

48th ISCoS ANNUAL SCIENTIFIC MEETING

21-24 October 2009

Congress Center
Piazza Adua,1 - Firenze (Italy)

UNDER THE HIGH PATRONAGE OF
The President of the Italian Republic

PATRONAGES
University of Florence
Tuscany Region
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IN COLLABORATION WITH
Società Medica Italiana Paraplegia (SoMIPar)

Azienda Ospedaliero-Universitaria Careggi
Agenzia Regionale per la cura dei Medullolesi
Unità Spinale Firenze
Neuro-Urologia Firenze

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WELCOME ADDRESS



Dear Colleagues and Friends,

It has been extremely exciting to be at the centre of the spinal cord lesion community while organising the 48th International Meeting of ISCoS. It has been a great challenge, but it was much easier with the help of the ISCoS guidelines on one hand and the collaboration of Susie Charlifue, chair of the Scientific Committee, on the other.

Marianne Bint, Raffaella, my wife, Bernardo and Thomas, my sons, Giulio del Popolo, co-chairman of the congress, and Ornella Sessa, were so precious that nothing would have been possible without their support.

This year the main topics are: management of spasticity, spinal lesions in children, new treatments of pressure ulcers, outcome prediction and measurement and urinary incontinence.

The scientific sessions will be preceded by several pre-meeting workshops aimed to give to the delegates the opportunity to deepen their knowledge of the topics that will be discussed during the following 3 days. Other workshops are also scheduled during the three day scientific meeting. They will be held by outstanding clinicians and the most brilliant researchers engaged in those fields.

John Ditunno, during the opening ceremony, will enlighten us with the Sir Ludwig Guttmann lecture titled "Outcome Measures: Evolution in Clinical Trials" and Wagih El Masry, president of ISCoS, will open the scientific sessions with a lecture titled "Past, present and Future of ISCoS: da piccola ghianda a grande quercia".

Among the other lecturers, I would like to mention Jacopo Bonavita who, on behalf of SoMIPar, will present the clinical guidelines for the management in the first month following the spinal injury proposed by the Italian Scientific Society of Spinal Cord.

Out of the several symposia, I want to underline the "Advanced Research Symposium" that will be held in the Auditorium on Friday 23rd. It will focus on the pharmacological, cell therapy and rehabilitation interventions aimed at neural repair. It will be immediately followed, in the Sala Verde, by a free papers session that will include the presentations of some of the clinical trials mentioned before.

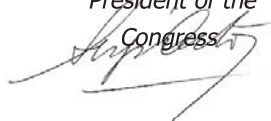
Nine free paper sessions and 186 selected posters, displayed in dedicated area at the Congress Hall, will enrich the program.

The best posters and oral communications will be awarded during the closing ceremony.

I want to thank from the bottom of my heart the ISCoS board that gave me this opportunity, all the delegates, all those who helped and supported me during this mission, all the chairs and invited speakers who accepted to enrich our program for workshops, symposia and scientific sessions, even without any financial support, and all the sponsors who helped us hold the 48th annual scientific meeting.

I am delighted to welcome all of you in beautiful and artistic Florence in the spirit of friendship that has always characterised the annual ISCoS meetings, and wish you and your accompanying guests a wonderful stay in Italy, enjoying our culture, and, hopefully, our sweet October weather. I look forward to meeting you during the congress and to being together at the gala dinner on Friday evening, where we will enjoy good food, good wine and beautiful live music.

Sergio Aito
President of the
Congress

A handwritten signature in black ink, appearing to read 'Sergio Aito', is written over the printed name and title.

Dear Friends & Colleagues,

I should like to welcome all members of ISCoS and SoMIPar, as well as all delegates, to the 48th Annual Scientific Meeting of the International Spinal Cord Society here in the beautiful city of Firenze, one of Italy's most exhilarating, distinctive and impressive cities .



Members of ISCoS and its National and Regional Societies have come from the five Continents to further enhance our philosophy of comprehensive and holistic management as well as exchange clinical experience, knowledge and research findings in the various intricate and complex aspects of traumatic and non-traumatic spinal cord paralysis.


Our Scientific Committee and our Host Organising Committee have arranged an impressive Scientific Programme and a number of Workshops which again have proved popular.

I am certain the scientific material will contribute to the enhancement of our clinical practice and will undoubtedly in time help improve the lives of our patients. I am equally confident the social events will be most enjoyable and memorable.

I would like to thank you all for your attendance and the sponsors for their support to our 48th Annual Scientific Meeting.

I hope you will all have a very good time.

Vi auguro tutto il meglio.


Wagih El-Masry
President, ISCoS

COMMITTEES AND ORGANIZERS

ISCOs COMMITTEES

President

Wagih El-Masry (UK)

Past President

William Donovan (USA)

President Elect

Fin Biering-Sørensen (Denmark)

Honorary Secretary

Shinsuke Katoh (Japan)

Honorary Treasurer

Martin McClelland (UK)

Editor of SPINAL CORD

Jean-Jacques Wyndaele (Belgium)

Vice Presidents

Europe: *Sergio Aito (Italy)*

Latin America: *Julia Maria D'Andrea Greve (Brazil)*

SE Asia: *Fazlul Hoque (Bangladesh)*

Africa: *Robert Campbell (South Africa)*

Oceania: *Stella Engel (Australia)*

Committees Chairs

Education: *Harvinder S. Chhabra (India)*

Nominations: *Wagih El-Masry (UK)*

Prevention: *Douglas Brown (Australia)*

Scientific: *Susie W. Charlifue (USA)*

Scientific Secretariat

Marianne Bint (Stoke Mandeville, UK)

ISCOs Affiliated Societies	Representatives Council ISCoS
American Paraplegia Society	I. Perlash (USA)
American Spinal Injury Association (ASIA)	A. Jackson (USA)
Association Francophone Internationale des Groupes d'Animation de la Paraplégie	M. Ventura (Belgium)
Australian and New Zealand Spinal Cord Society	T. Geraghty (Australia)
Deutschsprachige Medizinische Gesellschaft für Paraplegie	Frank Rainer Abel (Germany)
Dutch Flemish Spinal Cord Society	G. Snoek (Netherlands)
Latin American Society of Paraplegia	Julia Maria D'Andrea Greve (Brazil)
Nordic Spinal Cord Society	S. Yngvason (Iceland)
Società Medica Italiana di Paraplegia	C. Pilati (Italy)
Southern African Spinal Cord Association	E. Baalbergen (South Africa)
Spanish Society of Paraplegia	J. Vidal Samso (Spain)
Spinal Cord Society - Indian Chapter	H. S. Chhabra (India)

48TH ANNUAL SCIENTIFIC MEETING

President

Sergio Aito

Co-Chairman

Giulio Del Popolo

ISCoS Scientific Committee

- Susie Charlifue - Chair
- Sergio Aito
- Ed Baalbergen
- Fin Biering-Sørensen
- Douglas J. Brown
- Amiram Catz
- Harvinder S. Chhabra
- John F. Ditunno
- Wagih El-Masry
- Hans L. Frankel
- Amie Jackson
- Gordana Savic
- John Steeves
- Jean-Jacques Wyndaele
- Stefan Yngvason

Host Scientific Committee

- Sergio Aito (Chair - Florence)
- Sauro Biscotto (Perugia)
- Giuliana Campus (Cagliari)
- Adriana Cassinis (Milan)
- Maria Chinnici (Palermo)
- Feliciana Cortese (Vicenza)
- Giulio Del Popolo (Florence)
- Mario De Gennaro (Rome)
- Giuseppe De Scisciolo (Florence)
- Mauro Menarini (Montecatone, Imola)
- Giovanni Mosiello (Rome)
- M. Cristina Pagliacci (Perugia)
- Claudio Pilati (Rome)
- Tiziana Redaelli (Milan)
- Giorgio Scivoletto (Rome)
- Mariangela Taricco (Bologna)
- Agostino Zampa (Udine)

Local Organizing Committee

- Daria Almesberger
- Imma De Vivo
- Francesca Del Corso
- Valentina Di Donna
- Vincenzo Li Marzi
- Vivana Marcellino
- Livia Tucci

Scientific Secretariat

Marianne Bint (Stoke Mandeville, UK)

Organizing Secretariat



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SOMIPAR

SOCIETÀ MEDICA ITALIANA PARAPLEGIA

Italian Medical Society of Spinal Cord Injury

GUARDIAMO LONTANO.
WE LOOK FAR

www.somipar.it

PROGETTO GRAFICO: INTERACTIVE&DESIGN.COM

PROSSIMO CONGRESSO
NEXT MEETING

18 - 20 MARZO 2010
SAN PAOLO PALACE HOTEL - PALERMO
March 18th - 20th, 2010

PER INFORMAZIONI / FOR INFORMATION:

MY MEETING S.R.L.

Tel. +39 051 796971 - Fax +39 051 795270

E-mail: info@mymeetingsrl.com

Web: www.mymetingsrl.com



ISCoS SOCIETY MEDAL HOLDERS

1975/1976	Sir Ludwig GUTTMANN	(UK)
	Dr Ernest BORS	(USA)
1978	Dr L. MICHAELIS	(UK)
	Sir George BEDBROOK	(Australia)
1979	Dr Marc MAURY	(France)
1980	Dr J. S. YOUNG	(USA)
1981	Dr A. G. HARDY	(UK)
1982	Prof Fred MEINECKE	(Germany)
1983	Prof Hans FRANKEL	(UK)
1984	Dr Y. NAKAMURA	(Japan)
1985	Dr M. WEISS	(Poland)
	Mr Phillip HARRIS	(UK)
1986	Dr H. HAHN	(USA)
1987	Prof Alain ROSSIER	(Switzerland)
1988	Dr Al JOUSSE	(Canada)
1989	Mr J. COSBIE ROSS	(UK)
1990	Dr Paul DOLLFUS	(France)
1991	Dr Ed CARTER	(USA)
1992	Dr A. KEY	(South Africa)
1993	Air Marshal (Rtd) Amar CHAHAL	(India)
1994	Mr Isaac NUSEIBEH	(UK)
1995	Dr Avrom E COMARR	(USA)
1996	Dr Guido ZÄCH	(Switzerland)
1997	Prof Helmut MADERSBACHER	(Austria)
1998	Prof Takaaki IKATA	(Japan)
1999	Dr William GEISLER	(Canada)
2000	Prof John YEO	(Australia)
2001	Prof Jean Jaques WYNDAELE	(Belgium)
2002	Mr Wagih EL-MASRY	(UK)
2003	Prof Giles BRINDLEY	(UK)
2004	Prof William DONOVAN	(USA)
2005	Dr Ray SHROSBREE	(South Africa)
2006	Dr Lee ILLIS	(UK)
2007	Dr Fin BIERING-SØRENSEN	(Denmark)
2008	Dr John F. DITUNNO	(USA)

