29, 7 respectively.

Results: GFR in the whole group was significantly lower than expected at first measurement. At second investigation the GFR had increased and was close to the age-correlated expected value. GFR was significantly better in the thoracic and lumbal and sacral groups compared to the cervical group. With respect to the bladder emptying regimen patients performing CIC had increased GFR at follow-up compared to the initial values. A similar change was not noticed in patients with an indwelling catheter although this group was considerably smaller. IVP revealed stones in 5–6% of the patients at all examinations. Four patients got new stones between the first and second examination.

Conclusions: Kidney function is well preserved in all groups but significantly lower in the cervical group. The incidence of stones is somewhat higher than expected.

P26

Charcot Spine: a diagnostic challenge

D'Andrea M., Werhagen L., Aito S.

Charcot's joint of the spine is a condition that affects the intervertebral disc and vertebral bodies in patients with different types of neurological lesions (post-traumatic spinal cord injury, spinal tumors, neurosyphilis, diabetic neuropathy). The loss of deep sensation causes mechanical degeneration of the joint due to the failure of protective mechanisms. Seven cases of Charcot spinal arthropathy in patients with complete (five patients were classified as ASIA A) and incomplete (two patients were classified as ASIA B) post-traumatic SCI are presented. All subjects were males and the age, at the time of diagnosis, ranged from 50 to 76y. One suffered from tetraplegia and six from paraplegia. The time interval between the spinal cord trauma and the diagnosis of neuropathic arthropathy was 10 months to 54 years. The most frequent symptoms were cracking during mobilization, pain, kyphosis and increased spasticity. The neuropathic arthropathy involved the thoracic spine in two patients, the thoracolumbar spine in two patients and lumbar spine in three patients. Two arthropathies were localized at the end of an area of surgical arthrodesis (junctional syndrome) and two arthropathies developed as a consequence of prior extensive laminectomy. 6 patients were initially diagnosed having spondylodiskitis. Closed biopsies were performed in three patients and open biopsy in one instance: no infectious agents were isolated. In one patient there was a bursal cavity of soft tissue that communicated to a synovial cavity in the intervertebral disc space involved in the destructive condition. It's mandatory to differentiate this condition from spinal tumor or infection before performing medical or surgical treatment.

Charcot spine after spinal cord injury. case report and review of the literature

B Perrouin-Verbe, A Stefan, J Rome, JF Mathé

The authors reported the case of a 50 year-old female who sustained in 2000 a C8 spinal injury (ASIA A) following spine arthrodesis (for T1 to L3) for a thoraco-lumbar scoliosis. In 2002, an intrathecal baclofen pump was implanted for spasticity and the bladder management was clean intermittent catheterization associated with anticholinergics drugs (bladder overactivity). In 2003, the ocurens of a lumbar kyphosis and grinding noise during transfers lead to the performing of spine X-Rays showing bone resorption of the vertebral end-plates of L5. Laboratory findings, CT scan, bone biopsy revealed osteonecrosis and eliminated tumoral or infection cause. The diagnosis of Charcot joint of the spine was evoked and a follow-up was decided. In 2004, incontinence by sphincter insufficiency (cauda equina syndrom), difficulty in maintaining sitting balance and transfers occurred. Spine X-Rays showed an osteolysis of vertebrae L4 and L5, and a subluxation between the lumbar and sacral spine. A surgical treatment was decided, it was performed by anterior and posterior approach. Charcot Spine, a neuropathic spinal arthropathy is a late complication of spinal cord injury, commonly in the complete thoracic paraplegia. Symptoms includes cracking, pain, deformity, loss of spasticity, neurological change. Repeated motion of the joint in insensitive area leads to disk degeneration and destruction of the facet and bone. The diagnosis is radiological: osteolysis, pseudarthrosis, luxation and the treatment: Immobilization, surgical fusion and fixation +/- immobilization, follow-up. Without treatment the issue can be serious, the prognosis is mainly functional, particularly the urinary function. To avoid Charcot spine, early diagnosis and surgical treatment are necessary. That emphasises the necessity of a systematic follow-up in spinal injury people.

Standaert C, Cardenas DD, Anderson P. Charcot spine a late complication of traumatic spinal cord injury. Arch. Phys. Med. Rehabil. 1997, 78 (2): 221–5.

P28

Limb amputation due to pressure ulcers in Spinal Cord Injured patients

G. Correa Illanes, W. Calderon, L. Burnier, S. Danilla, R. Roa, L. Guzman

Objectives: To describe the course of 5 Spinal Cord Injury (SCI) patients who underwent proximal amputation of the inferior extremity, secondary to recurrent, complicated pressure ulcers (PU) and the clinical impact this intervention had in these patients.

Methods: Revision of 5 clinical cases of patients who underwent partial hemipelvectomy or hip disarticulation with amputation of the extremity as treatment for pelvic recurrent PU with chronic secondary osteomyelitis. The clinical impact was quantified as days of hospital stay, number of surgeries and previous and post surgery PUs.

Results: After the proximal amputation of the extremity, patients significantly decreased number of days of hospital stay ($p=0.035$), number of surgeries ($p=0.015$) and PUs ($p=0.0065$).

Conclusions: Partial hemipelvectomy and hip disarticulation with proximal amputation of the inferior extremity are rescue procedures that can be last resource treatment for chronic recurrent pelvic pressure ulcers secondary to chronic osteomyelitis.

P29

Study to look at the ability to re-inflate the chronically collapsed lung in patients with SCI

A. Prasad, A. Jamous

Objectives: Respiratory complications are a major cause of morbidity and mortality following spinal cord injuries (SCI). This is mainly from paralysis of the intercostal and abdominal muscles, which impairs cough efficacy and promotes secretion retention, increasing the risk of lobar collapse. The aim of this study is to evaluate the efficacy of a set protocol to reinflate chronically collapsed lung lobe.

Design: A prospective study in a SCI service.

Participants/Methods: 5 tetraplegic (C4-C7) patients with lower lobe collapse of greater than 6 months. The patients underwent a set protocol involving bronchoscopy to remove secretions, instillation of N-acetylcysteine into the collapsed lobe and intensive chest physiotherapy followed by continuous positive pressure ventilation. Outcome measures used were changes in CXR, spirometry and inflammatory markers.

Results: CXRs done 7 days post protocol showed an improvement in 3 patients, however none showed complete resolution. Spirometry revealed a significant change of forced expiratory volume in one second (FEV1) and forced vital capacity (FVC) from 0.8litres (l) and 1.2l to 1.1l and 1.5 respectively in one patient but no significant change in the other 4 patients. There was no significant change in C- reactive protein post procedure.

Conclusions: This study suggests that it may be possible to reinflate chronically collapsed lungs with an intensive regimen, thereby reducing long term morbidity. However, the number of patients undergoing the set protocol is small and more patients would need to be enrolled to give meaningful conclusions. This is an ongoing study.

P30

Heterotopic calcification in Spinal Cord Injury: Case report

I Veiros, M. Bartolo, S. Santos, L Martins, F Martins

Introduction: Heterotopic ossification (HO) is a frequent complication of spinal cord injury (SCI), which is often difficult to treat. Reported incidence varies from 10 to 53%. It is characterized by formation of ectopic bone in soft tissues surrounding joints. Although the exact pathophysiology underlying HO is not completely understood, different mechanisms have been proposed.

Objectives: A 24-year-old man with complete paraplegia (ASIA A-T6 sensitive level and high thoracic motor level) was sent to the SCI consultation at the Centro Hospitalar de Coimbra (CHC), two years and ten months post injury. He complained about right hip limited range of motion, and a conventional hip radiograph was taken. The authors present this case report and a literature review.

Methods: The literature review was made based at a Medline search and the case report achieved with a retrospective analysis of the patient clinical process.

Conclusions: Although HO is frequent in SCI patients, there is not yet any effective prevention. Nevertheless, the early diagnosis may enhance a more aggressive and effective treatment.

POSTERS

Coping strategies and impact of SCI on the family

P31

Robotized orthotic system to assist/rehabilitate standing&walk in paralyzed patients and elderly

G. Onose, V. Cardei, A. V. Ciurea, A. Anghelescu, L. Onose, T. S. Craciunoiu, E. Visileanu, G. Epureanu

Severe impairments of orthostatism and walk generate most important disabilities. A direction in robotic bionics is to design: sensing / encoding / translating devices, able to translate the remaining movements of the assisted person – including within the pelvic region – into informatics language, appropriate for mechanic-cybernetic actuating systems, resulting in cutting-edge, (robotic) human-machine interaction based possibilities, to functional assist / rehabilitate standing and gait in paralyzed – mostly post SCI – patients and severe poli-disabled old people. Our consortial, multidisciplinary team – through a National excellence grant – completed 11 research / design themes and is already building-up the components of a mechatronic orthotic device. Compared to similar projects, we have several original contributions – to yet unsolved problems at an international level – concerning this sort of device, mainly: smaller components (especially the actuators), elastic systems – for own weight's compensation – a new modality to recharge the batteries, a semiautonomous system to protect lymphatic return circulation in lower limbs. Complete assembly and first tests are scheduled for next year.

P32

Initiation of a national informatic network for the dynamic clustering of the patients with Spinal Cord Injury, dedicated to the improvement of the quality of life, in the aim of efficientisation of the specific medico-social services, in transition – Preliminary data

Gelu Onose, Aurelian Anghelescu, Doina Georgescu, Anca Sanda Mihaescu, Constantin Mardare, Av Ciurea, Florin Exergian, Epureanu Gratiela, Ionescu Alexandru, Baluta Cornel, Onose Liliana, Ioanid Ramona, Nicolau Cristi

Study design: presentation of the preliminary data of the National project mentioned in the title (acronym RISCII), fulfilled in a multidisciplinary consortium.

Objective: realization of a virtual database and network structure using the modern reporting technologies, in the aim to facilitate communication, co-operation and partnership between hospitals, universities, or/and medical research centers, rehabilitation sanatoriums, spas, public institutions with social function, structures of the civil society, economic agents.

Materials: description of the preliminary steps.

Conclusions: The project will ensure effective management interventions, adequate supply of human (and material resources), allow interpersonal communication between patients and specialists, improve infrastructures, all focused on a better SCI prevention, treatment and social reintegration.

The database and network will serve for the achievement of the Romanian SCI Society and a National SCI register.

We prognosticate an important impact upon the improvement of the quality and performance of the services offered by the Romanian medical health and social systems, in transition to a European level of quality.

P33

Empowerment through control over assistive technology: An online database of and for persons with Spinal Cord Injury (SCI)

D. Riedel, E. Lagerkrans

The provision of suitable assistive technology is an important part of the rehabilitation of people with SCI. Assistive technology provided by Swedish local governments is limited and often not adapted to the individual user. Many persons with SCI have become experts on their own disabilities and very often they design their own devices. They either use standard technical aids or devices intended for use by the general population in their individual way, modify them for their own needs or design their solutions from scratch.

Examples for such user ingenuity are documented in an online database including photos, descriptions and comments of the user. The database promotes peer support and empowerment and highlights disabled people as a resource.

Another target group are Occupational Therapists for whom the database can be a source for new ideas, a forum to present, share and discuss solutions in the area of assistive technology and special adaptations.

The database is online since April 2006 at www.spinalis.se/tips and is updated continuously. It is run by Spinalis Foundation and supported by the Swedish Inheritance Fund (Allmänna Arvsfonden).

P34

Psychological adjustment of patients with Spinal Cord Injuries

B Erhan, B Gunduz, R Hayran, AN Bardak, S Borici, S Baran

Objectives: To determine the psychological adjustment in patients with spinal cord injuries (SCI).

Methods: Fifty patients (14 female, 36 male) were recruited in the study. All the patients were evaluated with respect to education and marital status, duration of injury, level of injury and ASIA Neurological Standards. Symptom Check Lists, SCL 90 was used to screen the psychological status of the patients.

Results: The mean age of the patients was $36,04 \pm 12,27$ years. Median value of the duration of the injury was 10 months. Level of the injury was cervical in 11 patients, above T6 in 13 patients and below T6 in 26 patients. There was no correlation with age, educational and marital status, duration of injury and SCL 90 scores.

Among the subgroups of SCL-90, interpersonal sensitivity was found to be significant in patients with a level of injury above T6. In female patients somatization, anxiety, obsessive compulsive scores were significantly higher than male patients. Also in patients who were unemployed before the injury obsessive compulsive scores were significantly higher.

Conclusions: Spinal cord injuries are serious events that have catastrophic effects on patients' and families lives. We conclude that rehabilitation teams should be more alert when dealing with high paraplegic patients because they can be more demanding and reactive.

P35

Does a group psycho-educational-treatment change the coping strategies?

I. Giorgi, G. Fizzotti, M. Manera, M. Marchioni, C. Pistarini.

Many studies in the literature have documented the efficacy of the cognitive behavioural programs based on the Lazarus and Folkman's stress and coping model.

Objectives: the aim of our clinical study is to evaluate the efficacy of this treatment method in patients with spinal cord injury.

Methods: 18 patients were evaluated (12 men and 6 women). The mean age was 50 \pm 15,7. All of patients have participated in nine psycho-therapeutical meetings aimed at speaking about their physical, psychological or relations problems in order to enhance their awareness about disability. At the start and at the end of the treatment the patients filled the Beck Depression (BDI) and the Cope Inventories.

Results at the end of the treatment the mean score of BDI is significantly lower (9,83/ 6,67 $p < 0.05$). This means an improvement of the emotional status. As to Cope, the "Humor" mean score shows a significative enhancement (6.5/8.5 $p < 0.05$). Conclusions the preliminary results agree with literature (Kennedy, 2003) and suggest to further exploit this method in the rehabilitative treatment of the patients with spinal cord injury.

P36

Nurses' Experience in psychological care of patients with spinal cord injury

Firas Sarhan

Following Spinal Cord Injury, patients are faced with the challenge of coping and adjusting with their injury. The psychological aspects of sustaining SCI can be as difficult to adjust to as they physical aspect.

Aim: to identify the role of nurses in the psychological care of patients with spinal injury, identify the needs of nurses delivering the psychological care

Methodology: questionnaire distributed to 25 nurses asking them to identify their role in psychological care and identify their needs in order to deliver effective psychological care

Results: nurses able to identify that they need to have a creator role in assessing patients psychologically to identify key issues re patient understanding of injury and its impact, need more time and privacy in delivering the psychological care is needed, the need for training to care for patients psychologically, finally nurses identified the importance of referring patients for psychological help by psychologists at early stage of injury.

Conclusions: the delivery of psychological care is difficult and challenging to nurse therefore it is important that nurses are aware of the psychological impact of SCI and receive appropriate training and education to deliver an effective and structured psychological care

P37

Nurses' Experiences of Working with Spinal Patients

Firas Sarhan

Caring for Spinal cord injury(SCI) patients could present a challenge for nurses and other health care professionals involved, therefore working and caring for SCI patients requires careful and comprehensive planning, during the acute and rehabilitative phases in order to prevent complications and maximise independence post injury The aim of this study was to identify the issues relating to nursing care of SCI patients and identify nurses' experience of caring for SCI Patients Methodology: 20 questionnaires distributed to staff nurses working with spinal patients at acute and rehabilitative wards, nurses were asked seven questions relating their experience of working with spinal cord injury patients Results: The analysis of questionnaires data identified that issues such as documentation, education and in service training, communications, implementations of protocols and policies related to caring for patients with spinal cord injury, standard procedures, need of equipments, care pathways and Education of patients and relative. Conclusion: this study identified the needs of nurses who work with Spinal Cord Injury patients and the need to address the key issues identified in order to enhance and develop appropriate training and further education in order to enhance and develop services for patients with spinal cord injury so quality care being delivered at all times.

P38

Rehabilitation follow up – can we minimise the disruption to family and school life?

A Graham, F O'Donnell, K Hart, S. 'Oshea

Children with spinal cord injury have ongoing rehabilitation and medical needs throughout their growth and into adulthood. Not all functional aspects of rehabilitation can be taught in one episode of care as growth affects cognitive and physical abilities. In 2004, the NSIC, developed an inpatient childrens rehabilitation programme to improve and streamline the inpatient care of children with SCI to reduce delay from time of injury to admission and shorten the initial rehabilitation phase and return the child to their own family and community earlier. It was noted on parents satisfaction survey that for returning review children for many parents requested increasingly shorter admission periods to reduce school absences and time away from family. A retrospective review of the casenotes of the children was performed to identify the number of health professionals involved in the follow up of the children, the frequency of follow up with these professionals and an attempt was made to identify areas of service overlap. Children with non-traumatic onset of SCI had greater numbers of medical professional input from wide geographical areas than traumatic injured children. More therapy overlap occurred in tetraplegic children. Many areas of overlap were identified including management of bladder follow up, multiple orthotic referrals, posture and seating clinics while psychological review was absent from many children. To improve the ongoing service new methods of working including multidisciplinary day case reviews eg for physiotherapy, occupational therapy and botulinum toxin therapy have been developed. Improved shared documentation and patient held notes has been implemented.

P39

Mothers w/SCI – adjustment, technical aids and assistance needed in pregnancy and after delivery

G. Aune

Background: There is often a need to adjust the environment and provide technical aids when women with SCI become pregnant, and also after delivery.

Purpose: The purpose of this study is to investigate the effects SCI has on pregnancy, related to these women's need for technical aids and environmental adjustments before and after delivery.

Methods: Internet was used to search for relevant scientific studies or client-centred publications. A systematic literature search in Cochrane library, Embase, CINAHL, Medline and Pubmed was conducted.

Mesh terms: Women – Spinal Cord Injury – Sexuality – Fertility – Pregnancy – Delivery – Technical aids – Environment.

Clinical work has given the opportunity to learn more from these women's experiences.

Results: Preliminary results from Internet indicate that there are some studies related to pregnant women with SCI and their medical needs. However, there are few studies related to the needs for assistance and technical aids. The literature found on this topic are published as books and articles, describing how wheelchair using parents adjust their surroundings in order to take care of children. The mothers' experiences indicate that OTs need more knowledge about the effects SCI has on pregnancy to find practical arrangements before and after delivery.

P40

Psychosocial Morbidity in SCI patients

SL Yadav, D Borah, U Singh, V Sindhu, AK Gupta

Design: Cross-sectional retrospective study.

Objectives: To study the impact of SCI on the psychosocial aspects on the affected person's life. To assess the influence of premorbid psychosocial condition, level of injury, medical and social care on the psychosocial outcomes of SCI patients.

Setting: Department of Physical Medicine & Rehabilitation, All India Institute of Medical Sciences, New Delhi, a tertiary care hospital.

Methods: SCI patients of different levels and of at least 6 months duration attending PMR department were included in the study. All the patients were examined clinically. A psychosocial evaluational questionnaire (indigenously developed specifically for this study) was completed involving the patient and the spouse or guardian after obtaining consent from both. The data were analyzed statistically and interpreted.

Results: Patient's age, sex, educational level, marital status, socioeconomic status, level of injury, nature of family support, nature of support from society, promptness of initiation of rehabilitation strategies, all were found to have an influence on the psychosocial aspects of patients with SCI.

Conclusions: Spinal cord injury is a major health accident in one's life. It is not just an injury to the body; it also results in significant changes in all aspects of the patient's life including the psychosocial aspects. Early rehabilitation intervention, measures for prevention of complications, good social and family support can minimize these changes and help in social integration and productivity of the patient.

Environmental Control Unit (ECU) use in cervical spinal cord injured (SCI) patients in the North Thames region

S N Paul, A Woodcock, R S Hanspal

High level SCI can have a devastating effect on both patients and their relatives. Impairment of cervical cord function results in tetraplegia and the use of an environmental control unit (ECU) may be extremely valuable in regaining as much independence as possible. Despite this, there are scant publications surrounding the use of ECUs in this population. The purpose of this exploratory study was to analyse the basic demography, utilization of and satisfaction with ECUs in the spinal cord injured population within a regional setting. The North Thames Regional Environmental Control Equipment Service database was interrogated to identify all users with cervical SCI. An independent assessor used available data and conducted standardized telephone interviews between August and Oct 2006. Sixty users were available (giving a 'response rate' of 85%). Eighty percent were male. Thirty-seven injuries were complete with the majority of SCI of traumatic origin. Mean age at interview was 47 years. Mean age at provision was 42 years. The users were left alone in their own room for a mean of 5.4 hours/day. Seventy-eight percent said having an ECU had decreased dependency on carers. The mean number of devices controlled via an ECU was 8.4. Seven users were engaged in full or part time charity work, one user was at university, six users were in full time paid employment. Users most valued TV and telephone control. All the subjects were using their systems, but 40% were not using one or more parts – most commonly the telephones as these were substituted for mobile phones. Twenty-six percent had used their ECU to summon emergency help. Eighty-three percent of users were satisfied with the ECU system. Seventy-five percent were satisfied with ECU service. This study has demonstrated reduced levels of perceived dependency, high levels of user satisfaction with the regional ECU service and systems themselves, and continued utilization post installation. Telephone and television control appear to be particularly important in this population. ECUs may enable this group to work and learn in adult life. Further work is needed to improve levels of user satisfaction and also highlight the impact of ECUs on carers themselves.

P42

Permanent dependence on others during meals. a phenomenological study of patients' experiences

I. Harder, F. Biering-Soerensen

Purpose: To investigate how people with a traumatic spinal cord injury (SCI) experience being helped by other persons during meals.

Material and Methods: Semi structured interviews in 16 informants three times within the first 18 months of the study. Between every round of interviews the transcripts shall be analysed according to the reflective lifeworld approach described by Dahlberg et al. (2001). The goal of the analysis is to describe the essential structure of the phenomena and its meanings.

Current findings: At time of writing the second round of interviews is finished. The preliminary findings suggest that the enjoyment of eating and drinking decreases when an individual has to rely on help from others. Furthermore the number of meals are reduced, especially the spontaneous meals. The participants appreciate when they and their helpers eat simultaneously. When eating in public places the participants struggle not to attract unnecessary attention.

Conclusion: Living with permanent dependency during meals seems to place the participants in a vulnerable situation. By verbalizing their needs there is a risk that the meal becomes more of a technical task than a time for pleasure.

Dahlberg K., Drew N., Nyström M. (2001) Reflective Life Lifeworld Research. Lund: Studentlitteratur.

P43

Empowerment of family members by support seminars

S. Korhonen, R. Rajala, E. Ahoniemi

The spouse and other family members are the key persons for many persons with SCI being a primary source of physical as well as emotional support. Family caregivers have to deal with possible negative psychological consequences of SCI like depression and aggressive behaviour. A caregiver have to adapt to the new circumstances, modify preinjury lifestyle and move forward one step at a time. In our centre we annually take care of 55 patients with subacute traumatic SCI. During recent 12 years usually one or two family members of each patient have taken part of organised support seminars. Those seminars arranged by multidisciplinary team of two days have been arranged several times per year with groups comprising 15–20 family members. The feedback of the seminars have revealed that the most important contents of the program have been common pathophysiological consequences of SCI and appropriate medication, practical hand-by-hand advice and counselling for caregiver learning to live with the SCI, and just pure comforting. In our program the family members of peer-patients play a great role collaborating the staff. Our experience is that organised support seminars may decrease partners risk for burnout and keep caregiver burden within acceptable limits.

P44

Tele-rehabilitation with SCI people: effects on quality of life and degree of functional independence

S. China, A.M. Cresciulli, D. Monducci, G. Ferrara, R. Pederzini, G. Bazzocchi, P. Pillastrini, M. Menarini

Study design: Randomized Controlled Trial Objectives: to evaluate the efficacy of telemedicine to improve the degree of independence and the quality of life of patients and their caregivers.

Settings: subjects discharged from the Spinal Cord Unit of Montecatone Rehabilitation Institute (Imola, Italy).

Participants: 60 patients with acute non progressive spinal cord injury between C4 and L2, back at home.

Methods: Patients were divided into experimental and control groups. Both groups underwent standard post-discharge support from Montecatone Rehabilitation Institute, but in addition the trial group received a weekly videoconference session, alternating between a medical/nursing protocol and a physiotherapy one. Protocol included tests as FIM, SCIM, WHOQOL100 and HADS. Sessions were attended by patients and their caregivers.

Results: In two years, 60 patients were recruited, 4 patients were withdrawn from the study. Sessions continued for 6 months. Comparison of the trial and control groups' showed an increase of the degree of functional independence and quality of life of patients and their caregivers. Moreover the trial group showed less post-discharge complications.

Conclusion: Tele-rehabilitation may facilitate the continuum of post-acute care to non clinical settings and may become a common practice to follow up outpatients.

POSTERS

Functional Electrical Stimulation

P45

Suppression of anal sphincter activation during sacral root stimulation in Göttingen minipigs

F Møller, N Rijkhoff, S Buntzen, S Laurberg

Introduction: In neurological impairment electrically induced defecation is an alternative approach when conventional treatment fails. We investigated the feasibility of activating fibres in the sacral roots innervating the rectum, without activating fibres to the anal sphincter using an implantable stimulator.

Methods: The anterior sacral roots S2 were implanted unilaterally with tripolar electrodes in ten minipigs. A laboratory stimulator and a custom made implantable stimulator were used. The effects of pulse trains from the laboratory stimulator (250µs and 600µs) were compared with 427µs pulses from the implant. All pulses were rectangular shaped at 15Hz, in trains of 5s. Anal and rectal pressures were recorded. In five animals, rectal evacuation was recorded with artificial faecal material.

Results: Blocking of sphincter activation with average 88 percent was achieved in 8 animals with long pulses from the laboratory stimulator (600µs) and the implant (427µs) without impeding evoked rectal response. The minimum current for maximum sphincter suppression and maximal rectal response was 0.9mA for both stimulators. Defecation occurred during stimulation with long pulses and as "post stimulus defecation" using short pulses.

Conclusions: An implant exist that selectively can activate the sacral anterior roots. This may provide a viable means of rectal evacuation in neurological impairment.