INVITED SPEAKERS AND CHAIRS

Aito Sergio	<i>Italy</i>	Ditunno John F.	<i>USA</i>
Alexander Sipski Marcalee	<i>USA</i>	Donovan William	<i>USA</i>
Anderson Kim	<i>USA</i>	Dugger Cathi	<i>USA</i>
Augutis Marika	<i>Sweden</i>	El Masry Wagih	<i>UK</i>
Bambagioni Lucia	<i>Italy</i>	Ellaway Peter	<i>UK</i>
Bassetto Franco	<i>Italy</i>	Elliott Stacy	<i>Canada</i>
Bazzocchi Gabriele	<i>Italy</i>	Engel Stella	<i>Australia</i>
Becker Clemens	<i>Germany</i>	Eriks-Hoogland Inge	<i>Switzerland</i>
Betz Randal R.	<i>USA</i>	Failli Vieri	<i>Italy</i>
Biering Sørensen Fin	<i>Denmark</i>	Finazzi Agrò Enrico	<i>Italy</i>
Biscotto Sauro	<i>Italy</i>	Fitzharris Michael	<i>Australia</i>
Bodley Roger	<i>UK</i>	Fleuren Judith	<i>The Netherlands</i>
Bonavita Iacopo	<i>Italy</i>	Frankel Hans	<i>UK</i>
Brix Finnerup Nanna	<i>Denmark</i>	Giannantoni Antonella	<i>Italy</i>
Brown Douglas	<i>Australia</i>	Gracies Jean-Michel	<i>France</i>
Bums Stephen	<i>USA</i>	Graham Allison	<i>UK</i>
Carbone Antonio	<i>Italy</i>	Harvey Lisa	<i>Australia</i>
Carletti Mario	<i>Italy</i>	Hartley Cindy	<i>USA</i>
Castro-Diaz David	<i>Spain</i>	Hoque Fazlul	<i>Bangladesh</i>
Catz Amiram	<i>Israel</i>	Hughes Richard	<i>UK</i>
Caviccholi Andrea	<i>Switzerland</i>	Hultling Claes	<i>Sweden</i>
Charlifue Susie	<i>USA</i>	Ieracitano Vincenzo Maria	<i>Italy</i>
Chhabra Harvinder S.	<i>India</i>	Jackson Amie	<i>USA</i>
Cogswell Michael	<i>UK</i>	Jamous Ali	<i>UK</i>
Craggs Michael	<i>UK</i>	Katoh Shinsuke	<i>Japan</i>
Curt Armin	<i>Switzerland</i>	Kennedy Paul	<i>UK</i>
D'Andrea Greve Maria Julia	<i>Brazil</i>	Kennelly Michael	<i>USA</i>
De Gennaro Mario	<i>Italy</i>	Kisser Rupert	<i>Austria</i>
de Groat William C.	<i>USA</i>	Knútsdóttir Sigrún	<i>Iceland</i>
De Jong Cornelh	<i>South Africa</i>	Krassioukov Andrei	<i>Canada</i>
De Scisciolo Giuseppe	<i>Italy</i>	Krogh Klaus	<i>Denmark</i>
De Vivo Michael J.	<i>USA</i>	Lazzeri Massimo	<i>Italy</i>
Del Popolo Giulio G.	<i>Italy</i>	Liong Wei Chuen	<i>UK</i>
Denys Pierre	<i>France</i>	Manera Marina	<i>Italy</i>

Marino Ralph	<i>USA</i>	Roser Florian	<i>German</i>
Marquez Maru	<i>Italy</i>	Rossetti Daniela	<i>Italy</i>
McClelland Martin	<i>UK</i>	Rossi Gabriella	<i>Italy</i>
Meagher Tom	<i>UK</i>	Savic Gordana	<i>UK</i>
Menarini Mauro	<i>Italy</i>	Schwab Jan	<i>Germany</i>
Middleton James	<i>Australia</i>	Scivoletto Giorgio	<i>Italy</i>
Molinari Marco	<i>Italy</i>	Scott Taylor Julian	<i>Spain</i>
Moscato Tancredi Andrea	<i>Italy</i>	Snoek Govert J.	<i>The Netherlands</i>
Mulcahey Mary Jane	<i>USA</i>	Soni Bakul M.	<i>UK</i>
Murray Herndon	<i>USA</i>	Spinelli Michele	<i>Italy</i>
Nene Anand	<i>The Netherlands</i>	Steeves John	<i>Canada</i>
Newton Dennis	<i>USA</i>	Stöhrer Manfred	<i>Germany</i>
Nobile Alberto	<i>Italy</i>	Taricco Mariangela	<i>Italy</i>
Norrbrink Cecilia	<i>Sweden</i>	Townson Andrea F.	<i>Canada</i>
Ottonello Manlio	<i>Italy</i>	Valsecchi Laura	<i>Italy</i>
Pagliacci Cristina	<i>Italy</i>	van Hedel Hubertus	<i>Switzerland</i>
Pandy Marcus	<i>Australia</i>	Violante Francesco Saverio	<i>Italy</i>
Pannek Jürgen	<i>Switzerland</i>	Vogel Lawrence	<i>USA</i>
Pesce Francesco	<i>Italy</i>	von Groote Per Maximilian	<i>Switzerland</i>
Pignotti Paola	<i>Italy</i>	Waring William P.	<i>USA</i>
Pilati Claudio	<i>Italy</i>	Warwick Rowena	<i>UK</i>
Privat Alain	<i>France</i>	Weerts Eric	<i>Belgium</i>
Rauch Alexandra	<i>Switzerland</i>	Wing Peter	<i>Canada</i>
Redaelli Tiziana	<i>Italy</i>	Wyndaele Jean-Jacques	<i>Belgium</i>
Reeves Ronald K.	<i>USA</i>	Young Wise	<i>USA</i>
Spreyermann Regula	<i>Switzerland</i>		



GENERAL INFORMATION

ABOUT FLORENCE

Located on the banks of the Arno and surrounded by green hills, Florence is a unique art treasure in the heart of Tuscany. Once a Roman city, Florence developed into a medieval commune and then into an ideal Renaissance city. Each era, from the Baroque through to the 18th and 19th centuries, has left important traces.

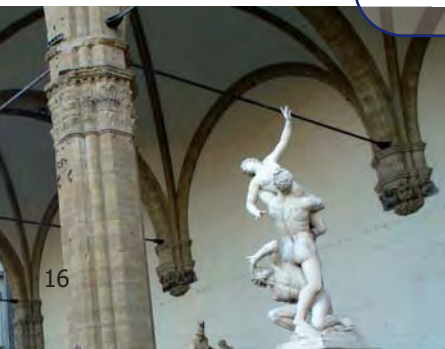
Florence is the home of Dante, Francesco Petrarca and Giovanni Boccaccio.



These writers are largely considered as the most illustrious representatives of Italian poetry and language. Artists such as Giotto, Botticelli, Luca della Robbia, and Paolo Uccello were also born and lived in Florence. Leonardo da Vinci, Michelangelo Buonarroti, Piero della Francesca and Raffaello came to Florence to learn and later teach art.

Such concentration of geniuses during the 15th century was due, as it is largely known, to the patronage of Lorenzo de' Medici (also known as the Magnificent for its buoyant funding of artists). He commissioned works of the most brilliant architects, philosophers, poets and artists of the time.

The Church of Santa Croce (down), built in 1294, is considered as the Pantheon of great Italians.





Michelangelo, Galileo, Alfieri, Machiavelli, Foscolo, Rossini and many other famed geniuses are buried in this church.

It is also an impressive piece of art: a Gothic gallery decorated with frescos by Giotto and his best followers. Its unique atmosphere is provided by the the Renaissance sculptures of Donatello, Rossellino, Desiderio and others.

Although being a site of past artistic glory, Florence is yet considered as a sophisticated town, a lively and ironic centre, eager to offer opportunities for business, knowledge and leisure. Ultimately, Florence is dynamic, innovative and avant-garde, in every occasion opened to new ideas.

Public Transports

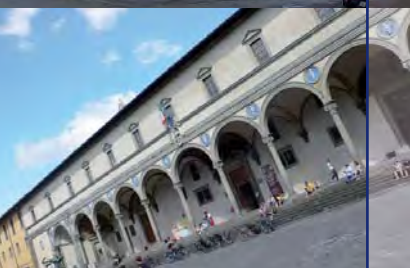
Almost all metropolitan buses stop at Piazza della Stazione (Santa Maria Novella train station), which is a short walk away from the congress venue.

In addition, a large number of bus services connect the centre of Florence to its splendid surroundings (i.e. ATAF bus n. 7 goes to Fiesole; ATAF bus n. 10 goes to Settignano, etc.). The regional coach lines (Cap, Lazzi, SITA) connect Florence to the other wonderful Tuscan towns such as San Gimignano, Pienza, Arezzo, Volterra, Forte dei Marmi, etc

Banking and Exchange Facilities

Currency in Italy is the Euro. Foreign money can be changed at banks during normal business days (9.00 am - 5.00 pm Monday - Friday) as well as at hotels, at the airport and in exchange offices. Exchange rates are set daily by the Central Bank. All major credit cards (Visa and Master Card) are accepted in most hotels, restaurants and shops. Automated bank machines are available at many points throughout the city, the railway station and at the airport.





GENERAL INFORMATION

Time

The local standard time zone in Florence is Greenwich Mean Time GMT +1 hour.

Liability

In registering for the Congress, participants agree that neither the Scientific Committee nor the Organizing Secretariat assumes any liability. Participants should therefore organize their own health and travel insurance.

Telephone - Mobile Phones

Pay phones and credit card phones are available in Florence.

The Italian country code is +39.

Participants are kindly requested to turn off their mobiles inside the Congress halls during the sessions.

Smoking Policy

The Congress wishes to be a non-smoking event. Participants are kindly requested to refrain from smoking in the Congress venues, including the Exhibition Area. We remind you that smoking in Italy is forbidden in all public areas.

Messages

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

Electricity

The electrical power supply in Florence is 220 volts. Delegates will need to bring mains adapters for powering portables, phones, toothbrushes etc. If you are using an Apple Mac laptop, please bring your dongle.



Restaurants and Tuscan Cuisine

There is a wide choice of restaurants in Florence, offering a broad spectrum ranging from excellent national cuisine to first class international dishes.

Tuscan cuisine still has its roots in peasant cooking, relying on basic staples such as olive oil, for which the region is renowned, tomatoes, beans, hams and salamis. Chewy, saltless bread or thick vegetable soups such as "ribollita" often take the place of pasta, followed by grilled or roast meats, the great stand-bys of rustic cuisine. Sheep's milk cheeses are common, especially pecorino and the creamy ricotta. Fruit or ice cream round off many meals, or try Siena nougat-like "panforte" or the famous "cantucci" accompanied by "vin santo". Tuscany is a region famous also for its wines, reds and whites ranging from table wines to wines of great prestige and universal fame. The most famous are "Brunello di Montalcino," "Nobile di Montepulciano" and Chianti, produced in the hills and bottled by the Sangiovese vineyards. Among the characteristic sweet wines is the "Vin Santo" made with raisins from Trebbiano and Malvasia, aged for several years in small casks and then bottled. If you wish to have any suggestions and reservations, please contact the desk of the Organizing Secretariat.

Tipping

Although service charge is included in most restaurants, leaving a tip at one's own discretion is appreciated. We recommend you tip 10% - tipping is quite normal in restaurants but not a requirement in bars.

Shopping

Shops open to Monday (afternoon) - Saturday at 9:00 am - 7.30 pm and Sunday at 2.00 - 7.00 pm. For Tax-Free shopping, visitors from countries outside the EEC can reclaim VAT on goods purchased in tax-free shops when leaving the country, either at the airport or at the border.

Useful numbers

Florence Airport: 0039 055 3061300

Pisa Airport: 0039 050 849300

Florence main Railway Station: 199 30 30 60 (Trenitalia)

Taxi: 0039 055 4390

CONGRESS INFORMATION

CONGRESS VENUE

Palazzo dei Congressi
Piazza Adua, 1
50123 - Firenze

The "Palazzo dei Congressi" is located in a 19th Century Villa Vittoria. The Villa was commissioned by the Strozzi family and it is situated in the centre of Florence, just a short walk from the main railway station (Santa Maria Novella) and surrounded by impressive artistic, historic and architectural landmarks.

Parking areas near Palazzo dei Congressi:

- Parcheggio Fortezza - address: Piazza Caduti nei Lager. Next to the Fortezza da Basso, a few minutes walk from Palazzo dei Congressi and Palazzo degli Affari.
- Parcheggio Santa Maria Novella - address: Piazza della Stazione. This is the underground parking lot of the Santa Maria Novella Train Station, a few steps away from the Palazzo dei Congressi, Palazzo degli Affari and Fortezza da Basso.
- Parcheggio Parterre - address: Piazza della Libertà. About 1.5 km away from Fortezza.

Registration fee includes

Name badge

Admission to all meeting sessions, poster sessions and exhibition

Access to Workshop and Symposia (according to availability)

Final Program and Abstract book

Congress bag

Access to Opening Ceremony and Welcome Reception (according to availability)

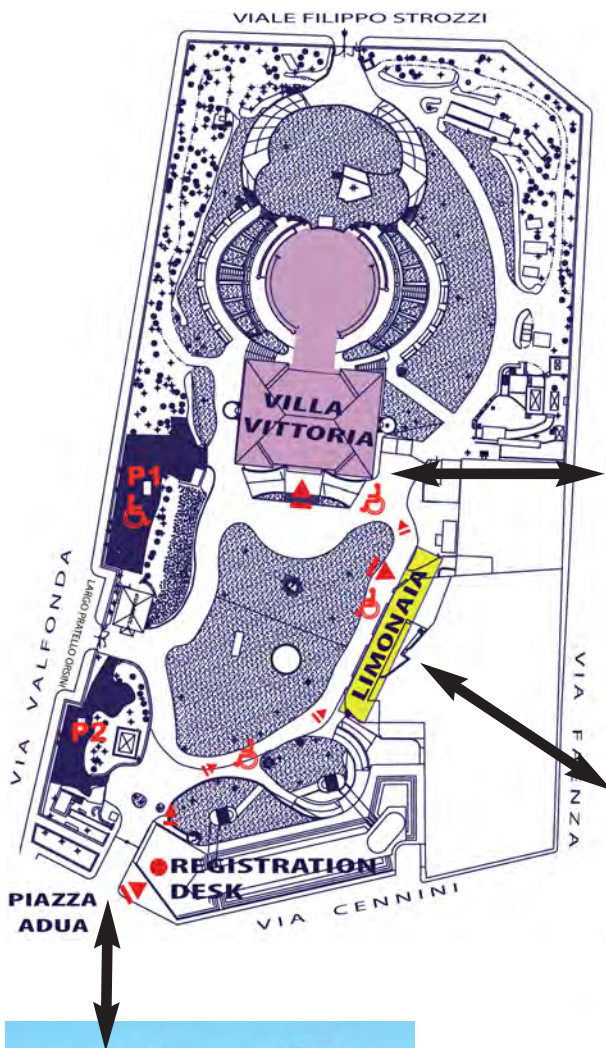
Coffee, tea and lunches during meeting breaks

Certificate of attendance

Accompanying person's fee includes

Name Badge

Access to Opening Ceremony and Welcome Reception (according to availability)



- 1- VILLA VITTORIA PIANO TERRA - GROUND FLOOR
- 2- VILLA VITTORIA PIANO PRIMO - FIRST FLOOR
- 3- VILLA VITTORIA PIANO SECONDO - SECOND FLOOR
- 4- VILLA VITTORIA BELVEDERE
- 5- ANFITEATRO - AMPHITHEATRE
- 6- AUDITORIUM
- 7- PASSI PERDUTI
- 8- LIMONAIA



+2 SALA VERDE
LIFT A/B

+1 NO EVENTS

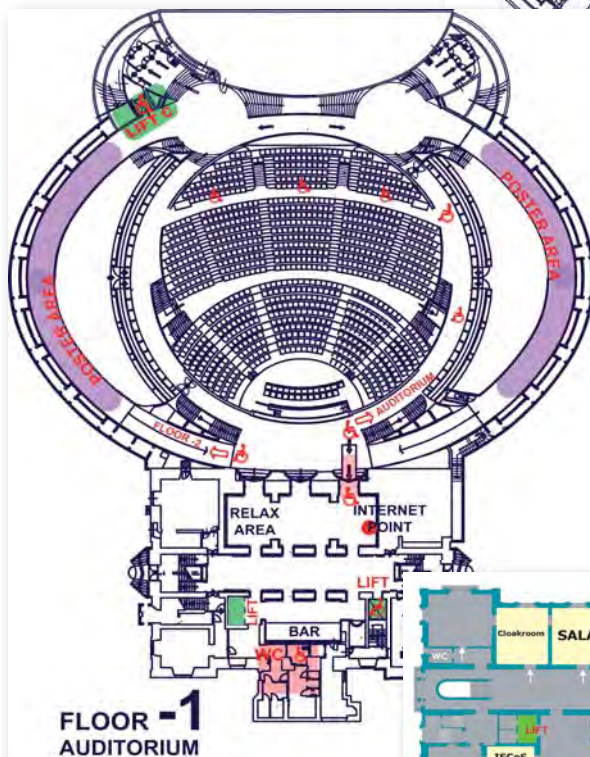
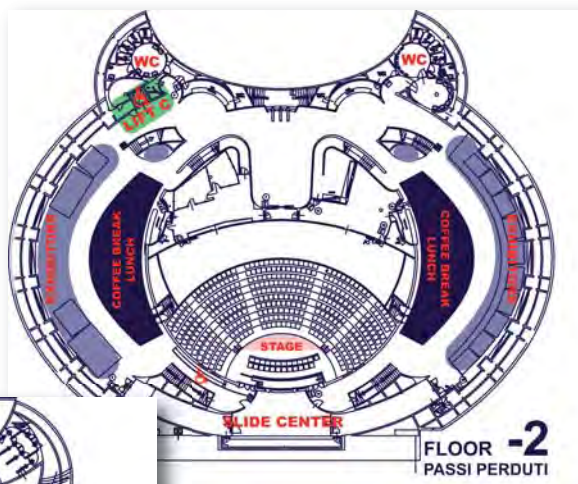
0 SALA ONICE
ISCOS DESK
CLOAKROOM
LIFT A/B

-1 AUDITORIUM
POSTER AREA
RELAX AREA
INTERNET POINT
WC
LIFT A/B

 ONLY WHEELCHAIR USERS
TO GO -2 LEVEL
LIFT C

-2 AUDITORIUM STAGE
SLIDE CENTER
COFFEE & LUNCH AREA
EXHIBITION AREA

 ONLY WHEELCHAIR USERS
TO GO -2 LEVEL
LIFT C



ORGANIZING SECRETARIAT

The on-site registration desk of the Organizing Secretariat will be open each day during the Congress, as follows:

- October 21st – 7.00 am – 6.00 pm
- October 22nd - 7.00 am – 7.00 pm
- October 23rd - 7.00 am – 7.00 pm
- October 24th - 7.00 am – 1.00 pm

Cancellation and refund policy

Requests of cancellation will be accepted on writing to the Organizing Secretariat within October 1st, 2009; an administrative fee of 50,00 Euros per person will be charged. After this deadline, no refund will be provided.

On site new registration does not necessary entitle the participants to receive all congress material, that will be available in limited quantity.

Language

The official language of the Congress is English. Simultaneous translation will be provided only during October 22nd (Auditorium Session, 4.30-6.30 pm).

Congress Badges

All participants, accompanying persons and exhibitors are kindly requested to wear their Congress badges, in order to be admitted to the lecture halls and all scheduled activities.

Slide Center

The slide center is located in the back of the Auditorium (Floor -2).

Speakers are kindly asked to give their Power Point presentations at least three 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.

Chairs are invited to present in the meeting room at least 20 minutes before the beginning of their session.

It is important that all sessions stay on schedule; Speakers and Chairs are invited to observe their timetable.

Poster Display

Posters will be displayed in panels in the Galleries (Floor –1) near the Auditorium for the duration of the Congress. Presenters are kindly asked to attend their posters during breaks.

Panels will be marked with the number of the poster according to the numbers in the Abstract Book. Posters can be set up from 10.00 am to 17.00 pm on October 21st; size of the poster is 80cm wide x120cm high. Double tape will be provided.

Poster presenters are asked to take down their poster after closing session on Saturday.

Poster Awards

The International Spinal Cord Society awards a prize for the three best Posters at the Congress. The Poster Presentations will be evaluated by the Scientific Committee. The prizes for the Posters will be awarded at the Closing of the Congress on Saturday, October 24th 2009.

Program Changes

The Scientific and Organizing Secretariats reserve the right to change the program for technical and/or scientific reasons.

Workshops and Symposia

Participants must be registered in the Congress. A limited number of places are available.

Commercial Exhibition

The most recent technical innovations will be represented at the Congress with a significant exhibition, open accordingly to the Scientific Program. The area will be located near the Auditorium (Floor –2), at the Congress venue.

Catering Services

Coffee, tea and lunches will be served in the Exhibition area (Floor –2), during coffee-breaks or lunch time.

CME Accreditation (only for Italian participants)

The Organizing Secretariat is in the process of obtaining accreditation of the scientific sessions scheduled on October 22nd by the Ministry of Health in compliance with national CME regulations. All participants who wish to receive CME credits must fill in the CME evaluation form.

IMPORTANT: CME forms cannot be collected on behalf of other people. The Organizing Secretariat will send CME certificates only to participants who have complied with all CME

requirements and only after having checked the learning test. No credits will be granted for illegible and incomplete forms.

The attendance will be certified signing the official documents provided by the Organizing Secretariat at the entrance of the Auditorium.

Certificate of Attendance

Certificates of attendance will be available for all regularly registered participants, at the Registration Desk and will be distributed, upon request, on Saturday, October 24th 2009.

ISCoS Desk

The ISCoS Desk is located in the Grand Floor. The ISCoS Board and Secretariat staff will be at your disposal for any information about the Association.

SoMIPar Desk

The SoMIPar Desk is located in the Grand Floor, near the Social Events/Accompanying Person's Desk.

SCOPE

SPINAL CORD OUTCOMES

PARTNERSHIP ENDEAVOR

www.scopesci.org

SCOPE (Spinal Cord Outcomes Partnership Endeavor) is an inclusive working group fostering collaboration among stakeholders concerned with improving spinal cord injury (SCI) outcomes. SCOPE is working to improve both the translation of discoveries and human study protocols, so therapeutic interventions for SCI can be more accurately and efficiently validated, thereby leading to the adoption of improved best practices.

SCOPE includes representatives from: community of people living with SCI, basic science, clinical research, academic institutions, hospitals, industry, professional societies (APS, ASIA, ISCoS), government agencies, and not-for-profit organizations and foundations.

SCOPE Activities for 2009-2010

1. Development of recommendations to achieve valid translational paths from preclinical discovery of a therapeutic intervention for SCI to human clinical trials.
2. Provide a prescriptive path ("how to" manual) for researchers wishing to start, continue or complete a validation process of a SCI outcome tool or measure.

For a recent SCOPE review, please see: Alexander et al. 2009. Outcome measures in spinal cord injury: recent assessments and recommendations for future directions (published in the journal *Spinal Cord*)

We are grateful for the support of our corporate partners and foundations. Your participation and financial contributions are welcome. www.scopesci.org

For further information, please contact Dr. John Steeves (steeves@icord.org).



ACCOMPANIED VISITS TO THE SPINAL CORD UNIT IN FLORENCE

Special visits to the Spinal Cord Unit of Careggi University Hospital in Florence will be organized for interested Congress participants. Visits will take place during the Congress days.

Participants are kindly invited to check the scheduled visits list, which will be available at the 'Social Events/Accompanying Persons' Desk. Requests received at Congress Venue will be fulfilled with respect to the remaining availability.

DEPARTMENT: AGENZIA REGIONALE PER LA CURA DEL MEDULLOLESO

Direttore Dr. Sergio Aito

Strutture Organizzative Dipartimentali (S.O.D.)

NEURO-UROLOGY - Direttore Dr. Giulio Del Popolo

SPINAL UNIT -Direttore Dr. Sergio Aito

Largo Palagi 1, 50139 Firenze

tel. 0039 055-7948372

fax: 00039 055-7948526



**Azienda
Ospedaliero
Universitaria
Careggi**

SOCIAL PROGRAM AND EXCURSIONS

All Congress participants are cordially invited to take part in our social events.

Opening Ceremony

will take place in Palazzo Vecchio (Salone dei Cinquecento), on Wednesday, October 21st 2009 at 6.30 pm hours.

The Ceremony will be followed by a Welcome Cocktail Reception. This event is free of charge to all Congress participants, but registration is compulsory. Registrations will only be accepted upon availability.

ISCoS Congress Dinner

is open to all participants of the Congress. It will take place on Friday, October 23rd 2009 at 8.30 pm at the Arsenale of Fortezza da Basso (very close to the Congress venue).

An exciting evening is planned in one of the most beautiful city in the world. You will enjoy good meals, wines and first class entertainment while having the chance to meet and catch up with your colleagues from around the world!

On Congress site, tickets are available at the price of 120,00 Euros each.

Closing Ceremony

of the Congress will take place in the Auditorium, on Saturday, October 24th 2009 at 12.30 am hours.



ACCOMPANYING PERSONS' PROGRAM

Accompanying persons will be free to visit the Exhibition area only by registration at the Desk and are kindly requested to wear the Congress badge, in order to be admitted to the lecture halls and all scheduled activities. Accompanying persons' fee includes access the Opening Ceremony and Welcome Reception.

A detailed list of very interesting visits to the city of Florence has been organized, upon payment of the registration fee; participants are kindly invited to fill in the registration form, available at the 'Accompanying persons Desk'.

Requirement of minimum booking applies to any of the following programs. Full refunds will be issued if an activity is cancelled due to lack of participants. Full refund of all tours will be granted if written notice of cancellation 1 month prior to the event. For cancellations after that date no refund will be made.