P46

The use of Surface Electrical Stimulation (SES) to Enhance Cough in Spinal Cord Injured (SCI)

JE Butler, J Lim, RB. Gorman, JP. Saboisky, BB Lee and SC Gandevia

Several studies describe the effective use of SES to assist with enhancing cough in tetraplegic patients, however they describe limited success in producing high enough expiratory pressures for effective cough. This paper presents the results of studies performed on 11 healthy spinal cord injured (SCI) subjects. Subjects were seated in their wheelchair and breathed through a mouthpiece. Airflow was measured by a pneumotachometer and measures made of lung function including, inspiratory capacity (IC), slow vital capacity (VC), forced vital capacity (FVC), and peak expiratory flow (PEF). A gastro-esophageal catheter was inserted via the nose to measure stomach gastric pressure (Pga) esophageal pressure (Pes). During the cough maneuvers, the effect of posterolateral SES was to significantly increase peak expiratory flow (by $36 \pm 5\%$), increase expired lung volume (by $41 \pm 16\%$) via a significant increase in the abdominal and thoracic pressures (by an average of 5.5 and 2.5 times, respectively) generated during the cough effort. All SCI subjects improved their expiratory pressures during the MEP and cough efforts when combined with abdominal muscle stimulation. All subjects also improved the PEF during cough efforts with superimposed SES, while all but one subject increased their expired volume during a stimulated cough.

P47

Rehabilitation robotics with closed loop electrical muscle stimulation, a pilot study in SCI populat

A. Al-Khodairy, P. Métraiier, R. Brodard, R. Clavel, R. Frischknecht

The MotionMaker™ is a new stationary test and training robot for the lower limbs combining two motorized hip-knee-ankle-foot orthoses with a closed loop electrical muscle stimulation system. We report the effect of a training with the MotionMaker™ on motor performance of chronic SCI persons 5-20 years after injury. Five paraplegic subjects, 25-52 years old, 4 with an incomplete lesion, 3 with spasticity, completed a functional electric stimulation (FES) assisted, robot guided leg training every second working day for 2 months. FES of selected muscles was superimposed on residual voluntary muscle action and modulated in real time so as to produce an isokinetic full-range leg press movement. No harmful incidents or drop-out were observed. The electroinduced force increased by 397% (n=5). The incomplete SCI patients reported an increased proprioceptive awareness of their muscles during electrically induced leg movements. Their voluntary force increased by 388% on their most affected leg and by 193% on the controlateral side. During the training sessions hypertonia of the spastic subjects, decreased by 1.9 points on the modified Ashword scale (n=3).

The MotionMaker™ seems to be a useful and well tolerated tool to improve motor function after SCI, whether in the acute or the chronic phase.

POSTERS

Free papers

P48

Evaluation of an Occupational Therapy program for patients with spinal cord injury

M. Menarini, P. Pillastrini, R. Vannini, G. Bazzocchi, S. China, R. Pederzini

Study design: Clinical Controlled Trial

Objectives: To evaluate the efficacy of an occupational therapy program combined with neuromotor rehabilitation, by assessing the degree of functional independence reached by patients with spinal cord injuries at first hospitalization.

Settings: Subjects selected from the Spinal Cord Unit of the Rehabilitation Institute of Montecatone (Imola, Italy).

Participants: 36 male patients, below age 60 with complete paraplegia (ASIA-A) in thoracic-lumbar level, at first hospitalization.

Methods: Patients were divided into experimental and control groups. Subjects in the experimental group underwent neuromotor rehabilitation coupled with an Occupational Therapy program, whereas those in the control group followed neuromotor rehabilitation only. Increase in functional independence at discharge was evaluated by the Valutazione Funzionale Mielolesi (VFM) assessment scale.

Results: Patients in the experimental group showed a significant increase in the total VFM score, and in domains concerning transfers and wheelchair use. A significant improvement was observed in unmarried patients as compared to married ones.

Conclusions: An Occupational Therapy service within a Spinal Cord Unit allows to reach a higher degree of functional independence.

P49

Rehabilitation of spinal cord lesion in Thai Red Cross Rehabilitation Center

W. Kitisomprayoonkul

Objectives: To study demographic data, length of stay (LOS), functional outcome and rehabilitation efficiency of patients with spinal cord lesion.

Methods: Medical records of inpatient with spinal cord lesion (SCL) in Thai Red Cross Rehabilitation Center during year 2002–2006 were reviewed. A patient who discharged before achieving goals was excluded.

Results: Seventy-four records were met criteria. The etiologies were as followed: 37 (50%) from trauma, 18 (24.3%) from neoplasm-infection, 17 (23%) from degenerative joint disease (DJD) and 2 (2.7%) from AV fistula. Traumatic SCL had a significantly longer LOS than DJD (117.49 vs. 63.18 days; $p=0.007$) but not significant different from SCL from neoplasm-infection and AV fistula (117.49 vs. 84.83 and 106.50 days; $p=0.25$ and 0.98 respectively). Functional admission score of traumatic SCL was not significant different from neoplasm-infection and AV fistula ($p=0.23$ and 0.96 respectively) but less than DJD ($p=0.05$). Functional score at discharge and rehabilitation efficiency were not significant different in each group ($p=0.93$ and 0.96 respectively). Thirty-eight (51.4%) were achieved full score. Ninety percent were discharged to home.

Conclusions: SCL patients from several causes had different LOS, functional admission score and functional score improvement but same rehabilitation outcome and efficiency at discharge.

P50

A regular follow up of SCI patients after discharge: Incidence of pressure sores and urinary problems

Sigríður Jóhannsdóttir, Bylgja Kristófersdóttir, Ólöf Björg Þórðardóttir

Purpose: To look into the prevalence of pressure ulcers and urinary complications among individuals with spinal cord injury (SCI) pertaining the follow-up of the spinal cord injured at Department of Rehabilitation Landspítali University Hospital, Reykjavík (Rehab.of LSH). In addition, researchers wished to examine the correlation between age, gender, injury and the number of biannual follow-ups with pressure ulcer and urinary complications.

Methods: The research statistics were acquired from the SCI follow-up at the Rehab.of LSH. The sample of the study were 73 individuals with SCI, of 18 years and older.

Results: Overall the researchers find the outcome to be positive because the prevalence of pressure ulcers has decreased and the prevalence of urinary incontinence has not increased. Despite the fact that the follow-up doesn't show a decreased prevalence of these complications the pressure ulcers don't get worse between follow-ups and there has been a decrease in surgeries. There is a significant increase in the use of intermittent catheterization between follow-ups.

Conclusion: It is estimated that in the years to come the success of the spinal cord follow-ups will show and result in a better quality of life for individuals with SCI.

P51

Influence of complications on the efficacy of early rehabilitation in patients with spinal cord inju

A. Krisciunas, T. Morkevicius, R. Medzeviciute, A. Valanciute

Aim: To assess the time of development of the most often occurring complications in patients with an injured spinal cord and evaluate their influence on the efficacy of early rehabilitation.

Methods: A retrospective analysis was done of medical charts of 165 patients cared during the years of 1999–2005 in the Division of Neurorehabilitation.

Results: The time of development of complications: 1) pain was recorded for the first time before the rehabilitation in 90.9% of patients; during the rehabilitation, in 1.2%; 2) uroinfection was diagnose before rehabilitation in 55% of patients; during rehabilitation, in 18%; 3) anemia was found prior to the rehabilitation in 40% of patients; during rehabilitation, in 2%; 4) psychosomatic problems were recorded before the rehabilitation in 34% of patients; during rehabilitation, in 21%; 5) bed sores, in 11% of patients before the rehabilitation; in 2%, during the rehabilitation. The mean Barthel index at arrival was 8.5; at discharge 24. Bed sores had statistically significant influence on the efficacy of early rehabilitation.

Conclusions:

1. All the analysed complications developed already before arrival at the Division of Neurorehabilitation.
2. Bed sores diminish the efficacy of the rehabilitation.

Intraspinal migration of a pellet following gun shot injury

N Hussain, B Basu, P Thumbikat, G Ravichandran

Lodged pellets in the tissues may wander about and follow surprising paths. Forces produced by activities such as coughing, swallowing, peristalsis, blood flow and gravity are responsible for the migration of the pellet in the body.

We report a rare case of a pellet traversing the whole spinal canal from first cervical vertebral level to second sacral vertebral level.

A 16 year old boy sustained an air gun pellet injury with an entry wound on the right side of his neck. A CT Scan of spine revealed a fracture of right Lamina of C1 and the pellet was found to be lodged in the spinal canal at the level of upper part of the odontoid peg on the left side. Clinical examination revealed an incomplete C2 ASIA C tetraparesis of Brown Sequard pattern.

The pellet on subsequent radiological examinations was seen to migrate caudally within the spinal canal. A month after the injury it was located in upper thoracic region and by eleven months after injury it had come to rest at S1/S2 level. During this time his neurological status improved from ASIA C to ASIA D. There are previous reports in the literature of bullets coming to rest in the midthoracic area, the narrowest part of the spinal canal, but this to the best of our knowledge is the first report of a full-length intraspinal migration of a foreign body.

P53

A pilot study of unscheduled outpatient contacts with a rehabilitation ward

H Bergvinsdóttir

Aim and Methods: All doctors and nurses in a rehabilitation ward with a SCI team were asked to fill out simple one-page questionnaires during 2006, in order to find out how much time is spent on work generated by unscheduled outpatient contacts with the unit.

Results: 147 reports (95 from the nurses, 52 from the doctors) described problems that took between 3 and 240 (mean, 23) minutes to resolve, or 57 hours in all. Compliance of the staff was quite variable; 2 of the 14 nurses filled out 71/95 = 75% of all questionnaires, while only 3 of the 6 doctors submitted all of the doctor's reports. Number of reports varied, decreasing from 32 in February to 4 in November.

Conclusions: Follow-up of individuals with SCI "from injury to grave" requires considerable time and effort. Huge amounts of missing data make interpretation difficult, but extrapolation of the best results yields a conservative estimate of ((13 tasks per month x 14 nurses) + (7tasks x 6 doctors)) x 12 = 2700 tasks x 23 minutes = 26 work weeks, or more than one week per year per employee. Thus, it seems worthwhile to pre-plan this type of unplanned work.

P54

Development of the Spinal Cord Injury Prevention Program for Children in Korea

HK Park, BS Lee, MH Lim, CW Park, KY Hong, MH Kim, BS Kim, JK Kim

Objectives: To develop systematic Spinal Cord Injury (SCI) prevention program in Korea for the first time.

Methods: This SCI prevention program was based on the analysis of causes of injury in Korea. We also reviewed literatures and collected related domestic and foreign data. We surveyed to identify educational effect before and after the SCI prevention program.

Results: In 2005 January, the ‘Disability Prevention Team’ was composed in Korean National Rehabilitation Center, and we had developed the ‘Disability prevention program with speakers in wheelchair’ for 4, 5, 6 grades students in elementary school. We produce the ‘Video for disability Prevention’ for education. The video contained accident experiences of 10 disabled persons. After preliminary education in 3 elementary schools, we revised the 60 minutes education program. We executed injury prevention education to over 9,000 elementary school students (10 time in 2005, 51 time in 2006).

Conclusions: This is the first systematic SCI prevention program in Korea. We have developed the SCI prevention program and a video. And we also have trained the spinal cord injured persons as speakers. This SCI prevention program may help the children not to be a disabled person by accident in Korea.

P55

Effect of the Spinal Cord Injury Prevention Program for Elementary School Students

Chul-Woo Park, Bum-Suk Lee, Mun-Hee Lim, Ki-Yo Hong, Mi-Hye Kim, Hyo-Sun Jung, Byung-Sik Kim, Ja-Kyong Lee

Objectives: To identify the effect of the Spinal Cord Injury (SCI) Prevention Program for elementary school students.

Methods: The SCI prevention program is a 60 minutes program which consists of watching the education video for disability prevention, and having a conversation (interview) with disabled speakers in wheelchairs. The questionnaire was administered to 3,365 students (11–12 years old) and it was administered at 7 days before and 7 days after education.

Results: The result showed that only 8.4% of bicycle owners and 17.0% of rollerblade owners wear helmets, and only 48.2% of students fastened seat-belts in a car. After the program was conducted, there were significant improvements in self-efficacy and practice-intention to wear protective device and to fasten seat-belt in a car ($p < 0.05$). Most impressive content of the education program was conversation with speaker with spinal cord injury and the next was watching the video. After program was conducted, 50% of students answered "I will wear helmet and fasten seat belt", and 10% of students answered "after the program, I could learn a better understanding of the disabled persons and I also want to help them."

Conclusions: The SCI prevention program with speaker in wheelchair was effective in improving the self-efficacy and practical-volition for injury prevention. In addition, this program could improve students' understanding of disabled people.

P56

Spinal Cord Injury Rehabilitation Evidence: Synthesis of the Knowledge

A F Townson; J Hsieh; W C Miller; R Teasell; S Connolly; MA Regan; JJ Eng; & the SCIRE Research Team

Objectives: A synthesis of the strengths, weaknesses and gaps in knowledge in the field of SCI rehabilitation.

Design: A systematic review of all relevant literature published from 1980–2005 using MEDLINE/PubMed, CINAHL®, EMBASE, and PsycINFO.

Methods: Each study was assessed using one of two standardized scales: the Physiotherapy Evidence Database Scale (PEDro) for all randomized control trials (RCTs) or the Downs and Black tool for all non-RCTs. The accumulated evidence for each topic (e. g., pressure ulcers, spasticity, lower extremity function) was graded using a modified version of Sackett's levels of evidence.