Requests to be received at Congress Venue will be fulfilled with respect to the remaining availability.

List of some of the suggested organized tours:

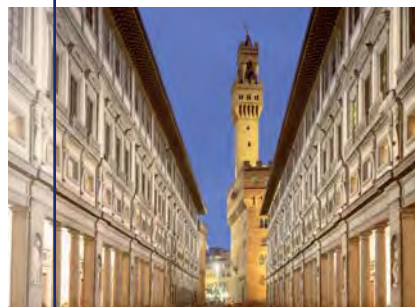
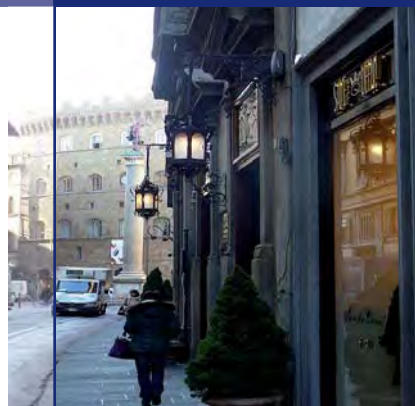
22nd October (morning) - Florentine craftsmen: a guided tour to the artisan workshops of Oltrarno

22nd October (afternoon) - Tour of Santa Maria Novella church and cloisters

23rd October (morning) – An Exclusive City Tour

23rd October (afternoon) – Uffizi Gallery

Meeting point of the tours will be at the registration desk.



A photograph of a man and a woman in wheelchairs, positioned outdoors on a paved path. The man, in the foreground, is wearing a blue sleeveless shirt and orange pants, looking towards the right. The woman, behind him, is wearing a black top and dark pants, looking towards the left. The background shows a bright sky and some distant trees.

LoFric[®]

Welcome to our symposium at ISCoS 2009 in Florence, Italy

Philosophical Counselling and Neurogenic Bladder Management – What's next?

Chair: Giulio Del Popolo

Time: Friday, October 23 at 11.30–13.30

Room: Auditorium

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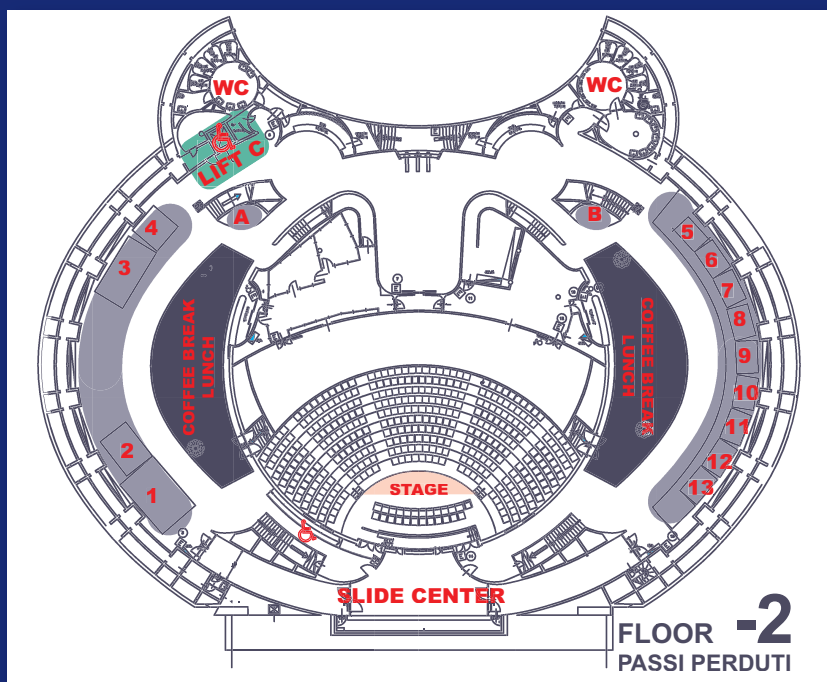
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EXHIBITORS AND EXHIBITION AREA

- | | | | |
|---|------------------|----|--------------------------|
| 1 | ASTRATECH | 9 | B BRAUN |
| 2 | KCI | 10 | ALLERGAN |
| 3 | COLOPLAST | 11 | HERNIAMESH |
| 4 | TELEFLEX MEDICAL | 12 | HOCOMA |
| 5 | SUNRISE MEDICAL | 13 | AVERY BIOMEDICAL DEVICES |
| 6 | EUREL | A | FAIP - ATP |
| 7 | EISAI | B | NATURE PUBLISHING GROUP |
| 8 | MEDTRONIC | | |



SPECIAL THANKS

**The Organizing Committee gratefully acknowledges
and thanks the financial support from the following
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WINGS FOR LIFE

SPINAL CORD RESEARCH FOUNDATION

TIME TABLE

	WEDNESDAY 21/10/09			THURSDAY 22/10/09			
07:00	Registration			Registration			
	Limonaia	Sala Verde 2° Floor	Sala Onice Ground Floor	Auditorium	Sala Verde 2° Floor	Sala Onice Ground Floor	
08:00	Functional Outcome Measures Susie Charlifue	Autonomic evaluations: up to date Andrei Krassioukov	Management of SCI in Children Lawrence Vogel	Presentation Authorities			
08:30				Presidential Lecture Wagih El-Masry			
09:00				ISRT Lecture Peter Ellaway			
09:30							
10:00		Coffee break			Coffee break		
10:30	Functional Outcome Measures Susie Charlifue	Spasticity: Measurement and Management Anand Nene	Management of SCI in Children Lawrence Vogel	Hollister Symposium	IPSCI-ISCoS P.M. von Groote	Using the ICF in clinical practice and research Inge Eriks-Hoogland	
11:00				Bladder Management and Sexuality	Symposium Neuropathic Pain Following SCI		
11:30							
12:00				Free Papers Session 1	Free Papers Session 2		
12:30							
13:00		Lunch			Lunch		
13:30							
14:00	Neurogenic detrusor overactivity in SCI: a journey from the bladder wall to the brain SIUD	Multiprofessional Working Team	Management of SCI in Childre Lawrence Vogel	Opening Lecture Amiram Catz	Free Papers Session 3	Free Papers Session 5	
14:30		CNOPUS		Predicting Outcomes			
15:00		Management of secondary complications Andrei Krassioukov					
15:30							
16:00					Coloplast Symposium	Free Papers Session 4	Free Papers Session 6
16:30					Neurogenic Bladder, Bowel Management and Quality of Life		
17:00				SoMIPar Annual Meeting			
17:30							
18:00							
18:30	OPENING CEREMONY Piazza della Signoria (Palazzo Vecchio, Salone dei 500)						
19:00	LUDWIG GUTTMANN LECTURE Outcome Measures: Evolution in Clinical Trials John F. Ditunno						
19:30							
20:00				WELCOME COCKTAIL			

MEETING	WORKSHOP	SYMPOSIUM
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FRIDAY 23/10/09			SATURDAY 24/10/09		
Registration			Registration		07:00
Auditorium	Sala Verde 2° Floor	Sala Onice Ground Floor	Auditorium	Sala Verde 2° Floor	
	Free Papers Session 7	Free Papers Session 9	Prevention Symposium in collaboration with WING FOR LIFE	Opening Lecture Manfred Stöhrer	08:00
Symposium Update on Experimental Pharmacological, Cell Transplant, Rehabilitation Interventions for the Treatment of SCI				Urinary Incontinence	08:30
					09:00
					09:30
	Coffee break			Coffee break	10:00
	Free Papers Session 8	Symposium Imaging the Complications Standards for Neurological Classification of SCI 2009 William P.Waring	Prevention Symposium in collaboration with WING FOR LIFE Closing ceremony Presentation 2010	Symposium KCI Pressure Ulcers	10:30
Astra Tech Symposium Philosophical counselling and Neurogenic Bladder Management				New Treatments for Pressure Ulcers	11:00
					11:30
					12:00
					12:30
					13:00
	Lunch				13:30
					14:00
Opening Lecture Anand Nene	Opening Lecture Lawrence Vogel	Intervention of Psychologists in Spinal Unit: Coping Effectiveness Training Paul Kennedy			14:30
Spasticity Management	Spinal Cord Lesions in Children				15:00
					15:30
					16:00
	Coffee break				16:30
SoMIPar Guidelines					17:00
ISCOS Annual General Meeting					17:30
					18:00
					18:30
					19:00
					19:30
GALA DINNER Fortezza da Basso- Arsenale					20:00

ORAL COMMUNICATIONS	LECTURE	CEREMONY & EVENTS
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Bladder and bowel management

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- **SpeediBag Compact** – the new discreet urine bag for women using SpeediCath Compact catheter
- **Peristeen Anal Irrigation** – the unique bowel management system for children and adults

Join our symposium

“Neurogenic Bladder and Bowel Management and Quality of Life” Thursday 22 October, 16:30 – 18:30, Palazzo dei Congressi

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International Spinal Cord Society

ISCoS

2009

21-24 October

Florence

48th Annual Scientific Meeting

PROGRAMME

COMMITTEE & COUNCIL MEETING

TUESDAY
20 OCTOBER

COMMITTEE MEETINGS

07.00-18.00	Registration
08.00-10.30	Executive Committee
10.30-11.00	Nominations Committee
11.00-13.00	Scientific Committee
13.00-14.00	Lunch
14.00-15.00	Prevention Committee
15.00-16.30	Editoria lBoard
16.30-18.00	Education Committee

LIMONAIA

WEDNESDAY
21 OCTOBER

COUNCIL MEETING

13.00-14.00	Council Lunch
14.00-17.00	Council Meeting

PALAFFARI Floor 4

07.00 Registration

08.00-13.00	WORKSHOP New Developments in Functional Outcome Measures for People With SCI <i>Chair: Susan Charlifue</i>
08.00-08.15	General Overview W0 Introduction of the workshop faculty and a general overview of the ASIA/ISCoS/NIDRR <i>Susan Charlifue</i>
08.15-10.00	Medical outcomes in daily clinical practice: review, recommendations and update from new research W1 Use of the International Standards for the Neurological Classification of SCI <i>Ralph Marino, Mary Jane Mulcahey, Armin Curt, Amie Jackson</i>
10.00-10.30	Coffee Break
10.30-13.00	Functional Outcomes in daily clinical practice: review, recommendations and update from new research W2 Update on the Functional Independence Measure (FIM), the Quadriplegia Index of Function (QIF), and the Spinal Cord Independence Measure (SCIM III) <i>Gordana Savic, Amiram Catz</i> W3 The 5AML (Five Additional Mobility And Locomotor Items) <i>Lisa Harvey</i> W4 The VFM (Valutazione Funzionale Mielolesi) <i>Mariangela Taricco</i> W5 Update of walking capacity measures, the ten meter walking test (10MWT), Walking Index for Spinal Cord Injury (WISCI II) and the six minute walk test <i>Gordana Savic, John F. Ditunno, Giorgio Scivoletto, Marco Molinari</i>

W6 Recommendations from the Functional Recovery Measures Work Group and updates from new research on functional outcome measures

Kim Anderson

Wrap-up, open discussion with audience

Amie Jackson, Eric Weerts, Ralph Marino

13.00-14.00

Lunch

14.00-17.30

WORKSHOP S.I.U.D.

Understanding neurogenic detrusor overactivity in S.C.I.: a journey from the bladder wall to the brain

Chair: Sandro Sandri - Enrico Finazzi Agrò

W7 Pathophysiology of NDO: what happens in the central nervous system?

Antonella Giannantoni

W8 Pathophysiology of NDO: what happens in the bladder wall?

William C. de Groat

W9 Antimuscarinics and NDO

Enrico Finazzi Agrò

W10 Vanilloids and NDO

Massimo Lazzeri

DISCUSSION

W11 Botulinum Toxin A in Spinal Cord Injury Patients

Giulio Del Popolo

W12 Neuromodulation in Neurogenic Detrusor Overactivity

Michele Spinelli

W13 Surgery for NDO

Antonio Carbone

DISCUSSION

Take Home Messages

Francesco Pesce

08.00-10.00

WORKSHOP

Autonomic evaluations of patients with SCI: up to date

Chair: Andrei Krassioukov

- W14 Developing international standards for the assessment of autonomic dysfunctions following spinal cord injury.
Andrei Krassioukov
- W15 Documentation of Sexual Capabilities after SCI
Marcalee Alexander Sipski
- W16 Autonomic Standards for SCI Patients: Bladder Dysfunction: Up to Date
Michael Kennelly
- W17 Autonomic Data Sets
Fin Biering-Sørensen
- W18 Bowel dysfunctions
Klaus Krogh

10.00-10.30

Coffee Break

10.30-13.00

WORKSHOP

Spasticity: measurement and management

Chair: Anand Nene

Introduction
Anand Nene

- W19 Pathophysiology of Spastic Paresis - Rationale For Focal Interventions
Jean-Michel Gracies
- W20 Assessment of spasticity - A Review
Gerlienke Voerman
- W21 New Measurement Approaches
Judith Fleuren
- W22 Treatment algorithm for spasticity in adults
Govert Snoek
- W23 Spinal Spasticity; Patients Perspective
Bakul M. Soni

Conclusions and closure of workshop
Anand Nene

13.00-14.00 **Lunch**

14.00-15.30 **WORKSHOP**
The workings of the multi-professional team in SCI unit
Chair: Laura Valsecchi

W24 Introduction to Multi-professional Team in Spinal Unit and review of basilar rules for Working in Team
Laura Valsecchi

W25 The role of the Nurse serving on the Team. Organizational models for better quality assistance (Primary nursing, Case manager, Goal planning)
Paola Pignotti

W26 Schedule for Working in Multi-professional Team
Lucia Bambagioni

W27 The role of social-worker and psychologist in Spinal Unit
Gabriella Rossi

W28 Network among health-care and social practitioners working in Spinal Unit
Alberto Nobile

W29 Main objectives of Occupational Therapist in Multi-professional Team in Spinal Unit
Maru Marquez

15.30 – 17.30 **WORKSHOP**
Evidence based management of secondary complications after SCI: what, when, and how?
Chair: Andrei Krassioukov

W30 What do we know, and what don't we know, about blood pressure management in patients with spinal cord injury?
Andrei Krassioukov

W31 Evidence based management of spasticity secondary to spinal cord injury
Andrea F. Townson

W32 Sexual Health SCIRE Case Study
Stacy Elliott

08.00-17.00

WORKSHOP

Management Of SCI in Children

Chair: Lawrence Vogel

W33 Introduction/overview of pediatric SCI including medical complications/bowel
Lawrence Vogel

W34 Urological management of SCI in children and adolescents
Mario De Gennaro

W35 Epidemiology of pediatric SCI
Michael J. DeVivo

10.00-10.30

Coffee Break

W36 Pediatric Spinal Cord Injury in Europe
Marika Augutis

W37 Orthopaedic considerations in pediatric SCI (acute management of spine fractures, hips and spine disorders, HO, pathological fractures)
Randal R Betz

W38 Use of the International Standards for Neurological Classification of Spinal Cord Injury in Pediatrics
Mary Jane Mulcahey

W39 Rehabilitation of the child with a SCI (general principles, ambulation, mobility, SCI education)
Allison Graham

13.00-14.00

Lunch

W40 Innovative rehabilitative strategies (activity based rehab, body weight supported ambulation, and FES cycling, ambulation and UE function)
Randal R Betz

W41 Evaluation and Management of the Hand in Children with Tetraplegia
Mary Jane Mulcahey

W42 Discharge planning of pediatric ventilator dependent Spinal Cord Injury patients
Tiziana Redaelli

W43 Psychosocial/sexuality/transition and innovative recreation and leisure time programming for the child and adolescent with a SCI
Marika Augutis, Lawrence Vogel

07.00	Registration
08.00-08.30	PRESENTATION 48th Annual Scientific Meeting
08.30-09.15	PRESIDENTIAL LECTURE L2 Past, present and Future of ISCoS <i>"da piccola ghianda a grande quercia"</i> <i>Wagih El Masry</i>
09.15-10.00	ISRT LECTURE L3 Physiological tools for monitoring outcome of interventive measures in spinal cord injury: a Clinical Initiative <i>Peter Ellaway</i>
10.00-10.30	Coffee Break
10.30-11.45	SYMPOSIUM Syponsored by Hollister Bladder Management and Sexuality in Spinal Cord Injury <i>Chair: Manfred Stöhrer</i>
20 min	S1 The development and assessment of a vaprophilic catheter <i>Pierre Denys</i>
20 min	S2 Intermittent catheterization and urinary tract infection <i>David Castro-Diaz</i>
20 min	S3 Sexuality and Incontinence: Uncharted Urogenital Systems <i>Marcalee Alexander Sipski</i>
	Discussion
11.45-13.00	FREE PAPERS Session 1 <i>Chair: Gordana Savic - Giorgio Scivoletto</i>
15min	O1 Assessing orgasm in men with spinal cord injury <i>Frédérique Courtois</i>
15 min	O2 Hollywood to Hospital <i>Allison Graham</i>
15 min	O3 SCIRehab: Documenting the Amount and Type of Interventions in Spinal Cord Injury Rehabilitation and their Variation among Patients <i>Gale Whiteneck</i>

- | | | |
|--------|----|---|
| 15 min | O4 | Sensory options for a brief screening SCI examination
<i>William P. Waring</i> |
| 15 min | O5 | Conversion in ASIA impairment scale during the first year after traumatic Spinal Cord Injury
<i>Hubertus van Hedel</i> |

13.00-14.00 Lunch

14.00-16.30 PREDICTING OUTCOMES
Chair: Mariangela Taricco - Amiram Catz

- 14.00-14.30 OPENING LECTURE**
- | | | |
|--|-----|--|
| | OL1 | Functioning outcome measures, their combination, and the concept of ability realization, for the care and research of spinal cord injuries
<i>Amiram Catz</i> |
|--|-----|--|

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- | | | |
|--------|-----|--|
| 15 min | O6 | One year follow-up of monotraumatic vs. polytraumatic paraplegic patients - Is polytrauma a confounding factor of the functional outcome?
<i>Cornelia Putz</i> |
| 15 min | O7 | Is determination between complete and incomplete traumatic spinal cord injury clinically relevant?
<i>Joost J. van Middendorp</i> |
| 15 min | O8 | Comparable predictive value for walking ability of early tibialis motor evoked potentials and total motor score in incomplete cervical SCI
<i>Martin Schubert</i> |
| 15 min | O9 | Falls in ambulatory patients with spinal cord injury: validity and reliability of the berg-balance scale
<i>Markus Wirz</i> |
| 15 min | O10 | Responsiveness of dermatomal somatosensory evoked potentials (dSSEPs) and electrical perception thresholds (EPTs) in cervical spinal cord injury (SCI)
<i>Kip J. Kramer</i> |
| 15 min | O11 | Appraisals, coping and psychological outcome measures in a European sample
<i>Paul Kennedy</i> |

16.00-16.30 Coffee Break

16.30-18.30

SYMPOSIUM

Sponsored by Coloplast

Neurogenic Bladder and Bowel Management and Quality of Life

Chair: Fin Biering Sørensen

- | | |
|--------|--|
| 15 min | S4 Generic introduction on neurogenic bladder problems and management
<i>Jean-Jacques Wyndaele</i> |
| 15 min | S5 Colorectal Dysfunction In Spinal Cord Injury: Pathophysiological And Clinical Considerations
<i>Gabriele Bazzocchi</i> |
| 20 min | S6 Quality of life instruments for people with disabilities
<i>Susie Charlifue</i> |
| 20 min | S7 Qualiveen: A QoL scale designed for spinal cord injured individuals
<i>Jürgen Pannek</i> |
| 20 min | S8 How bladder and bowel problems can influence the life of a disabled person
<i>Michael Cogswell</i> |
| | Round Table and Discussion |

18.30-19.30

SoMIPar GENERAL MEETING

10.30-11.00 ISCoS-IPSCI PRESENTATION

- L4 *Chair: Wagih El-Masry*
International Perspectives on Spinal Cord Injury (IPSCI)
A collaborative ISCoS-WHO project
Per Maximilian von Groote

11.00-12.00 PAIN SYMPOSIUM Neuropathic pain following SCI: Classification, Mechanism and Treatment *Chair: Nanna Brix Finnerup*

20 min S9 Classification and epidemiology of neuropathic pain following SCI
Nanna Brix Finnerup

20 min S10 Pathophysiological mechanisms of neuropathic pain after SCI
Julian Scott Taylor

20 min S11 Treatment of neuropathic pain following SCI
Cecilia Norrbrink

12.00-12.45 FREE PAPERS Session 2 *Chair: Nanna Brix Finnerup - Cecilia Norrbrink*

15 min O12 Screening tools for assessing and diagnosing neuropathic pain: can they be of use in the diagnostic work-up in individuals with spinal cord injury
Helene Hallstroem

15 min O13 Effects of intrathecal ziconotide and baclofen on pain and spasticity in subjects affected by spinal cord injury
Giulia Stampacchia

15 min O14 Functional surgery for foot deformities in SCI patients
Maria Grazia Benedetti

13.00-14.00 Lunch

14.00-16.00 FREE PAPERS Session 3 *Chair: Amie Jackson - Harvinder S. Chhabra*

15 min O15 What do people with spinal cord injury value most: priorities as a function of self efficacy
James Middleton

15 min O16 Changes in need for assistance in long-standing spinal cord injury
Gordana Savic

15 min O17 Physical Activity Recall Assessment and Metabolic Syndrome symptoms in men with Spinal Cord Injury
Laurent Ballaz

15 min	O18	Training people with chronic spinal cord injuries to sit unsupported: a randomised controlled trial. <i>Claire Boswell-Ruys</i>
15 min	O19	Modular rehabilitation: a client-centred task-oriented training to improve arm-hand-skilled-performance in cervical spinal cord injured persons <i>Annemie If Spooren</i>
15 min	O20	Efficacy of balance rehabilitation in spinal cord lesion patients <i>Valentina Di Donna</i>
15 min	O21	Are passive movements effective for the treatment and prevention of contractures? A randomised controlled trial <i>Lisa Harvey</i>
15 min	O22	Effect of intensive exercise therapy with and without gravity compensation on upper extremity function in subjects with chronic cervical SCI <i>Mirjam Kouwenhoven</i>

16.00-16.30 Coffee Break

16.30-18.30 FREE PAPERS Session 4 Chair: Claes Hultling - William Donovan

15 min	O23	Development of international data sets for activities and participation <i>Marcel Post</i>
15 min	O24	It takes two to tango revisited: the meaning of integration and participation for people with sci in europe - a comparison of Switzerland and Norway <i>Jan D. Reinhardt</i>
15 min	O25	Comparison of the demographic characteristics and outcomes for patients admitted into specialist and non-specialist SCI rehabilitation units <i>Peter New</i>
15 min	O26	Predicting individual patterns of bone loss from baseline bone scans taken in the early stages of spinal cord injury <i>Sylvie Coupaud</i>
15 min	O27	Weight matter: physical and psychosocial health of persons with spinal cord injury in relation to body mass index <i>Yuying Chen</i>
15 min	O28	Severe degeneration of peripheral nerves after SCI: a European multicenter study in 345 patients. <i>Hendrik Van de Meent</i>
15 min	O29	Critical illness polyneuromyopathy in patients with spinal cord injury. <i>Giuseppe De Scisciolo</i>
15 min	O30	Dysphagia in spinal cord injury patients <i>Margarita Vallès</i>

10.30-13.00

WORKSHOP

Using the ICF (International Classification of Functioning, Disability and Health) in clinical practice and research

Chair: Inge Eriks-Hoogland

- 15 min W45 Using the ICF (International Classification of Functioning, Disability and Health) in clinical practice and research
Inge Eriks-Hoogland, Regula Spreyermann, Alexandra Rauch

13.00-14.00

Lunch

14.00-16.00

FREE PAPERS Session 5

Chair: Stella Engel - Mauro Menarini

- 15 min O31 Expectations about work: young adult's experiences of work after spinal cord injury
Lisa Bergmark
- 15 min O32 Level of stress: A study on caregivers of traumatic tetraplegic patients with Spinal Cord Injury in a rehabilitation centre in Bangladesh
Shariful Islam
- 15 min O33 Sexual dysfunction in Cauda Equina Syndrome
Amrithlal A Mascarenhas
- 15 min O34 Sexual-urological dysfunction and psychological distress in female patients with spinal cord lesions (SCL)
Lina Di Lucente
- 15 min O35 The Stockholm Thessaloniki Acute Traumatic Spinal Cord Injury Study (STATSCIS): Conditions and outcomes at one year post-trauma
Anestis Divanoglou
- 15 min O36 Annual follow up after SCI with a new ICF-based tool
Regula Spreyermann
- 15 min O37 Long term follow up (mean 24 years) of post-traumatic lumbar syringomyelia
Niknam Hussain
- 15 min O38 Physical therapy, occupational therapy and sports therapy in 3 Dutch SCI rehabilitation centers.
Sacha van Langeveld