Results: The search reviewed over 17,000 titles and 8,400 abstracts, with final extraction and synthesis of almost 700 articles. Pharmacological interventions were supported by a greater number of randomized controlled trials (level 1 evidence) while other rehabilitation interventions were primarily supported by single group, pre-test/post-test studies (level 4 evidence). In general, a wide variety of outcomes with little psychometric evaluation was used, making comparisons between studies difficult. Across all topic areas, mixed populations were common within a study sample (e. g. complete and incomplete, acute and chronic injuries).

Conclusions: The SCIRE project systematically reviews the existing literature and provides a summary for the latest evidence in SCI rehabilitation.

P57

Neurophysiological examinations of SCI patients for predicting motor outcome

G de Scisciolo, F Del Corso, V Schiavone, R Caramelli, G Stipa, G Grippo, A Cassardo and S Aito

Predicting neurological and functional outcomes following SCI is one of the most important issues in the acute stage care. The clinical neurological assessment can be supplemented by electrophysiological recordings, which may have high prognostic value even in uncooperative patients. We performed SSEP, MEP, SSR and EMG/ENG as a routine examination to all admitted patients suffering from SCI. Tibial nerve SSEP plus anterior tibial muscle MEP may indicate the outcome of ambulatory capacity while median/ulnar SSEP plus abductor digiti minimi muscle MEP may predict the outcome of hand function. In our study seventynine SCI patients underwent three times the above mentioned neurophysiological investigations as follows: within 1 month; between 4 and 6 months and after 18 months post injury. Prediction of neurological and functional outcomes by using ASIA ISCoS standard of neurological classification and WISCI with regards to the ambulation capacity, were highly statistically significative, beeing the scores of the tests highly correlated to the clinical outcome. These results show that the combination of clinical and electrophysiological recordings in acute SCI patients represent the most reliable predictors about the degree of recovery of upper and lower limbs. This is helpful for planning the appropriate therapeutic approaches of the rehabilitation program.

SCI systems of care: A global model

Priebe M, Strayer J, Aito S, Middleton F, Eriksson-Bjorling J, Wing P

Objective: To review existing models of spinal cord injury (SCI) systems of care, and create a model that identifies the minimum requirements for SCI care systems around the world.

Methods: We reviewed the medical literature to identify publications describing SCI systems of care. We identified and reviewed documents from key governmental and non-governmental organizations regarding SCI care systems. We analyzed and synthesized the commonalities and differences between these systems and identified key components of a comprehensive SCI care system. We specifically identified data on the following topics:

- Scope of services
- Personnel
- Knowledge resources & communication
- Factors Internal to SCI facility [physical resources, access]
- Factors External to SCI facility [community care, clinic, peer, community integration]

Results: A small number of studies have been performed demonstrating benefits of systems to provide quality care for persons with SCI. Many organizations have developed standards of care for persons with SCI with many common themes.

Conclusions: SCI's complexities necessitate a coordinated system of care. We propose a model for SCI care locally adaptable throughout the world. Portions of the model can be expanded or contracted to fit the resources and needs of health care system in the region.

P59

Systems of care for traumatic Spinal Cord Injuries in Thessaloniki/ Greece and Stockholm/ Sweden

A. Divanoglou, R. Levi

Purpose: Comparison of clinical pathways between two regions of comparable size in two European Union (EU) countries, as part of a larger study comparing demographics and outcomes between these regions.

Methods: A population-based, prospective, cohort study. The clinical pathways of all new Traumatic Spinal Cord Injuries (TSCI) patients during the study period were systematically documented.

Results: In Stockholm, the clinical pathway consists of a predefined chain of collaborating specialist centers that share a common documentation system. All acute patients are referred to one regional university hospital. Post-acute inpatient rehabilitation then takes place in one of two designated centers. Life-long follow-up is conducted in one specialized outpatient clinic. In Thessaloniki, the clinical process is not pre-defined. Patients can be admitted to any Neurosurgical, Orthopaedic, ICU, General Surgical department at any of the six regional hospitals, then either they are referred to a rehabilitation centre in Thessaloniki, Athens or in another EU country, or they are discharged home. There is no systematic follow-up.

Conclusions: Two regions of comparable size within the EU display radical differences in systems of care for TSCI. Further data from this study will provide information on differences in outcomes between these disparate systems.

Complications following SCI during the Acute Phase

M Saif, F. Sarhan

Aim of Study: To explore the incidence of complications in 2 centres, Explore the possible relation of complication development and the time lapse from injury to admission to a spinal unit, Compare results in both centres and those in literature. And establish and develop recommendations and guidelines to improve our practice

Material and Methods: Retrospective study has been taken to determine complications following SCI during the acute phase, Random samples from the RNOH and Stoke Mandeville (25 patients from each hospital during their first admission post injury. Data collected is from patient's medical records, Data collection tool designed to explore the following aspects: Completeness of the notes, Referrals forms/ outreach services, Aetiology and level of injury, Pre & post admission management, Time between injury and admission to spinal unit, Type of complications reviewed include skin, respiratory, urinary, bowels, cardiovascular/ DVT/PE, psychological, surgical, GI, Pre and post admission complications.

Results: Study suggested that early admissions to specialised spinal centres reduce the incidence of complication development. A high incidence of at least one complication on admission documented, the most common complications detected: skin, urinary, respiratory and psycho. The study findings highlighted the poor documentation of the multidisciplinary team. Other findings will be outlined within poster presentation

Conclusions: It is evident from the finding of the study that a uniform standard of SCI treatment will soon be provided throughout the country As a result this will serve to improve the quality of care given to SCI patient groups, This will lead to diversion of resources to improve services of SCI management further, further recommendations will be outlined within poster presentation.

P61

Half-way each: The Iceland-Gothenburg to introduce reconstructive hand surgery in a small unit

PE Ingvarsson, S Yngvason, S Loftsdóttir, K Bjarnhédinsdóttir, H Thórisdóttir, J Fridén

Objectives: Numerous recent reports have demonstrated dramatic improvement of functional hand skill after surgical reconstruction. This project was launched to offer Icelandic patients with tetraplegia a reevaluation focused on possible benefits from reconstructive hand surgery.

Methods: A close cooperation with a well established reconstructive hand surgery team (Sahlgren University Hospital, Göteborg, Sweden) was initiated. This involved extensive education and training of occupational and physical therapists during repeated one-week stays in Göteborg, accompanying patients undergoing surgery and follow-ups. A regular supervision including discussions of patients' performance based on video clips of the progress of training reduced considerably the need for post-operative control visits overseas.

Results: Currently, 8 patients have been assessed and additional 10 to 15 possible candidates for operation will be evaluated during consultation visits to Iceland in the near future. In 2006, 3 extensive surgical procedures have been performed in Göteborg on two patients and 5 more patients are scheduled for reconstructions.

Conclusions: All tetraplegics in Iceland will be offered the opportunity to be examined and, when feasible, subject to reconstructive tetraplegia surgery. This type of cooperation could be an affordable and practical approach for other countries that hitherto have not had access to this treatment.

P62

VSCS upper limb tendon transfer program – a model of practice

A Chu, C Cooper, D Brown

Cervical spinal cord injury (SCI) can have a devastating effect upon a person's ability to perform everyday activities and participate in the life roles assumed prior to SCI (Bryden, Sinnott & Mulcahey, 2005). Tendon transfer surgery is one method of improving upper limb function and participation in occupations, however in Australia, access to this specialised surgery can be limited.

The Upper Limb Program (ULP) of the Victorian Spinal Cord Service (VSCS) has evolved over the past 20 years and now completes some 12–20 upper limb tendon transfer surgeries per year. This is more than the sum total of surgeries completed in all the other states of Australia. This paper will describe a model of practice, including the integration of this program into general rehabilitation, the employment of staff specifically dedicated to this program and a team approach. The benefits of this program include:

- minimising surgical cancellations and decreasing surgical waiting lists
- minimising the original length of stay from 3 months to 3–5 days
- increasing the efficiency of through-put and discharge planning
- establishing outreach services to increase patients' accessibility to surgery
- establishing strong mentor and support links for patients

P63

HAND TEAM – Organized program to optimize upper limb activity for tetraplegia

P. Leppänen, K. Sigzelius, E. Ahoniemi

One essential challenge in rehabilitation of a tetraplegia patient is as optimal upper limb function as possible. The multidisciplinary collaboration should be well organized and structured from step to step. In order to achieve best possible upper limb activity the HAND TEAM (the physician, the physiotherapist, the occupational therapist and the patient) was founded. In our centre there are annually 30 new SCI patients with tetraplegia. The structured program with mutual rules and written guide has been developed. The team will check all the tetraplegia patients dividing them into subgroups of C4 or higher, C5–C6 and C7–C8 levels. Evaluation of the upper limb consists of range of motion in shoulder, elbow, wrist and fingers, manual muscle testing, tonus evaluation, pain intensity, swelling, sensation and fine motor activities. The main parts of the therapy are positioning, splinting, remedial exercises, lymphatic drainage therapy and injection of botulinum. The counselling of nurses are regularly included to the program especially dealing with positioning and splinting advice. The hand surgeon will consult if needed. The appropriate and individual upper limb program for each tetraplegia patient has clear benefit of minimizing complications as flat hand, claw hand, swollen hand or stiff joints.

P64

Hand cycle use of persons with a SCI in the Netherlands during and after rehabilitation

Valent L. J. M., Dallmeijer A. J., Houdijk H., Slootman J., Angenot E. L. D., van der Woude L. H. V.

Introduction: In the last decade, hand cycling (HC) has become increasingly popular as an outdoor mobility device in the Netherlands. The purpose of this study is to present a descriptive analysis of hand cycle use in persons with a spinal cord injury (SCI) during and after rehabilitation.

Methods: Patients with the prognosis 'mainly wheelchair bound' and admitted to one of the 8 main Dutch SCI rehabilitation centers, were included. Hand cycle use was monitored with a questionnaire at discharge and one year thereafter. A cross-sectional descriptive data-analysis was performed.

Results: 64% of the included persons with a SCI (n=188) became acquainted with HC and 30% practiced HC on a regular basis (once a week or more) during rehabilitation. Compared to persons who did not use a hand cycle, persons who practiced HC appeared to be younger (38 versus 48 yrs), had a lower walking ability and were all below lesion level C4. 38% of persons with a tetraplegia and 20% of persons with a paraplegia who were HC during rehabilitation did not continue after rehabilitation. The following reasons were reported: no hand cycle allocated (39%), injuries (26%), too heavy (26%), no fun (9%). One year after rehabilitation the HC is still used regularly by 80% of the 68 persons who possessed a HC.

Conclusions: Hand cycling appears to be an important additional mode of mobility and exercise during rehabilitation of persons with a SCI in the Netherlands. A majority of persons continues hand cycling after discharge.

P65

Feasibility of a classification system for physical therapy, occupational therapy and sports therapy

AHB van Langeveld, MWM Post, FWA van Asbeck, K Postma, J Leenders, K Pons and H Liefhebber

Feasibility of a classification system for physical therapy, occupational therapy and sports therapy in spinal cord injury rehabilitation.

Background: Previously, a classification system with 29 categories divided over three levels of functioning was developed to describe therapeutic activities of physical therapists, occupational therapists and sports therapists that are directed at mobility and self care in SCI rehabilitation.

Objectives: To test the feasibility of the classification.

Methods: In 3 SCI centres 36 therapists recorded all treatment sessions in a 2 to 4 weeks period.

Results: In total 36 therapists assigned 1625 codes to 826 treatment sessions of 142 patients. For 86,3% of the treatment sessions the time needed to classify was within 3 minutes. For 93% of the treatment sessions the coding elicited little or no doubt. Of the 29 categories, 24 were used by at least 2 disciplines. Most frequently recorded categories were muscle power, muscle length, basic body positions and movements, walking and wheelchair driving. Only 1,5% of the classified codes was coded as "unspecified". All participants found the classification easy to use and reflective for clinical practise.

Conclusions: The findings support that the developed classification is adequate to classify daily given SCI treatment sessions in different settings by different therapists at three levels of functioning.

P66

Visual feedback to improve sitting balance after Spinal Cord Injury

A. Al-Khodairy, S. Raemy, B. Rau, F. Burdet

Postural stability in the sitting position is a prerequisite condition to carry out many activities of daily living. We studied an innovative exercise program based on visual biofeedback using a pressure mapping system routinely used with wheel-chair bound patients in the seating clinic. Trunk stability in the sitting position and independence level were respectively estimated using a self-designed timing scale and the Spinal Cord Independence Measurement-II in 10 spinal cord injured patients aged 21 to 81 years with motor neurological levels C5 to T12. Subjects took part in two sessions of standardized exercises at 7–14 days interval during which they had the pressure mapping system underneath and were asked to focus on their center of gravity, a circle on the screen, during several tasks. In high neurological levels with poor trunk control some exercises had to be adapted. Patients filled out a questionnaire of interest and satisfaction, constructed with a visual analogue scale. Data analysis did not reveal links between interest to the therapy, age, trunk stability, independence level, date of injury and neurological level in this heterogenic group. The program seems feasible after spinal cord injury and was found very interesting and a useful tool by all participants.

Clinical guideline for management of problematic spasticity in individuals with a spinal cord injury

I Löfvenmark, M Håkansson, H Westerberg, R Levi

Clinical guideline for management of problematic spasticity in individuals with a spinal cord injury (SCI) at Spinalis, Karolinska University Hospital, and Rehab Station Stockholm.