16.00-16.30 Coffee Break

16.30-18.15 FREE PAPERS Session 6
Chair: Shinsuke Katoh - Giorgio Scivoletto

- | | | |
|--------|-----|--|
| 15 min | O39 | Traumatic and non traumatic spinal cord lesions: comparison of neurological and functional outcomes
<i>Giorgio Scivoletto</i> |
| 15 min | O40 | Motor unit number estimation in cervical or thoracic SCI persons and rats
<i>Hua Guan</i> |
| 15 min | O41 | Experimental spinal cord repair by CNS PNS connection
<i>Giorgio Brunelli</i> |
| 15 min | O42 | New Insights into the Pathophysiology of Cervical Spondylotic Myelopathy from MRI Measurements of Cerebrospinal Fluid Flow and Spinal Cord Motion
<i>Erin MacMillan</i> |
| 15 min | O43 | Minimally invasive expansive laminoplasty
<i>Yasunobu Itoh</i> |
| 15 min | O44 | The influence of the neurological level of injury in bone's mineral content and mechanical properties, lean mass and fat mass in paraplegia
<i>Yannis Dionyssiotis</i> |
| 15 min | O45 | Clinical trial of Myoelectrically controlled FES (MeCFES) for assisting hand function in subjects with tetraplegia –A study of usersatisfaction
<i>Davide Dalla Costa</i> |

07:00 **Registration**

08.30-11.30 **SYMPOSIUM**
Update on experimental pharmacological, cell transplant and rehabilitation interventions for the treatment of spinal cord injury
Chairs: Sergio Aito, John Steeves

30 min S12 General guidelines for the conduct of SCI clinical trials and factors influencing the interpretation of human study data
John Steeves

30 min S13 Clinical trials for spinal cord injuries
Wise Young

30 min S14 Stem cell transplants after SCI: What is the preclinical evidence for benefit and what are the sources of transplant materials?
Alain Privat

10.00-10.30 **Coffee Break**

30 min S15 Active rehabilitation strategies to promote neural plasticity and functional recovery after SCI
Hubertus van Hedel

30 min Panel discussion with audience
Sergio Aito

11.30-13.30 **SYMPOSIUM**
Sponsored by Astra Tech
Philosophical counselling and Neurogenic Bladder Management - What's next?
Chair: Giulio Del Popolo

Introduction
Giulio Del Popolo

20 min S16 History of bladder catheter
Francesco Pesce

20 min S17 How to optimise the outcome of CIC?
Jean-Jacques Wyndaele

20 min S18 Bladder and mind -Even Wittgenstein needed to pee
Claes Hultling

30 min S19 Understanding the neurogenic bladder
William C. de Groat

25 min Plenary Session: Evolution of bladder management

FRIDAY 23 OCTOBER

13.30-14.30 **Lunch**

14.30-16.30 **SPASTICITY MANAGEMENT**
Chair: Anand Nene - Giuseppe De Scisciolo

14.30-15.00 **OPENING LECTURE**
 OL2 Spasticity – What's the Catch?
Anand Nene

15 min O46 Inertial sensing in pendulum test of spasticity
Rajmond Šavrin

15 min O47 Chronic Pudendal Nerve Stimulation in incomplete spinal cord injury is able to reduce lower limb spasticity while treating neurogenic detrusor overact
Silvia Malaguti

15 min O48 Reduction of spasticity with repetitive transcranial magnetic stimulation in patients with incomplete spinal cord injury
Hatice Kumru

15 min O49 Intrinsic hand stiffness - underdiagnosed phenomenon in tetraplegia and spasticity
Carina Reinholdt

15 min O50 Improved activity performance after surgical treatment of spasticity in the hand
Johanna Wangdell

15 min O51 Identification of motor point for neuro-block in spasticity management
Jianan Li

16.30-17.00 **Coffee Break**

17.00-17.30 **SoMIPar LECTURE**
 L5 **Italian Multidisciplinary Guidelines for the Acute Management of Spinal Cord Injury**
Jacopo Bonavita

17.30-18.30 **ISCoS ANNUAL GENERAL MEETING**

08.15-10.00 FREE PAPERS Session 7

Chair: Cristina Pagliacci - Fazlul Hoque

- | | |
|--------|---|
| 30 min | O52 Orthostatic hypotension among elite wheelchair athletes
<i>David Mikhail</i> |
| 15 min | O53 A new approach to improve fecal occult blood test (fobt) for colonic cancer screening in patients with sci
<i>Gabriele Bazzocchi</i> |
| 15 min | O54 A prospective examination of the menopause transition in women with sci
<i>Claire Kalpakjian</i> |
| 15 min | O55 Computational 3d modeling of cerebrospinal fluid dynamics for simulation of drug delivery and distribution
<i>Luca A. Finelli</i> |
| 15 min | O56 The effect of radiotherapy on the prophylaxis of heterotopic ossification in patients with spinal cord injury
<i>Julia Maria D'Andréa Greve</i> |
| 15 min | O57 Cortical Plasticity: effects of a BWSTT and FES training in spinal cord injured patients.
<i>Emiliana Bizzarini</i> |
| 15 min | O58 A Decade of Experience with Laparoscopic Intramuscular Diaphragm Pacing at a Single Institution: Replacing Ventilators in Tetraplegics
<i>Raymond Onders</i> |

11.30-13.30 FREE PAPERS Session 8

Chair: Susie Charlifue - Michael Craggs

- | | |
|--------|--|
| 15 min | O59 High frequency spinal cord stimulation (hf-scs): a new method of inspiratory muscle activation in an animal model of spinal cord injury
<i>Anthony F. DiMarco</i> |
| 15 min | O60 The effect of motor imaginary on cortical activation during robot assisted gait in normal subject
<i>Futoshi Wada</i> |
| 15 min | O61 Visual and motor related activity in sci and normal subjects: a magnetoencephalography study of plastic changes in the brain.
<i>Roger Bodley</i> |

- 15 min O62 Autologous incubated macrophage treatment in complete spinal cord injury: results of the multicenter trial
Daniel Lammertse
- 15 min O63 Development of criteria for unexpected neurological change in a phase 1 sub-acute, complete spinal cord injury study
Linda Jones
- 15 min O64 Therapeutic anti-nogo-a antibodies in acute spinal cord injury - first information on safety and pharmacokinetics
Rüdiger Rupp
- 15 min O65 Preclinical and phase 1 development of oligodendrocyte progenitor cells derived from human embryonic stem cells for the treatment of spinal cord injury
Edward Wirth
- 15 min O66 Resistance to the physiological activities of fibroblast growth factor 23 (FGF23) following spinal cord injury (SCI)
Ruth Marshall

13.30-14.30 Lunch

14.30-16.30 SPINAL CORD LESIONS IN CHILDREN

Chair: Tiziana Radaelli - Lawrence Vogel

14.30-15.00 OPENING LECTURE

- OL3 Participation and quality of life among youth with spinal cord injury
Lawrence Vogel

- 15 min O67 Comparison of child and parent reported activity performance and participation in children and youth with spinal cord injury
Stephen M. Haley
- 15 min O68 International standards for neurological classification of spinal cord injury: utility of motor, sensory and anorectal exams with children
Mary Jane Mulcahey
- 15 min O69 A review of the musculoskeletal, urologic and pulmonary complications in 118 patients with pediatric spinal cord injury
Thomas Meiners
- 15 min O70 Spinal tumours in childhood. A single institution experience of ninety-seven cases
Barbara Spacca
- 15 min O71 Scoliosis development following childhood spinal cord injury
Ebba Bergström
- 15 min O72 Ischemic spinal cord lesion in children
Maria Letizia Salsano

08.00-10.00 FREE PAPERS Session 9

Chair: Hans Frankel - Martin McClelland

- 15 min 073 Threshold currents at the electrode-nerve interface of phrenic nerve stimulators are stable during patient survival time
Gerhard Baer
- 15 min 074 Respiratory dysfunction of spinal cord injury (SCI) patients. Optoelectronic plethysmography (OEP) evaluation
Maria Luisa Lapenna
- 15 min 075 Spirometric values importance in a decannulation protocol for quadriplegic tracheostomized patients
Libero Bianchi
- 15 min 076 Effects of lower thoracic spinal cord stimulation (SCS) on expiratory muscle function in subjects with spinal cord injury (SCI)
Krzysztof E. Kowalski
- 15 min 077 Intrathecal baclophen may improve breathing as well as walking
Ann-Katrin Karlsson
- 15 min 078 Quantification of spasticity in incomplete SCI subjects during a pedaling movement and influence of training with FES
Margit Gföhler
- 15 min 079 Extracorporeal shockwave therapy (ESWT) for the spasticity management in children with cerebral palsy – preliminary results
Gelu Onose
- 15 min 080 Treatment of HIP ARTHRITIS in SCI patients
Joanna Rome-Saulnier

10.00-10.30 Coffee Break

10.30-12.00 SYMPOSIUM

Imaging the Complications of SCI: What Can XXI Century Radiology Offer?

Chair: Roger Bodley

Introduction
Roger Bodley

S20 Imaging the Injured Cord in the Sub-Acute and Chronic Phase
Richard Hughes

S21 Imaging the Bony Spine in the Late Phase Post Injury
Rowena Warwick

S22 The role of Interventional Radiology in the management of patients with spinal cord injury
Wei Chuen Liong

S23 Imaging of the Renal Tract in Spinal Cord Injury
Tom Meagher

S24 SCI including respiratory, Bowel and Cardiovascular Issues
Roger Bodley

S25 Clinical Perspectives on Imaging Strategies in Chronic Spinal Injury
Ali Jamous

General Discussion - Questions

12.00-13.30

WORKSHOP

Exporting research and best practices to the bedside: standards for the neurological classification of spine cord injuries - 2009

Chair: William P. Waring

W46 Understand how the International Standards Training e-Learning Program (InSTeP) performs

Understand recent revisions in the International Standards for the Neurological Classification of Spinal Cord Injuries utilizing the revised InSTeP program

Understand the controversies with revising the AIS classification definitions and the use of non key muscle function

Understand the potential and limitations of a web based training course including the current psychometrics for InSTeP and proposed research for InSTeP

Understand the proposed additions to InSTeP for examination of children (WeeSTeP) and the Autonomic Standards (ASTeP)

Understand the proposed process for future review and revision of the international standards and in step

William P. Waring, Andrei Krassioukov, Ronald K. Reeves, Ralph J. Marino, Stephen Burns

13.30-14.30

Lunch

14.30-16.30

WORKSHOP

Therapeutic Intervention of Psychologists in Spinal Unit: Coping Effectiveness Training

Chair: Paul Kennedy

Introduction

Silvia Lapini

W47 Coping effectiveness training in SCI

Paul Kennedy

W48 Discussion on experiences in psychoeducational group activity

Marina Manera

W49 The experience of SU Niguarda

Gabriella Rossi

W50 The experience of the psychological treatment with the groups at
the Montecatone Rehabilitation Institute

Daniela Rossetti

08.00-10.00

URINARY INCONTINENCE

Chair: Manfred Stöhrer - Sauro Biscotto

08.00-08.30

OPENING LECTURE

OL4 Neurogenic Bladder and Urinary Incontinence
Manfred Stöhrer

30 min

O81 A technically reduced urodynamic measuring method compared with a conventional urodynamic study
Christian Niedworok

15 min

O82 Effective treatment of neurogenic detrusor overactivity (NDO) by combined low dosed antimuscarinics
Michele Spinelli

15 min

O83 A novel wearable device for controlling urinary incontinence by conditional neuromodulation
Michael Craggs

15 min

O84 Continent cutaneous urinary diversion and neurogenic bladder. About 21 patients.
Brigitte Perrouin-Verbe

15 min

O85 Sacral neuromodulation in children with neurogenic bladder
Giovanni Mosiello

10.00-10.30

Coffee Break

10.30-11.00

SYMPOSIUM

Sponsored by KCI

Pressure Ulcers in SCI: From Prevention to Advanced Treatment

Chair: Claudio Pilati

S26 Use of Special surfaces in the prevention of pressure ulcers
Andrea Cavicchioli

S27 Histological evidences of the effectiveness of negative pressure therapy
Franco Bassetto

11:00-12:30

NEW TREATMENTS FOR PRESSURE ULCERS

Chair: Maria Julia D'Andrea Greve - Manlio Ottonello

- | | | |
|--------|-----|--|
| 15 min | O86 | Application of Skin Traction for the Treatment of Grade-IV Pressure Sore: A Clinical Report of 160 Cases
<i>Xi Chen</i> |
| 15 min | O87 | New treatments for pressure ulcers - Don't forget the maggot therapy
<i>Yorck B. Kalke</i> |
| 15 min | O88 | The joint venture between a dermal substitute and platelet growth factors: a novel approach to cutaneous ulcer repair
<i>Giulia Lo Russo</i> |
| 15 min | O89 | Electrical stimulation-Induced Gluteal and Hamstring Muscle Activation Can Reduce Sitting Pressure In individuals With Spinal Cord injury
<i>Christof A.J. Smit</i> |
| 15 min | O90 | Evaluation of a new treatment and rehabilitation programme for patients with spinal cord injury and pressure sores
<i>Anders Ljung</i> |
| 15 min | O91 | VAC Therapy: Critical analysis between clinical and Histological results
<i>Manlio Ottonello</i> |
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SATURDAY 24 OCTOBER

08.00 - 12.30

SYMPOSIUM

Sponsored by Wings for Life (WFL)

ISCOs 2009 PREVENTION SYMPOSIUM

Chair: Doug Brown

- | | | |
|--------|-----|---|
| 40 min | S28 | Overview of Prevention of SCI due to Road Traffic Crashes
<i>Michale Fitzharris</i> |
| 20 min | S29 | Biomechanics of the Pediatric Spine
<i>Marcus Pandy</i> |
| 20 min | S30 | Spinal Cord Injury Epidemiology: In which cases a prevention device could be used
<i>Michael J. Devivo</i> |
| 20 min | S31 | Spinal Cord Injury incidence in Europe
<i>Rupert Kisser</i> |
| 20 min | S32 | Spinal Cord Injury incidence in Sport
<i>Andrei Krassioukov</i> |
| 20 min | S33 | Neurosurgical perspective on prevention: what are the spinal cord weak points?
<i>Florian Roser</i> |
| 20 min | S34 | Biomechanics of SCI and example of a marketable device: Leatt Brace
<i>Cornel de Jongh</i> |

10:00 - 10:30

Coffee Break

- | | | |
|--------|-----|---|
| 10 min | S35 | Report of Sub-Committee on Global Mapping of SCI
<i>Peter Wing</i> |
| 20 min | S36 | YIPES! An education and prevention program for young people: Youth Injury Prevention Education @ Shepherd.org
<i>Herndon Murray</i> |
| 20 min | S37 | Report of Sub-Committee on Prevention of SCI in Water Activities. Diving Injuries: Are they really preventable? A Sisyphean challenge?
<i>Herndon Murray</i> |
| 10 min | S38 | Catastrophic rugby injuries in Italy: Prevention measures that are taken and their success
<i>Vincenzo Ieracitano, Claudio Pilati</i> |

- | | | |
|--------|-----|---|
| 20 min | S39 | Prevention of SCI due to high falls
<i>Tancredi Moscato, Mario Carletti</i> |
| 20 min | S40 | Prevention of SCI due to low falls in older fallers
<i>Clemens Becker</i> |
| 20 min | S41 | Natural disasters and building construction. The Sichuan Earthquake
<i>Eric Weerts</i> |

12.30 - 13.30 CLOSING CEREMONY

BEST PAPER AND BEST POSTER AWARD

PRESENTATION 2010



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International Spinal Cord Society

ISCoS 

2009

21-24 October

Florence

48th Annual Scientific Meeting

ABSTRACTS

LECTURES

L1

Ludwig Guttmann Lecture

Outcome Measures: Evolution in Clinical Trials of Neurological/Functional Recovery in Spinal Cord Injury

John F. Ditunno

Thomas Jefferson University
USA

The need to determine the beneficial effect of the treatment of spinal cord injury (SCI) requires clearly defined standardized measures of the severity of the injury and how well function is restored. Improved neurological recovery should be linked to increased capacity to perform tasks such as walking, reaching and grasping, which results in meaningful gains in mobility and self care. The measurement of recovery, capacity, mobility and self care are the outcomes used to determine the benefit of treatment and have evolved over the last century with contributions by the mentors and protégés of Sir Ludwig Guttmann, whom we honor today. Randomized clinical trials in the past 20 years have taught us many lessons as to which outcome measures have the greatest validity and reliability. The International Standards for Neurological Classification of SCI has become the clinical gold standard for measurement of severity, but would benefit from pathophysiological surrogates to better understand mechanisms of recovery. Measurements of walking capacity have emerged as valid/reliable/responsive and upper extremity measures are in development, which help distinguish neurological improvement from rehabilitation adaptation. Performance of self care and mobility has been linked to capacity and severity outcomes. In addition, new partnerships between clinical trial entities, professional societies, industry and federal agencies should facilitate identification of priorities and uniformity of measurement standards. Our ultimate goal is to improve the quality of life of those individuals with SCI whom we serve, but we must focus our investigative efforts carefully, systematically and rigorously as clinical scientists.

L2

Opening Lecture

Past, present and future of ISCoS 'da piccola ghianda a grande quercia'

Wagih El-Masry

President International Spinal Cord Society
UK

There are not many International societies that can boast 48 years of growth and development and being responsible for: the transformation of patients' lives on a world wide scale; advancing research and influencing management in fields beyond its own.

After World War II, Spinal Cord Injuries Services of varied types were set up in many countries. The staff working in these centres worked in relative isolation and information about management and outcomes was largely passed by word of mouth and by visiting other centres. The International Stoke Mandeville Games started at Stoke Mandeville Hospital in 1958 and became an annual event. The doctors accompanying the sports teams met informally and after a few years an Annual Scientific Meeting was held in the Hospital Gymnasium at the time of the Games. Anyone attending the Scientific Meeting

could present short papers. The "audio visual" content consisted of a microphone, a blackboard, a "magic lantern" and the recently developed 35 mm slide projector. Each session was Chaired by Ludwig Guttmann, there was no programme and no strict time limits. The lengthy discussions following the presentations were the most important part of the Meetings.

At the 1961 Meeting, Professor Pierre Houssa from Belgium suggested that we should form a Society. Ludwig Guttmann accepted this suggestion enthusiastically and the International Medical Society of Paraplegia (IMSoP) was founded. Guttmann was the Founder President until he was succeeded by Herb Talbot from Boston, USA in 1970. At the Inaugural Meeting there were 38 Founder members from nine countries. The first Vice Presidents were Professor P Houssa (Belgium), Professor A Lob (Germany) and Professor A Maglio (Italy).

In 1963 the journal 'Paraplegia' was founded. Guttmann was the first Editor until his death in 1980. He was succeeded as Editor by Phillip Harris. The journal was published four times a year and consisted of original articles and a lengthy description of the Annual Scientific Meeting (ASM) together with a transcript of the discussions.

The Society and its Journal had an immediate worldwide influence. Many more clinicians joined from all countries and continents including the USA. By 1970 the Society had 446 members. The ASMs of IMSoP were initially held in Stoke Mandeville annually except for the year of the Para-Olympics when the meeting was held in the host country.

I first attended the ASM in 1972 as a young trainee at SM. I must admit I was initially overwhelmed by the energy generated at the ASM. The discussions and debates were sometimes very 'heated' but they were always carried out within a very friendly spirit. Alcohol flowed in the evening at the Red Lion in Wendover and past midnight in the postgraduate Centre of SM reinforcing the camaraderie and in nowadays terms "bonding" between the members of the Society. By 1983 the membership had risen to over 550 members and the number of members attending the ASMs was more than 130 (exceeding the capacity of the Auditorium at Stoke Mandeville Hospital) and ASMs were held in various other countries. The last ASM held at Stoke Mandeville was in 1991.

Many changes have occurred since. The Society has grown at a much faster rate. Clinicians with pedigrees from allied specialties were invited to become members, benefit from the knowledge that the first generation of "Paraplegists" had accumulated and contribute with their special knowledge as well as with basic and clinical research in their own fields. The great majority who joined enhanced the philosophy of the "Injury to Grave Service" for patients with SCI and helped advance management.

In April 1996 the Journal was renamed Spinal Cord as already the majority of the members were dealing with spinal cord paralysis from various non traumatic origin. Many more members joined and the Society changed its name to The International Spinal Cord Society (ISCoS) at the Annual General Meeting held in Nottwil, Switzerland on 14 September 2001 to reflect the varying activity of its members.

Both the Journal and ISCoS continued to thrive. The impact factor of Spinal Cord

continued to rise under the successive leadership of Dr Lee Illis and Professor Wyndaele. This together with the publication of basic research findings have made Spinal Cord attractive for a wider audience.

Currently ISCoS has over 1,000 members from 87 countries and five continents. In order to address the difficulties in disseminating knowledge, experience and good practice ISCoS has encouraged the development of Affiliated, Regional and National Societies and supported many scientific meetings and workshops throughout the world. In the last few years ISCoS has also engaged in a number of activities to enhance education, uniformity in data collection and adequate comparison of outcomes of management.

ISCoS and its members have made significant contributions to the fields of Urology, Neurology, Orthopaedics, Neurosurgery, Neurophysiology, Endocrinology, Reproductive Medicine and many others. ISCoS' biggest achievement, however, was to highlight the important fact that the clients it serves are relatively small in number and have special characteristics that are not shared by any other group of patients: they are physiologically impaired, have a multi-system malfunction, have multiple disabilities, most of which can be minimised and can develop a wide range of complications most of which are preventable and/or can be minimized. Because of the sensory impairment/loss the presentation of pathology (related or unrelated to the SCI) is a challenge to most clinicians who are not practicing in the field. Furthermore the principles of management of most conditions in SCI patients are by force of the physiological impairment generally different from principles of management of the same condition in neurologically and physiologically intact individuals. Looking after patients with these characteristics does require specialist training, skills and expertise that develop over many years. ISCoS is aware that without the recognition of the field as a "Specialist" field of medicine it would be difficult in future to attract good quality clinicians who are prepared to work in what is rightly or wrongly perceived as a non glamorous field of medicine. This is a challenge among the many challenges that ISCoS is not shirking of tackling.

I strongly believe, however, that ISCoS will need to become a little more assertive in order to meet the many challenges ahead. ISCoS will have to develop further to become the first contact for providing advice on all issues related to spinal cord paralysis, including curriculum and accreditation of training, interpretation of research findings as well as advice on quality of outcomes following acclaimed interventions and treatments. ISCoS should become the first organisation to contact about the management of casualties with SCI from disaster areas. I equally strongly believe that ISCoS should encourage all clinicians who look after SCI patients to become members of the Society or an affiliated Spinal Cord Society highlighting the benefits of a huge pool of experience and the hazards of isolation. Our client group is an asset and a potential force that has not been harnessed on a global scale. I am confident that once our client group understands what our Society is about, ISCoS will acquire all the support it needs to help achieve its endeavours.

In a world where the forces of fragmentation are enormous and increasing; where quick profit irrespective of consequences is often promoted; where expediency is acclaimed as progress, where it is easier to make false claims than promote what has been proven to be effective, where nature is denied its power of healing, ISCoS has many challenges ahead which have to be met and can certainly be met. Fortunately, the membership of

ISCoS, despite its relatively small number compared to other International Societies, is supreme in its quality and is quite capable of meeting the challenges it faces for as long as the main aim is the benefit to patients. It is equally fortunate that WHO has relatively recently taken an interest again in our relatively small and disadvantaged group of patients and WHO and ISCoS has rekindled their relationship.