Background: About 60 individuals in Stockholm area suffer a SCI every year and spasticity is a common symptom. For about 30% of the patients spasticity is problematic. It interferes with their daily live activities, is painful, increases the risk of contractures and/or makes optimal care-giving challenging or impossible. There is a variety of treatment possibilities for spasticity but we have felt a need of having a more structured method to achieve optimal assessment and treatment for this patientgroup.

Methods: We collected data through literature, interviews with professionals in rehabilitation clinics and through our own clinical experience. This was all compiled in a clinical guideline.

Results: Today we work after the clinical guideline that includes recommended assessment tools, protocols, treatment and follow-up guidelines. It strongly advocates for the need of teamwork around these patients since problematic spasticity often requires multi-professional treatment. The clinical guideline also emphasizes the need of subjective measure from the patient, which in most research seems to be the most valid assessment. It has been divided in a general part and an extended part (spasticity-team). Patients get referred to the spasticity-team when the general treatment is not sufficient and/or when botulinumtoxin injection or intrathecal treatment is adequate.

P68

Heart rate-based indices as proxies for oxygen consumption in ambulatory Spinal Cord Injury

RJ Marino, AS Burns, JF Ditunno, M Besser

Purpose: To evaluate and compare the physiologic cost index (PCI) and total heart beat index (THBI) for determining energy requirements of ambulation in spinal cord injury (SCI).

Methods: Eight subjects with chronic incomplete SCI were evaluated for ambulatory ability using the Walking Index for Spinal Cord Injury (WISCI). Subjects ambulated at self-selected speed at their usual WISCI level and their highest possible level. Continuous heart rate (HR) and oxygen consumption (VO₂) recordings were collected. Gait parameters were obtained using the GAITRite system. Using steady-state data, PCI (change in HR/meter) and THBI (total heart beats/meter) were calculated and compared to VO₂/meter.

Results: Usual WISCI (n=8) ranged from 9–20; maximum WISCI (n=7) from 12–20. Pearson correlations (r-square) between VO₂ and PCI was 0.71 and between VO₂ and THBI was 0.70. A linear regression model of $VO_2 = THBI + THBI^2$ explained 77% of the variance in VO₂. A linear regression model of $VO_2 = PCI$ explained 69% of the variance and was not improved by adding a quadratic term. PCI was less accurate at lower VO₂ levels.

Conclusions: THBI and PCI seem to be acceptable proxies for VO₂ in ambulatory SCI patients. The THBI is superior to the PCI, particularly at lower energy levels.

P69

Gait orthosis in patients with complete thoracic paraplegia

Aybenur Bardak, Belgin Erhan, Berrin Gündüz, Özcan Seyyah

Objectives: Investigation of adapting of the patients to gait orthosis who have complete thoracic paraplegia

Methods: A total of 50 patients with complete paraplegia, level T3-L1 who had gait orthosis (hip-knee-ankle – foot orthosis, knee-ankle-foot orthosis, reciprocating gait orthosis). Patients were both interrogated whether they used the orthosis efficiently, and difficulties encountered while they were using the orthosis.

Results: The 50 patients who had injury level T3 to L1 were examined. 18 patients were in ASIA B, 32 patients were in ASIA A group. Orthotic gait use was continued in 70% of patients and were able the orthosis indepently, 65,7% for walking 25.7% for standing. Ortotic gait use discontinued in 30% patients. The main reason for discontinuing use were the necessity human help or supervision, difficulties in wearing, weight of the device, pain, pschological reason and not being cosmetic.

Conclusions: The majority of our patients used their orthosis for its true purpose. With the true orthosis choise and adequate training, SCI patients can attain the wanted ambulation.

Burn Rubber Burn: A Community Based Fitness Programme For Spinal Cord Injured Individuals In Wheelc

S. Engel, S. Robinson-Di Francesco, J. Batty, L. Katte, B. McMahon

Objectives: Develop a circuit based, goal oriented group exercise program meeting the exercise needs of spinal cord injured (SCI) individuals of various abilities, which is transferable to community based environments. Then, in partnership with established community organisations, transfer the programme to community sites.

Methods: Phase I: The programme combined cardiovascular and resistance exercises, attendance twice per week (plus a home exercise DVD). Phase II: The programme transferred to gymnasiums in a not for profit organisation, with multiple facilities in the Sydney Metropolitan area and country New South Wales.

Measures: attendance rate (AR), satisfaction questionnaire, strength, endurance and cardiovascular (Toronto Arm Protocol and Borg Scale).

Results: Phase I: 32 participants: At 6 months; AR – 68%, 100% highly satisfied. Bicep strength – mean 1RM increase of 16kg (91% participants improved), chest strength – mean 1RM increase of 9.3Kg (81% participants improved). 100% improved in endurance. 81% improved peak power change, mean improvement – 3.6 ml/kg/min in 0–3 months and 1.05 ml/kg/min in 3–6 months. Mean change in rate of perceived exertion, 2.6 in 0–3 months and 0.9 in 3–6 months.

Conclusions: Gains in fitness and well-being in SCI individuals can be made in a decentralised, community group programme.

Physiotherapy in Patients with Spinal Cord Lesion at First Place

J. Kriz, P. Kolar, L. Oplatkova, J. Fousova, V. Hysperska, A. Kobesova

At our spinal cord unit, which is a part of rehabilitation clinic, University hospital Motol, Charles University, Prague, Czech Republic, we provide rehabilitation for patients after SCI in acute stage as soon as stabilization of vital functions has been achieved until 2–3 months after the injury. Well educated and skilled physiotherapists and occupational therapists, using modern equipment including such as “Lokomat” care for our patients. We have been running some research projects, one of them focusing on effect of transcranial magnetic stimulation on reparation process of the spine. But even having such facilities at our disposal we are aware of the fact that no method itself results in full achievement. The most important part of our treatment is intensive, complex physiotherapy focused on improvement of the motor function. We have been applying standard techniques routinely used in SCI patients such as Bobath concept, PNF, exercise in load removing suspension device (Terapi Master), or active exercise. To facilitate motor activity we also make use of stimulation of the motor patterns following from the concept of developmental kinesiology. These are genetically determined motor functions which can be evoked by stimulation of specific zones at patient’s body at very well defined body position. By simultaneous stimulation and body positioning we evoke subconscious motor activity including respiratory stereotype. This method allows us to address still preserved motor functions which are not under patient’s voluntary control. Application of the techniques based on neurophysiological principle we consider to be essential especially in early stages just after the SCI. Our goal is to achieve the best quality of postural functions in individual stages of verticalization.

Wheelchair Driving Licence (WDL) – motivation tool for a SCI patient

I. Björklund, H. Ahtee, T. Lehto, H. Alaranta

Skilful wheelchair use is mostly one of the main targets of SCI rehabilitation. The aim of our program was to develop an assessment tool to test ability to cope with wheelchair. In Medline literature it was found that almost in every report concerning wheelchair use there were tests and scores not to separate clearly wheelchair handling skills and mobility skills (eg. transferring from wheelchair to bed). The test for a caregiver was not found. In our centre senior physiotherapists and specialists of adaptive sport ended up to the wheelchair handling test that consists 25 different wheelchair items, which are evaluated in four different surroundings: 1. moving in flat ground, 2. incline ascent/descent, 3. wheeling, and 4. overcoming obstacles. The scale for each item is 0–4 (full independence – total assistance). The range of WDL A scoring is 0–100 (25x4). The next step of the program is to determine the reliability and validity of WDL A. The second step is to develop a test (WDL B), which would measure the mobility skills in wheelchair eg. transferring, folding the wheelchair, door handlings. The third step is to develop a test of a caregiver dealing wheelchair assistance (WDL C). Good ability of wheelchair skills certified by WDL motivates SCI persons, professionals and caregivers to enable best possible benefit of wheelchair use.

Cardiopulmonary Responses to Arm Cycling Exercise in Subjects With Thoracal Spinal Cord Injury

Kesiktas N., Kasikcioglu E., Issever H., Muslumanoglu L.

The aim of this study was to assess cardiopulmonary parameters of complete chronic paraplegic patients (CCPP). Twenty CCPP were recruited into study according to the classification of ASIA, then randomization of the subjects was achieved by using a computer random numbers. Mean age of the patients was 36.8 ± 9.8 years. The mean time since the injuries was 9.7 ± 7.3 years. Beck Depression Inventory (BDI), Craig Handicap Report Technic (CHART), Spinal Cord Independence Measurement II (SCIM II), patient characteristics, were assessed. cardiopulmonary parameters were investigated with an arm crank ergometry and monitoring 12 lead electrocardiogram. Heart rates and blood pressures were measured before and after testing. Resting mean blood pressures and heart rates were lower in high thoracic than low thoracic CCPP (mean arterial pressure (MAP)): respectively, 75.5 ± 2 mmHg; 95.5 ± 3 mmHg; $P < 0.001$). Following exercise, heart rate and MAP were greater in low thoracic CCPP, ($P < 0.01$). No subject had significant electrocardiographic abnormalities at rest or during exercise. Two high level thoracic injured CCPP had no significant change in heart rate and blood pressure during exercise. The peak oxygen consumption (POC) of the patients were 11.5 ± 4.3 ml/kg/min. There were correlations between CHART, SCIM II and POC ($p < 0.001$). No correlations between BDI and POC.

Spinal monoamine release during locomotion – implications for transmitter replacement following SCI

B. R. Noga, A. D. Blythe, M. R. Brumley, I. D. Hentall, F. J. Sanchez, A. M. Taberner, E. Widerström-Noga

Intrathecal monoamines can induce or modulate locomotion. Thus this neurotransmitter class has potential for pharmacological enhancement of gait in injured patients. We examined endogenous monoamine release paralleling brainstem-evoked locomotion within the lumbar cord of decerebrate cats. Extracellular concentrations were sampled simultaneously at high spatiotemporal resolution from multiple sites by the method of fast cyclic voltammetry. Monoamine levels increased dramatically during evoked locomotion to levels that can activate the monoaminergic receptor subtypes implicated in locomotion. Release was observed where locomotor activated neurons are found (intermediate zone and ventral horn) and elsewhere (dorsal horn). In the intermediate zone, monoamines first rose around the onset of locomotor activity. During bilateral locomotion, highest grey matter levels were mapped in dorsal horns and intermediate zones, whereas unilateral locomotion produced greatest ipsilateral release in intermediate zone and contralateral release in dorsal horn. White matter levels also rose, often with a delayed buildup that probably reflected diffusion from grey matter. In conclusion, spinal monoamine release is widespread extrajunctionally during evoked locomotion and is dynamically regulated on a timescale of seconds or less. Replacement therapy may be feasible, but key spinal laminae may have to be targeted and levels dynamically controlled to approximate normal function.

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Translation of website on Physiotherapy Exercises for people with Spinal Cord Injury

Jørgensen V, Gaupseth HK, Harvey L

The Australian Website www.physiotherapyexercises.com is appropriate for people with spinal cord injuries, but also for patients with other neurological conditions. It consists of 600 exercises with excellent instructions and illustrations and some on-line video clips. It is regularly updated and can be downloaded, free of charge. As physiotherapists at the Spinal Cord Unit of Sunnaas Rehabilitation Hospital, Norway, we regard this website an excellent and inexpensive tool in our work and especially useful for therapists inexperienced with spinal cord injured patients. It can help provide good exercise programmes for patients, not only in rehabilitation settings, but also in primary care settings throughout the country. In order to make the website more user friendly in our country, a translation into Norwegian is required. The translation, partly financed by The Norwegian Foundation for Health and Rehabilitation, is in process and will be finalized by summer 2007. As this is the first translation of this website to another language, the poster will provide information on method and extent of work and of ways of promoting the website in Norway.

A comprehensive approach to spasticity assessment

JFM Fleuren, GJ Snoek, GE Voerman, AV Nene, HJ Hermens

Introduction: Assessment of spasticity is complex due to its various manifestations, difficulties to distinguish between neural and non-neural components, and different characteristics during passive and active movements. Additionally, there is often a discrepancy between outcomes of objective tests and the patients’ perception.

Objectives: Development of a comprehensive set of assessment tools for spasticity, to support decision making concerning the choice and dosage of spasmolytic therapy.

Methods: Following sets of tests, based on the WHO ICF framework, were developed:

- 1. Body Functions and Structures: (standardized) Ashworth scale and sEMG during standardized test situations, e. g. pendulum testing (PDL) or passive movement (PM).
- 2. Activities: sEMG and Visual Analogue Scale (VAS) and Borg scales (perceived degree of or discomfort due to spasticity respectively) during a specific activity.
- 3. Participation: long-term monitoring of muscle activity during daily life, VAS and Borg scales.

Results: Pilot testing of two patients treated with intrathecal baclofen (ITB) showed the following outcomes (see table 1).

Table 1. Abbreviations: AS, Ashworth score knee extensors; RFstretch, Rectus Femoris activity during stretch (µV).

| Subject | Instrument | Pre ITB | With ITB |
|------------------------|------------|---------|----------|
| 1 | AS | 3 | 0 |
| VAS | 6.6 | 1.3 | |
| Borg | 10 | 0.5 | |
| Relaxation Index (PDL) | 1.4 | 1.9 | |
| RFstretch (PM) | 1.5 | 1.7 | |
| 2 | AS | 4 | 1 |
| VAS | 7.6 | 0.8 | |
| Borg | 10 | 2 | |
| Relaxation Index (PDL) | 1.0 | 1.5 | |
| RFstretch (PM) | 2.6 | 1.6 | |

Discussion: Use of this comprehensive set of measurements covering all aspects of spasticity will improve clinical decision making regarding the choice of therapy and monitoring the effects of the therapy.

Long-term spasticity monitoring in complete SCI

GE Voerman, JFM Fleuren, CV Erren-Wolters, GJ Snoek, AV Nene, HJ Hermens

Introduction: Spasticity is context dependent and variable over the day, leaving its management suboptimal. Long-term monitoring techniques using surface electromyography (sEMG) are potentially interesting for this purpose but need further exploration. This study aims at defining parameters from long-term sEMG recordings, correlating with spasticity.

Methods: sEMG recordings of the Rectus Femoris (RF) were performed in complete SCI patients, during activities of daily living. Activities were scored for subjectively experienced spasticity (Visual Analogue Scale, VAS). Frequency, duration, and amplitude of sEMG bursts (fig. 1) were, single and combined, correlated with VAS and the Relaxation Index (RI) obtained with Pendulum testing.

Results: Preliminary results from 3 patients indicate that among the single parameters RF bursts duration during transferring is best correlated with VAS, but that the combined parameter is stronger associated (.5 r | N = 9) and therefore more likely relevant for spasticity monitoring.

Discussion: New data is currently being analyzed to verify these first findings and to relate sEMG parameters also to RI, a more objective laboratory based spasticity measure. The method seems promising for the objective assessment of spasticity during activities of daily living during which spasticity is most prominent, not depending on laboratory-based measurement.

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Possibilities in Riding Therapy with Spinal Cord Injury (tetraplegia) client

Elina Aula

The purpose of case report was to clarify the possibilities of Riding Therapy with Spinal Cord Injury (tetraplegia) client. The mean was to find out what Riding Therapy can give to SCI client in rehabilitation process. The study client was in accident three years ago. Before that she was a national level rider.

Documentation has been done with video camera, camera and the observation of client's functions in daily living. One part of the study was a four weeks riding therapy period, which included 12 therapy sessions. Results have been assessed by the reached goals. This study includes also groundwork with horse and carriage driving. With groundwork client has a possibility to communicate and take care of the horse. Carriage driving is possible with a vehicle designed for wheelchair users. Driving a horse gives the same exercise to patient as riding before SCI. She can train the horse by herself and work like in riding.

This study shows that after SCI and tetraplegia, client can ride a horse, do groundwork and drive with a carriage in riding therapy. Trained therapy horse, riding therapist and special aids are requisite to perform high quality and safe work with SCI tetraplegic client.

Participation in the development of ICF core set for Spinal Cord Injuries

J. Sleimann Steen and K. Hagemann Nielsen

1. Presentation of ICF-project
 - What is ICF
 - Which diagnose-groups have already entered into ICF Core Sets database
 - Which countries are participating in the ICF-project for SCI
 - Overview of ICF components:
 - Body functions
 - Body structures
 - Activity limitations and participation restrictions
 - Environmental factors
 - Inclusion criteria for participation in the project
2. Timeline for ICF-project for SCI
 - Worldwide
 - Clinic for Spinal Cord Injuries, Rigshospitalet
1. Implementation of ICF-project in Clinic for Spinal Cord Injuries, Rigshospitalet
 - Comparing English and Danish version of Case Record Form for Health Professionals
 - Translating Patient Information Sheet and Case Record Form for Patients
 - Practical performance:
 - Randomised selections of patients
 - Distribution of material
 - Interviewing (ASIA, FIM)
 - Data processing
 - Perspective of ICF

ICF is expected in the future to be used in many ways e. g. research, documentation, rehabilitation and economic resource allocation. The implementation of ICF gives opportunity to optimise the work performed both in relation to the individual and in relation to the overall rehabilitation in Denmark

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Development of documentation according to ICF with SCI patients

E-M. Hokkinen, H. Alaranta

Background and Aims: The International Classification of Functioning, Disability and Health (ICF) provides a comprehensive and internationally acknowledged framework for the description of human functional health. The ICF can be used by different health care disciplines.

The aim of this study was to find out the most common ICF codes in traumatically spinal cord injured (SCI) patients from rehabilitation discharge summaries and to promote the discussion about ICF for documentation.

Methods: Retrospective study was based on the rehabilitation discharge summaries of multidisciplinary rehabilitation teams. The information of rehabilitation discharge summaries were encoded by using the ICF.

Subjects: A sample of 26 SCI patients who were rehabilitated at Käpylä Rehabilitation Centre and were discharged in October 2006.

Results: The most common categories were found in the components of Body Functions (b) and Activities and Participation (d). Within the component environmental factors the categories support of immediate family and health professionals were the most important facilitators.

Conclusions: ICF gives a common language for rehabilitation teams. The team in going to discuss and make a decision of the most important core sets in documentation of SCI patients.

Paraplegia after rachianesthesia: a case report

F Martins, I Veiros, S Santos, R Nunes, L Martins

Introduction: There are several complications of rachianesthesia, but they are not frequent. The intrachannel haematoma is one of the rare complications of this proceeding with potentially severe consequences. The incidence of neurological dysfunction is estimated less than one case per 220 000, enlarging in presence of risk factors.

Case report: M. L. J. G., 64 years old, female, submitted to arthroplasty of right knee under rachianesthesia in 11/03/05. At 4º day after surgery was identified a complete paraplegia with a sensitive and motor level T6, consequence of a dorso-lombar intradural haematoma documented by MRI. It was surgical managed at the same day. The evolution was characterized by the absence of recovering.

Conclusions: This complication may arise in an apparently normal clinical context justifying a systematic post-surgery surveillance and early diagnosis

Spinal cord involvement in neurobehcet disease. Case report

Tugcu Ilknur, Yilmaz Bilge, Gencdogan Serhat, Goktepe Ahmet Salim, Duman Iltekin, Alaca Ridvan

Behçet's syndrome (BS) is an idiopathic multisystemic inflammatory vasculitic disorder of unknown origin with relapsing courses that may affect major organs, including the central nervous system. Although central nervous system involvement is common in BS, isolated spinal cord involvement is rarely an initial manifestation of the disease. We report a patient with BS who presented with spinal cord involvement as an initial manifestation. He was 21 years old and his sensory examination was normoesthetic till C6 level. Below this level there was no sensation. He had no anal contraction. At his motor examination; C5 myotom was 5/5 and C6-T1 level was 3/5 on the right side whereas there was no motor loss at the left upper extremity. There was no movement in his both legs. His rehabilitation program was planned with the diagnosis of C6 tetraplegia ASIA – A due to transverse myelitis. Cervical and thoracic spinal cord MRI revealed lesions at the level of C4–C5 and T6–T7. During the rehabilitation program, aphthous ulcers at his buccal mucosa and optic neuritis helped us to diagnose BS. It showed us that in the differential diagnosis of non-traumatic spinal cord injury, rehabilitation specialists should keep BS in mind with these features.

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Postpartum spinal cord injury, caused by multilevel epidural and subdural haematomas, in a patient with HELLP syndrome

J. M. van Kuppevelt, J. T. Groothuis

Objectives: To report an exceptional cause of vascular origin of spinal cord injury

Design: Case report

Case report: A 36-year-old female developed an acute onset of tetraplegia (neurological level C5, ASIA B) the day after delivery to a healthy daughter (39 weeks of gestation). Two days before parturition, she was admitted to the hospital with hypertension. Directly postpartum the blood pressure increased strongly and serum levels showed haemolysis, elevated liver enzymes and low platelet count (HELLP syndrome). The morning of the day postpartum, within one hour a tetraplegia developed. MRI-imaging showed multilevel epidural and subdural haematomas in the cervical and thoracic spinal canal extending from C2 to T8, with displacement and compression of the spinal cord. The hypertension was treated with intravenous labetalol and no neurosurgical intervention was needed regarding the haematomas. Within two weeks, the patient showed a significant recovery leading to a spinal cord injury, neurological level T1, ASIA D.

Conclusions: This rare cause of spinal cord injury shows the importance of close monitoring and repeatedly neurological examination of pregnant patients with hypertension complicated with HELLP syndrome both pre- and postpartum.

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Latrogenic Paraplegia from Percutaneous Vertebroplasty

H. Herndon Murray

To the list of medical procedures which place the spinal cord at risk, we must now add the percutaneous vertebroplasty.

While the vertebroplasty procedure with polymethylmethacrylate was developed during the late 1980s, the first report of paraplegia as a complication was not described until 2002.

We have recently admitted to Shepherd Center in Atlanta, our first patient with this complication, and the rarity and severity of this deserves review and discussion.

We will present the case, discuss the literature review, present theories of the cause of the neurologic injury, and review recommendations both to avoid this from happening and to evaluate and treat it if it does occur.

Employment in adults with pediatric Spinal Cord Injuries

B Gunduz, B Erhan, AN Bardak, B Akyurek, S Borici

Aim: To determine, employment outcomes and life satisfaction of adults who sustained spinal cord injury during childhood.

Methods: Patients who sustained a pediatric spinal cord injury at or before age 18 and who were 22 years old or older at the time of the study were include in the study. The patients were invited for a visit to the hospital. The demographic data, education and employment status, were evaluated. They were examined and classified according to ASIA 2002 Neurologic Standarts. Satisfaction with Life Scale was used to determine quality of life.

Results: Out of 34 pediatric onset spinal cord injured fulfilling the criteria of age, fourteen patients (9 male, 5 female) were included in the study. The mean age at the time of the injury was 14.1 ± 3.34 years, the mean age at the time of the study was 30.7 ± 7.9 years; and median time since injury was 168 months (range 48–396 months). Four of the patients had a job and 2 had retired (total of 42%). Only 3 of them were able to afford their expenses. Three patients were married and only 1 had children. There was not any difference in their quality of life; only the mean age of the group with employment was significantly older.

Conclusions: Cooperation of our pediatric SCI patients with this study were poor; the most prominent convertable limitation being the transportation problem. Social integration and productivity of the patients with pediatric spinal cord injury are important targets in rehabilitation goals. There should be more support from the goverment and social organizations.

Social Integration and Community Participation after Discharge following SCI Rehabilitation

J Middleton, I Cameron, R Quirk, A De Wolf, R Tate

Objectives: To evaluate a pilot intervention model involving independent living coordinators providing individualized support as well as using motivational interviewing ("coaching") techniques on extent of social integration and community participation of people with SCI during community resettlement.

Participants/Methods: Two cohorts of participants with acute traumatic SCI (comprising a pre-intervention control and pilot intervention group) were recruited sequentially from Sydney Spinal Units. Prospective outcome measures collected pre-discharge and at 6 weeks and 12 months post-discharge included the community integration measure (CIM), Sydney Psychosocial Reintegration Scale (SPRS), Craig Hospital Assessment and Recording Technique (CHART). and Medical Outcomes Study Short Form 36 health status measure (SF-36).

Results: Community participation (measured by CHART) was restricted more in people with tetraplegia than paraplegia, however, participants in intervention group with higher SCI impairment achieved greater social integration and participation ($p < .05$). Presence of bodily pain and psychological distress strongly predicted poorer social integration. Interpersonal relationships were stronger in the group (intervention) receiving individualized support. Multiple regression models with these variables explained 44–48% variability in social integration and participation outcomes.

Conclusions: Community integration and participation may be enhanced by adopting a "whole of life" approach incorporating individual support, coaching for information seeking, goal development, decisionmaking and advocacy.

Acknowledgement: The Community Participation Project, piloting a new model to promote community participation for people with traumatic spinal cord injury, is funded by the Motor Accidents Authority of NSW.

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Neuropathic pain in traumatic incomplete Spinal cord injuries

Werhagen L, Hultling C

Introduction: Neuropathic pain (NP) after traumatic spinal cord (TSCI) injuries is a clinical problem affecting the patients quality of life.

Aims of the study: To study the incidence of NP in patients with incomplete TSCI according to gender, age at the time of injury, ASIA classification grade and type of SCI syndrome.

Methods: TSCI patients were at the yearly check-up at "Spinalis" a post-acute SCI outpatient clinic serving the greater Stockholm area classified according to ASIA. Incomplete SCI were selected for the study and were classified according to the incomplete SCI-syndromes and divided into 2 groups: under or over 40 years of age at the time of injury. Pain was classified as neuropathic when burning, "like needles" in an area with decreased sensibility without relation to movements or infection. Included were 202 patients

Results: Eighty-six (43%) patients suffered from NP. Patient aged over 40 at the time of injury had more often NP. We found no significant difference in the incidence of pain according to gender, ASIA grade or incomplete SCI syndrome.

Conclusions: Patients injured late in life had higher NP incidence. Only small non significant differences were found between the different ASIA grades, SCI syndrome or gender

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Review of patients with Spinal Cord Injury related to the epidural analgesia

J Grydehøj, H J Kirkeby, I Lauge

The aim of the review was: to describe the clinical course of complications related to the epidural analgesia.

Methods: We examined retrospectively case reports of the patients admitted at the Department of Spinal Cord Injury in Viborg, Denmark, in the period from 1994 to 2006 to find patients with paraplegia related to epidural analgesia.

Results: 15 patients (7 males and 8 females) with spinal cord injury related to epidural analgesia were admitted to the department in this period of time. Median age of the patients was 55 years. In 6 cases epidural catheter was used for pain relieving after acute trauma, in 9 cases after operations. Duration from insertion of epidural catheter and the first symptoms was very different ranging between 1 and 46 days, median duration was 9,6 days. In 9 cases the cause of paraplegia was epidural abscess, in 2 cases epidural hematoma. In the remaining 4 cases there were no definite pathological changes at MR scanning. Only 3 of the patients had achieved almost full restitution.

Sexual counselling at Clinic for Spinal Cord Injuries

M. Linstow, J. Skyggebjerg, K. Rolfsager

Introduction: Following a spinal cord injury the vast majority of patients suffer from one or several difficulties, many of which may influence their sexual function, sexuality and quality of life. Since 1979 our patients have been offered patient education, peer-support, advise with regard to problems related to SCI and sexual function, but not in depth sexual counselling as such. We therefore wanted to focus more on sexuality and integrate sexual counselling as a natural part of the rehabilitation programme, in order to preserve the patients quality of life.

Initiatives: In order to do so a multi disciplinary group has completed the first and basic year of a 3-years course in sexual counselling, based on the education requirements of The Nordic Association of Clinical Sexology. Accordingly, we have introduced fixed schedules for appointments, always including 2 participants from our group, weekly meetings for supervision to ensure the self-development of all participants and thereby the future quality of our programme. The new option was introduced to the patients by means of a leaflet, patient education programme and by other personnel at the Clinic.

Preliminary topics: These initiatives have induced an increased demand for advice and sexual counselling among both in- and outpatients, including topics as: erectile dysfunction, lack of ejaculation, orgasm, sexual desire, decreased vaginal lubrication, pain during intercourse, neuropathic pain, change of erogenous zones, bladder and bowel incontinence, acceptance of disability, adjusting to their "new" body, positions, fear of sexual activity may cause further injury, what is sexuality apart from penile–vaginal intercourse?

Evaluation of pressure-relieving support systems for prophylaxis and therapy of pressure ulcers

P. Felleiter, T. Hansen, M. Baumberger

Pressure ulcers are one of the most frequent complications of immobilized patients. Treatment lasts long, is difficult, and expensive. We evaluated pressure-relieving equipment for prophylaxis and therapy of pressure ulcers with a number of tests. Among the parameters to be measured experimentally, temperature, humidity, shear and pressure forces are the most essential. Here we report our results of the pressure measurements. We compared 20 different pressure-relieving support systems available in Switzerland. Among others, we measured pressure under 3 subjects in different weight classes (50, 75 und 105 kg) using interface pressure mapping (Vista Medical, Winnipeg, Canada) with an array of 1024 points. The sampled data were divided into 11 categories and compared. Huge differences were found between the various pressure relieving systems, which were again varying distinctively between the 3 weight classes. The examples show the pressure distribution under a heavyweight subject on a good system and a lightweight subject on a bad system:

Although surface pressure is only one of the risk factors influencing pressure ulcers, choosing an optimal pressure-relieving support system for the individual patient should be considered carefully.

Respiratory function in persons with a Spinal Cord Injury one year after inpatient rehabilitation

Gabi Mueller, S. de Groot, L. H. V. van der Woude, M. T. E. Hopman

Purpose: To describe respiratory function in subjects with spinal cord-injury (SCI) one year after discharge from inpatient rehabilitation and to analyze possible associations between these outcome measures and lesion (level and completeness) and personal (gender, age, height, weight and smok-ing) characteristics.

Methods: Forced vital capacity (FVC), forced inspiratory and expiratory volume in 1s (FEV1) and peak inspiratory and expiratory flow (PEF) of 129 participants were assessed in a cross-sectional multi-center study. Peak in- and expiratory muscle strength (Pemax) was measured in a subgroup of 41 participants. Associations between respiratory function and personal and lesion characteristics were evaluated with multilevel regression analyses.

Results: FVC and FEV1 showed values around 100% of able-bodied predicted values. PEF values were markedly below reference values for able-bodied individuals. Pemax showed the highest limita-tion with values between 15 and 43% of able-bodied predicted values. Subjects with paraplegia showed higher lung function values than subjects with tetraplegia. Age, gender and height had sig-nificant influences on lung function parameters in subjects with SCI.

Conclusions: PEF and Pemax – important for airway clearance – are most severely affected by a SCI. Therefore, special attention should be given to the expiratory muscle function in subjects with SCI.

Neurogenic detrusor overactivity: comparison between complete and incomplete spinal cord injury pati

Dr. Sasa Moslavac, I Dzidic, Z Kejla

Objectives: To compare intravesical pressure and cystometric capacity in complete and incomplete SCI (spinal cord injury) patients with neurogenic detrusor overactivity.

Patients and methods: Filling cystometry at non-physiological filling rate was performed in 147 SCI patients at rehabilitation or annual check-up using Dantec Etude urodynamic machine.

Results: 147 (119 male, 28 female) SCI patients underwent cystometry and eighty (50 ASIA A, 30 ASIA B-E) were diagnosed with neurogenic detrusor overactivity, all of these with suprasacral level of injury. Mean Pves at cystometric capacity for ASIA A group was 79 ± 30 cmH₂O (range 26–140) and mean Pves for ASIA B-E group was 70 ± 29 cmH₂O (range 25–130). There was no significant difference between groups ($p=0.234$). Mean CC for ASIA A group was 239 ± 107 ml (range 47–526) and mean CC for ASIA B-E group was 227 ± 125 ml (range 42–500). Again, no significant difference was found ($p=0.655$).

Discussion: No difference in cystometric capacity and leak point pressure at terminal detrusor overactivity was shown between complete and incomplete spinal cord injury patients in our survey i. e. represented findings are equally unfavourable for both groups.

Conclusions: Incomplete SCI patients with NDO should be tested with cystometry and observed with same caution as we proceed in complete SCI patients.

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Urodynamic results and patient satisfaction following sphincterotomy in spinal cord injuries

F. Derry, W. Khaliq

Aim: External sphincterotomy is a recognised method of management of the neurogenic bladder in SCI patients. The study aims at establishing whether there is a perceived reduction in patients opting to undergo the procedure.

Materials and methods: Included patients had pre-operative and post-operative video-urodynamic studies and Mag 3 renograms. Both investigations were compared. A simple 8 item questionnaire based on SF36 was sent to all the patients included in the study.

Results: 49 patients who underwent sphincterotomy were included in the study. 21 were primary procedures, 28 were secondary redo procedures. The average post sphincterotomy voiding pressure and residual volumes were significantly reduced after primary procedures. There was no significant difference in either following secondary procedures. There was a significant reduction in procedures carried out in later years. There was significant patient satisfaction post primary sphincterotomy.

Discussion: Sphincterotomy achieves its objectives but this may not in the long term meet with patients' satisfaction. Alternative more convenient methods of management are becoming more popular.

Conclusions: Sphincterotomy is a safe and effective procedure in SCI men. However, it is important to consider the social and physical states of the patients in a careful selection process to avoid poor outcome.

An evaluation of physical interventions for bowel management after SCI using anorectal manometry

M. Coggrave, C. Norton, J. Wilson-Barnett

Aim: The significant impact of neurogenic bowel dysfunction and its management on morbidity and quality of life after spinal cord injury (SCI) is increasingly recognized. Our understanding of the available interventions is limited. In this study anorectal manometry was used to examine the effectiveness of physical interventions for bowel management and to explore the relationship between residual bowel function and interventions used for bowel management after SCI.

Methods: An assessment of current bowel management and an anorectal manometry protocol were undertaken with 164 SCI individuals (median age 52 years, range 22–81 years, median duration of injury 16 years, range 1–51 years) of varying level and density of injury.

Results: Skin stimulation did not produce an effective response (defined as rising rectal pressure, falling anal pressure), anorectal stimulation produced this response in only 54% of individuals with reflex bowel function. Abdominal massage produced a response possibly indicating increased colonic activity in 98% of individuals. There was no association between baseline manometry, responses to interventions and individual and injury characteristics and the bowel management employed by participants.

Conclusions: Anorectal stimulation may not be effective in all individuals with reflex bowel function; abdominal massage merits further examination. The lack of any relationship between manometry findings and bowel management interventions suggests that manometry alone is not sufficient to determine optimal bowel care.

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P95

SCI and bladder dysfunctions. A practical web site for health care personel

Jorid Tvedt, Ingeborg Barland Linnerud, Marianne Holth

The Urodynamic Laboratory at Sunnaas Hospital in cooperation with Astra Tech have drawn up a Web site. The purpose is to increase the access of information to health workers about spinal cord injured patients and bladder dysfunctions. This is a float chart which can be used by anyone working with SCI patients, who needs to know more about bladder dysfunctions, investigations and treatments. Just by pressing a button, further information will be provided.

The purpose of this project is to see if an easier way of getting relevant and thorough knowledge about SCI patients and bladder dysfunctions, might have a positive effect on the frequency of complications connected to bladder dysfunctions in the SCI population. The site will be accesssable to the public from March 2007. For the time being, it is too early to present the results of this work, but we will take the opportunity to come back with this later on.

P96

Bowel function before and after Sacral Anterior Root Stimulator (SARS) Implant

M. Vallès, A. Borau, A. Rodríguez, JL Gago, J. Vidal, F. Mearin

Introduction: Sphincter dysfunction is a key problem after spinal cord injury (SCI). Some patients receive SARS implant for neurogenic bladder treatment. SARS also affects bowel function.

Aim: To evaluate bowel function before and after SARS implant.

Patients and Methods: 18 SCI patients with SARS implant were evaluated (9 men/9 women, mean age at implant: 39 years), 4 tetraplegia/14 paraplegia, 14 ASIA A/1 B/3 C. A personal structured interview regarding bowel programme were performed: dietary changes, use of laxatives, defecatory method, bowel movements characteristics (frequency, time required), constipation (Rome II criteria) and fecal incontinence (Wexner Score). The interview was performed before and at one year after SARS implant. An evaluation of patient satisfaction with SARS at one year was also performed.

Results: After SARS implant patients had more frequent bowel movements and need less bowel methods to evacuate ($p < 0.05$). The prevalence of constipation and fecal incontinence were not different than before SARS implant. All patients less one were satisfied with SARS implant. About bowel management 12 patients feel better, 2 equal and 4 worse.

Conclusions: SARS implant produces changes in bowel function and most patients are satisfied with them, but it is necessary to study SARS effects on bowel function.

P97

Surface-EMG of the pelvic floor muscles among patient with incomplete SCI

Savolainen S

Pelvic floor muscle (PFM) surface – EMG (sEMG) evaluation is a common method to diagnose incontinence, but rather seldom used for neurogenic incontinence. The purpose of the study was to clarify the use of sEMG to identify those incomplete SCI patients, who may benefit from PFM therapy. A total of 58 individuals with incomplete spinal cord injuries (ASIA C and D) were evaluated: 37 were males and 21 females, age between 16–71 years. The sEMG-data was gathered using intra-anal or -vaginal surface electrodes in sitting-position and the structured questionnaire was completed.

High constant or high peaks sEMG-activation amplitudes seemed to correlate most with incontinence. Patients, less than one year from SCI, seemed to have more constant and high peaks on sEMG. They seemed to have spasticity, urinary tract infection and residuals over 100 ml more often.

The data shows that sEMG-evaluation can identify certain group of incomplete SCI patients with incontinence. Hypothetically the SCI patients with high sEMG activity may be helped by relaxation training.

Minimal invasive surgical treatment of haemorrhoids

K. Gstaltner, H. Rosen, J. Hufgard, K. Schrei

Purpose: In paralysed patients who are suffering from haemorrhoids we can see a high frequency of local irritations and bleeding caused and aggravated by the faecal incontinence. This means an alarming and frightening situation for the patient and his nurse. Furthermore some patients describe uncomfortable sensations during the period of defecation which increase with the grade of the haemorrhoids. Additionally we can often see a prolongation of the duration of defecation and in some cases local, perianally situated skin diseases like ulcerations. The traditional methods of the haemorrhoidectomy are not really suitable in paralysed patients. Therefore we are looking for alternative methods.

Methods: Nowadays we offer a minimally invasive method for the therapy of the haemorrhoids. With the use of a special rectoscope, which is combined with an ultrasound-probe, we can locate, overedge and ligate the haemorrhoidal-arteries. As a result we can see a hypocirculation and degeneration of the haemorrhoids within 4 to 6 weeks. In case of grade 3 and 4 haemorrhoids we can offer a recto-anal-repair together with the gathering up of the mucosa.

Results: Until now we have performed 20 operations without any complications. In all patients we could see an effective downgrading of the haemorrhoids. In 2 cases a perianal decubitus healed rapidly and 3 times we could see an impressive reduction of the required defecation time.

Conclusions: The ligature of the haemorrhoidal arteries is an effective and low risk method to treat haemorrhoids in patients suffering from spinal cord injury.

Subject demographics in a phase II, randomized, controlled trial of autologous macrophage injection

L. Jones, D. Lammertse, S. Charlifue, D. Poonian, D. Main, D. Snyder

This presentation describes subject demographics in a multi-center international acute SCI trial (2003–2006). Comparisons are made to the Sygen trial (1992–1997) and the most recent published figures from the National Spinal Cord Injury Data Base (NSCID), 2000–2003. Subjects were enrolled at 6 participating centers. Relevant inclusion criteria were: neurologically complete SCI within 14 days, traumatic, non-penetrating, single lesion SCI (≥3 cm hemorrhage on MRI), ages 16–65. In the 50 randomized subjects, the vertebral level of injury spanned from C5-T11, with a mode of C6-7 (14/50 subjects). Screening MRIs were taken on average day 2.8 following injury, 59.2% were pre-operative and demonstrated a mean hemorrhage length of 1.9 cm. Spine surgery occurred in 47 subjects prior to trial enrollment. Steroids were administered in 45 subjects, 5 either did not receive steroids or the information was not known.

| Comparisons to Sygen and NSCID for the 50 Enrolled Subjects (%) | | | |
|---|-------|------|------|
| Macrophage Sygen | NSCID | | |
| Male | 82.0 | 80.1 | 78.2 |
| Age (yrs) | 28.2 | 32.6 | 38.0 |
| Caucasian | 96.0 | 69.6 | 67.4 |
| Motor vehicle crash | 58.0 | 54.1 | 50.4 |

The demographics for this study more closely resemble the Sygen study than recent NSCID data and may provide a snapshot of practice patterns and demographics for trials with similar inclusion/exclusion criteria.

P100

Intrathecal baclofen improves lung function in tetraplegic patients

Skoog B, Rutberg, L and Karlsson AK

We report three male tetraplegic patients who after intrathecal baclofen improved their lung function. The first patient with a traumatic complete C5 lesion whose baclofen pump had to be removed due to infection, developed desaturation and pneumonia. Forced vital capacity (FVC) sitting was 0,9L. Three weeks of infusion (final rate 4,5 fŸg/h) improved his FVC by 60% and he recovered from pneumonia, could be decannulated and was released. The second patient with a traumatic complete C5 lesion had developed severe thoracic spasticity and respiratory insufficiency five months after the accident (FVC supine 1,5L). Four months of baclofen (final rate 10,6 fŸg/h) increased his supine FVC by 50%. The third patient with a spinal tumor removed from C1–C7 and an incomplete spinal lesion had developed thoracic spasticity and respiratory insufficiency two months after surgery (FVC supine 1,0L, sitting 2,45L). After two weeks with baclofen (3,5 fŸg/h) the sitting FVC had increased by 30%. After 7 months the FVC had increased further (supine 2,1L and sitting 2,3L, final infusion rate 5,8 fŸg/h). Thus thoracic spasticity demanding intrathecal baclofen should be considered in tetraplegic patients with respiratory problems. Even small doses of baclophen may improve respiratory function.

P101

Multi-Resistant *Acinetobacter Baumannii* Outbreak at a National Spinal Injuries Centre

J C O'Driscoll and A Jamous

Seven patients were identified as having Multi-Resistant *Acinetobacter baumannii* resistant to carbapenem antibiotics (MRAB-C) in July and August 2005. Five were considered to have acquired the organism at Stoke Mandeville Hospital; the others were colonised on admission. Analysis by Pulsed-Field Gel Electrophoresis revealed the five Stoke Mandeville isolates to be identical, being OXA-23 Clone 1.

Four of the five patients were on two wards, ie limited secondary spread had occurred twice. The fifth patient's strain was identified when on the hospital's ITU, this patient having been visited by staff from the National Spinal Injuries Unit.

The main factors that facilitated spread were contamination of the environment and sub-optimal infection control practices by healthcare workers (including hand hygiene and glove use).

The Outbreak was quickly brought under control by a multifaceted approach including reinforcement of good hand hygiene practices, strict isolation of colonised and infected patients, rigorous control of antibiotic use, and enhanced cleaning.

Only two patients had clinical infections (urinary tract infections); the others were colonised only. Both urinary tract infections were successfully treated using oral minocycline.

P102

Development of scoliosis as a function of SCIWORA in pediatric-onset SCI

PF Sturm, M McNitt, LC Vogel

Objectives: Identify the incidence of scoliosis in children with spinal cord injuries (SCI) as a function of spinal cord injury without radiographic abnormalities (SCIWORA).

Design: Retrospective record review

Participants/methods: Subjects were injured prior to 18 years of age and were followed for at least 2 years and were skeletally mature at last follow-up.

Results: Of 199 subjects, 13% had SCIWORA with a mean age at injury of 7.9 years; 77% had scoliosis with a mean age of 7.4 years at injury compared to 9.8 years for those not developing scoliosis. The 173 subjects without SCIWORA had a mean age at injury of 13.6 years; 34% had scoliosis with a mean age of 10.6 years at injury compared to 15.1 years for those not developing scoliosis. Incidence of scoliosis was significantly greater in those with SCIWORA (77% vs. 34%; $\chi^2 = 17.86$, $p = 0.001$). Among those developing scoliosis, there was not a significant difference in requiring corrective spine surgery among those with or without SCIWORA (65% vs. 42%; $\chi^2 = 3.484$, $p = 0.175$). Using multiple regression analysis, only age at injury was associated with scoliosis.

Conclusions: Although subjects with SCIWORA have a higher incidence of scoliosis, it is not a risk factor when age at injury is accounted for.

P103

Spinal deformities with pediatric onset Spinal Cord Injuries

B Erhan, B Gunduz, S Baran, B Akyurek, AL Aydın

Objectives: To determine the frequency of spinal deformities in adults with pediatric-onset spinal cord injuries (SCI) and to investigate the relationship with several factors like demographic characteristics, duration of injury and lesion level and severity.

Methods: Fourteen patients who sustained SCI at or before age 18 years were included the study. The patients were examined and classified according to ASIA 2002 Standarts; the spine was evaluated for deformities in the patients habitual posture and any deviations from normals were recorded. Also the anteroposterior and lateral plain x-rays including the vertebrae between T2-S1 were obtained to examine the deformities.

Results: The mean age of the patients were 30 ± 8 years, age at the time of the injury was 14 ± 3 years. The median of time since injury was 168 months (range 48–396 months). Five patients had tetraplegia and 9 paraplegia. According to etiology only 2 patients were atraumatic, 12 were traumatic. Spinal deformity was seen in 9 patients on examination and 6 patients on x-rays.

Conclusions: Spinal deformities are common among adults with pediatric-onset SCI. The role of demographic factors, duration of injury, lesion level in revealing spinal deformity are not clear in this small group of patients.

P104

SCIWORA and failed back surgery syndrome – How accurate and useful are these terms?

S Kolli, C Inman, R Nannapaneni

Spinal cord injury without radiological abnormality (SCIWORA) and failed back surgery syndrome are misnomers and not relevant in modern day clinical management. They are unhelpful terms both for clinicians and patients.

Objective: To review the terms SCIWORA and Failed back surgery syndrome and suggest a revision in their terminology.

Material and methods: We reviewed 410 published cases of literature on SCIWORA. Every patient had no X-ray abnormality but had MRI abnormality either in the form of extra neural (haematoma, disc prolapse) or neural (haemorrhages, edema or both) abnormality at variable times from the onset of injury. Failed Back surgery syndrome is described in literature affecting around 5–10 % of patients following lumbar surgery. It incorporates features of radicular pain, axial pain and neuropathic pain unexplained even with investigations like CT scan or MRI. In most cases it is neither the surgeons nor the patients fault and the term is misleading and un-helpful.

Conclusion: The term SCIWORA is no longer useful as these injuries can be seen on MRI at some stage, even though occult initially. It seems more rational to replace this with the new term 'occult spinal injury'. This would both increase awareness amongst clinicians to perform an initial MRI scan and would highlight ligamentous injury as a cause of clinical spinal cord injury. Failed back surgery syndrome is a blanket term which confers the wrong impression that the cause is either a faulty surgeon or an unfortunate patient – neither of which is necessarily true. It would be more prudent to replace the term with 'occult back pain syndrome'.

P105

Olfactory mucosa autograft – preliminary results 18 months after surgery

A. Lopes, M. Sizenando, F. Martins

ABSTRACT WITHDRAWN

P106

Rehabilitation goals after baclofen pump implantation in patients with multiple sclerosis

K Petropoulou, C-A Rapidi, M Fragkaki, M Venieri, E Kandylakis, V Kallinikos

Aim: To study the functional outcome after spasticity treatment with intrathecal baclofen.

Patients – methods: Between 2000–2006, 8 out of 100 patients with multiple sclerosis (MS) treated in our department, with intractable, severe, generalized spasticity underwent baclofen pump implantation (BPI); 3 males, 5 females; mean age 45.6 years.

Baclofen pump was considered the optimal therapeutic approach for spasticity related to difficulties of caregivers during ADL, improper posture at sitting position, involuntary muscles contractions (IMC), sleep disturbances, reduction of pROM and increased risk of contractures and pain syndrome.

Results: Average follow-up time post BPI: 3.6 years. Mean daily dose: 191 ig. After BPI, all patients remained dependent for ADL. In all patients, spasticity was significantly reduced (mAshworth Scale score: 1–2). Difficulties of caregivers during ADL in all patients, IMC reported by 3 patients, sleep disturbances by 6 patients and pain syndrome by 3 patients, were reduced. pROM and posture at sitting position improved in all patients.

Conclusion: MS patients in chronic stage, with severe, generalized spasticity benefit from BPI in proper sitting positioning, mobilization, and quality of life. BPI also helps caregivers in daycare.

P107

Therapeutic outcome after baclofen pump implantation in patients with spinal cord lesion

C-A Rapidi, K Petropoulou, M Fragkaki, M Venieri, A Papasotiropoulos, N Barotsis

Aim: To study the impact of intrathecal baclofen (ITB) in spasticity due to spinal cord lesion (SCL).

Patients – methods: Between 2000–2006, 9 out of 287 patients with SCL and intractable, generalized spasticity underwent baclofen pump implantation (BPI) ; 5 males, 4 females; 6 traumatic, 3 non-traumatic; ASIA A: 3 , C: 5, D: 1 patient; mean age : 33.3 years. BPI was considered the optimal therapeutic approach when severe spasticity resulted in increased risk of falls due to involuntary muscles contractions (IMC), sleep disturbances, pain syndrome, difficulties in ADL and ambulation.

Results: Average time of: (a) BPI post lesion: 3.9 years, (b) follow-up period: 2.7 years. Mean duration of post BPI rehabilitation program: 3.5 months. Spasticity (9/9), IMC (5/9), sleep disturbances (5/9), pain syndrome (3/9) and difficulties in ADL (6/9) were reduced. Before BPI, one patient had therapeutic and one functional ambulation. Post BPI, 5 patients achieved therapeutic ambulation and 2 functional.

Conclusion: In severe generalized spasticity due to SCL, BPI therapy is the optimal therapeutic method to achieve a functional level of spasticity, for improvement of motion and functional outcome. Selection criteria for BPI depend on rehabilitation goals.

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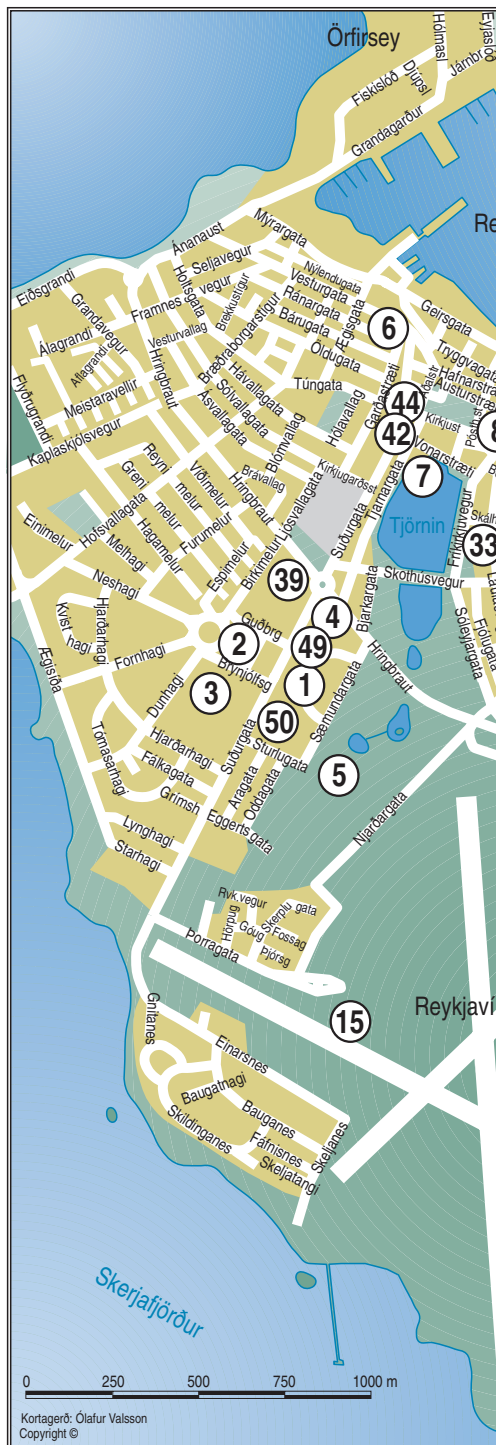
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