We owe thanks and gratitude to the founder members of IMSOP/ISCoS, the past Presidents and Officers as well as all members who over the years nurtured our Society. ISCoS has become increasingly stronger by adapting and changing while never deviating from its aims and objectives which are to improve the lives of our patients. I am confident that as long as ISCoS' continues on this path and continues to remain truly International our Society can only become stronger and more influential in the world of the future

L3

Isrt Lecture

Physiological tools for monitoring outcome of interventive measures in spinal cord injury: a Clinical Initiative

Peter Ellaway

Department of Clinical Neuroscience - Division of Neuroscience & Mental Health Imperial College
London
UK

The talk would introduce the new and improved physiological tests that we have been developing to assess the level and completeness of a spinal cord injury. These tools have been refined in order to detect the smallest change, whether beneficial or deleterious, that might result from novel interventions intended to promote recovery of function. The talk would focus on our use of repetitive transcranial magnetic stimulation (rTMS) of the sensorimotor cortex to improve motor and sensory function in incomplete spinal cord injury. If time permitted, I might also talk about the outcome of our other trial that employed weight-assisted treadmill walking (WAT) to promote improved locomotion. In both projects, the "treatment" (rTMS or WAT) was expected to promote recovery of function through plasticity of retained connections and their supraspinal control circuits. The aim was to compare the sensitivities of clinical (ASIA), functional and physiological outcome measures

L4

ISCOS-IPSCI Presentation

International Perspectives on Spinal Cord Injury (IPSCI) - A collaborative ISCoS-WHO project

Per Maximilian von Groote

Schweizer Paraplegiker-Forschung
Switzerland

Spinal cord injury (SCI) is devastating and costly in both human and social terms. People with SCI can experience diverse health problems and environmental barriers. The state of health care for SCI provides an indicator for the development of the health systems. In high income countries, advancements in medical treatment, rehabilitation and

community care have substantially improved survival rates, and enhanced quality of life for people with SCI. In most parts of the world, however, needed treatments, rehabilitation and support remain unavailable or underdeveloped. It is important to develop an adequate evidence base for SCI and related interventions.

On 13-14 November 2008, Swiss Paraplegic Research in Nottwil, Switzerland hosted the first editorial committee meeting on International Perspectives on Spinal Cord Injury (IPSCI), a joint WHO and International Spinal Cord Society project to provide a global overview of interventions, services, health systems and policies for people with SCI. The lecture will both introduce the production processes and the content of IPSCI.

The scope of IPSCI is the entire lived experience of SCI, from trauma and acute care through rehabilitation towards full participation in family and community life, education and employment. Chapters on causes and prevention of SCI, on assistive technology and the enabling environment, complete the world-wide picture of life with SCI. IPSCI is being developed in partnership with professional organizations and organizations of persons living with SCI from around the world and publication is planned for 2010. IPSCI will be invaluable to health professionals and policy makers, but most importantly, to people living with SCI around the globe.

L5

SoMIPar Guidelines

Italian Multidisciplinary Guidelines for the Acute Management of Spinal Cord Injury

Jacopo Bonavita

Italy

The implementation of Italian guidelines for the acute management of spinal cord injury (SCI) is the result of a comprehensive multidisciplinary work promoted by the Italian Medical Society for Spinal Cord Injuries (So.M.I.Par) started in 2005 and involving about 50 experts in differing disciplines (Emergency & Intensive Care, Physical Therapy & Rehabilitation, Neurophysiology, Occupational Therapy, Spinal Surgery, Urology, Plastic Surgery, Psychology) in collaboration with methodologists from the Mario Negri Institute. For each discipline, a comprehensive literature search was made looking for articles referring to the diagnostic and/or therapeutic management in the first 30 days after traumatic myelopathy.

Each article was subjected to critical appraisal and the results were assessed in light of the level of scientific evidence. These results were presented at a consensus conference in Rome in February 2009 where a panel of experts made evidence-based graded recommendations. The results and conclusions of the consensus conference are reported in a comprehensive monograph consisting of 16 monothematic chapters. Each chapter includes an introductory paragraph with an outline of the problem, a number of focused questions followed by evidence tables providing the evidence base for the recommendations. The text is structured for a rapid search of (and answer to) relevant problems encountered with the diagnosis and acute management of SCI, with special attention to clinical practice. We propose these guidelines as an evidence-based model for a standardized management of acute SCI.

SYMPOSIA

S1

The development and assessment of a vaprophilic catheter

Pierre Denys

Clesson I.; Perley J.; Wachs B.H.

Dept of Physical Medecine and Rehabilitation, Raymond Poincaré Hospital, University of Versailles
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Purpose: Intermittent Catheterisation (IC) is the Gold standard of care for patients with neurogenic bladder disorders induced by spinal cord injury (SCI). This study was designed to assess user appreciation of the VaPro catheter, a new hydrophilic catheter with introducer tip and protective sleeve, specifically designed for aseptic use.

Methods: A non blinded multisite user assessment and preference study was designed to assess user appreciation of the characteristics of the catheter, introducer tip and preference. Study included adults who were current users of hydrophilic catheters and who had independently performed IC more than 3 times daily and for more than 3 months. Patients were asked to use 15 VaPro in a period of 4 days and completed questionnaires at the end of the study.

Results: 57 patients were analysed (50 males), 46 SCI. VaPro has been found to be easy to open (98%) & remove from the package (98%), easy to handle (88%), easy to insert (85%), and easy to remove the protective cap (97%). VaPro has been found easy to advance through the introducer tip (95%). VaPro had adequate lubrication (92%) & no discomfort was felt while inserted (95%). Compared to the previous catheter: VaPro is easier to open (88%) & easier to remove from the packaging (83%). VaPro is easier to insert (86%), easier to advance through the urethra (91%), and easier to remove after catheterization (89%). Percentages include positive and neutral responses.

Conclusion: VaPro seems to be a valuable and comfortable hydrophilic catheter designed for aseptic use.

S2

Intermittent catheterization and urinary tract infection

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Urinary tract infection (UTI) is the most common complication of intermittent catheterization (IC). It is estimated that one in every 3 spinal cord-injured patients have bacteriuria at any time and that eventually almost all of them will become bacteriuric and many will suffer significant morbidity and mortality.

It has been reported that sterile IC significantly reduces the risk of UTI and/or bacteriuria compared with clean IC. Sterile IC, however, cannot be used routinely; aseptic or clean IC is feasible alternatives. Compared with clean IC, aseptic IC provides significant benefit in reducing the potential for contamination. Inadequate education and the inherently greater risk of UTI in patients with NLUTD contribute to the risk of infection. On average, for catheterization, a 12–14 French catheter is needed four to six times per day. Less frequent catheterization results in higher bladder-storage volumes and an increased risk of UTI. More frequent catheterizations increase the risk of cross-infection (1)

In a recent Cochrane review addressing different catheterization techniques (sterile or

clean), type of catheter (coated or uncoated), sterile (single-use) or clean (multiple use) catheter sterile (single-use) catheters or clean (multiple self-catheterization or catheterization by others and it was shown that it is not possible currently to state that any catheter, technique or strategy of CIC is better than another (2)

1.- Stöhrer M, et al. EAU Guidelines on Neurogenic Lower Urinary Tract Dysfunction, Eur Urol(2009), doi:10.1016/j.eururo.2009.04.028
2.- Moore KN . Long-term bladder management by intermittent catheterization in adults and children. Cochrane review 2009.

S3

Sexuality and Incontinence: Uncharted Urogenital Systems

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Spinal Cord Injuries cause significant problems with neurogenic bladder, bowel and sexual responses (urogenital systems). These systems are neurologically and physically interrelated because of the proximity of their autonomic control centers in the thoracolumbar and sacral spinal cord and the common use of genitalia to perform multiple functions. Excellent methods to document and manage the impact of injury on urogenital systems have been developed including the use of the International Standards for the Documentation of Autonomic Function and the International Data Sets. Advanced methods for diagnosis and treatment of various complications have also been developed. Despite these advances, we have yet to explore the obvious interrelationship that exists between the impact of spinal cord injury on incontinence and sexual responses.

Using case studies, the relationships between neurogenic incontinence and sexuality will be explored. The neurologic effects of various injury patterns on bladder and bowel function and sexual responses and the emotional impact of incontinence on sexuality will be addressed. Furthermore, the practicalities of sexual activity and incontinence will be reviewed. Future research questions will be proposed including the effects of timing, medications, vibratory stimulation and surgery on urogenital function including incontinence and sexual responses. Review of the International Standards Neurologic Examinations and the impact on neurogenic bladder and bowel and sexual function will also be undertaken with a goal of development of new therapies.

S4

Generic introduction on neurogenic bladder problems and management

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The innervation of the LUT knowledge has grown substantially: how the nerve structures and the urothelium change with impact on afferent and efferent nerve activity and resistance against infection. Secondary changes in muscle and vascularization will in term induce alterations in function.

Epidemiology: > 90 % of individuals with spinal cord lesion will develop neurological LUT dysfunction.

Management: Diagnosis: will be made by history taking (level and completeness of lesion, previous history, drug intake,...), clinical and neurological investigation. Urine analysis is mandatory. Some blood tests may be needed. Urodynamic testing is useful in capable hands and is strongly advocated before more invasive treatment is applied. The evaluation of the upper tract with imaging and/or scanning should be part of the

management.

Treatment: During spinal shock an indwelling catheter is used. For intermediate and chronic management intermittent catheterization is considered the best overall option today often in combination with bladder relaxing drugs. If longer or more permanent indwelling catheter is needed a suprapubic tube would lower the risk of urethral problems. Main overall goals are to avoid overdistension, infection, incontinence and keep the pressure in the LUT low and the bladder capacity sufficient. More aggressive treatment can be indicated if the conservative treatment gives unsatisfactory results.

Follow up; should be regular and life long.

Urological management is only one part of the total comprehensive multidisciplinary treatment of individuals with spinal cord lesion. Treatment will always be decided on an individual basis adapted to the own possibilities and needs.

S5

Colorectal Dysfunction In Spinal Cord Injury: Pathophysiological And Clinical Considerations

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Digestive function is one of the greatest problems in spinal cord injuries, particularly control of evacuation. The term "neurogenic bowel" is an indication of the belief that the two functions of bladder emptying and evacuation of the rectal contents are thought to be similar, but bladder muscular wall does not contain a complex neuronal network of the type that runs along the whole g.i. tract. Bladder content is invariably liquid, while faeces can be anything from semi-liquid to decidedly solid, with variations even within the same material evacuated in the same defecation. In addition, urine flows into the bladder almost continuously, while there is considerable variation both in the intervals between times when the rectum is filled, and how long this takes. More than 70% of the dry weight of faeces consists of bacteria, mostly living. Instruments to explore bowel function in spinal cord injury are now available in more advanced centres and in specialist spinal units, i.e. multichannel anorectal manometry, study of transit with radiopaque markers, computerised barostat measurement, and dynamic radiological studies with defaecography. Systematic use of these studies makes it possible to identify the various pathophysiological mechanisms that may cause apparently identical clinical situations. Just as in functional gastrointestinal disorders in whom histopathological lesions could not be found to explain the symptoms, so in SCI patients it is important to determine the precise disorder causing the evacuation problems, and so to plan targeted therapy.

S6

Quality of life instruments for people with disabilities

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USA

For the average person, bladder function and care requires little thought and only episodic attention. For the person with a spinal cord lesion, however, bladder management issues may consume considerable amounts of time and energy. In addition, the absence of satisfactory bladder control and problems associated with neurogenic bladder can pose

both health and quality of life issues. While health issues are typically more easily identified, described and treated, quality of life (QoL) issues are far more difficult to address. Several problems exist in assessing QoL, including the most basic issue of how we define the concept. In addition, the validity and reliability of various scales in the SCI population has only recently been examined. While some QoL instruments are widely used in SCI, there are often regional preferences. For example, the Satisfaction with Life Scale has been used extensively in North America, while the LiSat9 has been used extensively in Europe. Assuming definitional issues can be resolved to appropriately address QoL on a worldwide basis, additional factors need to be considered, such as capturing an individual's global perception of his or her QoL, or focusing more on a symptom or condition-specific approach. Using a single or multiple instruments to capture QoL in a quantitative manner may require supplemental information that is best gathered through qualitative interviews. Various approaches, such as using a newly developed International SCI Data Set for Quality of Life, will be presented and discussed, as well as descriptions of the limitations in existing QoL measures.

S7

Qualiveen: A QoL scale designed for spinal cord injured individuals

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Switzerland

For many years, complications of neurogenic lower urinary tract dysfunction have been the most frequent causes of death in the long term follow-up of patients with spinal cord lesions. Within the last years, mortality due to urologic complications has decreased. Thus, not the mere effectiveness, but also the implications of urologic treatment on patients' QoL have become an increasingly important issue.

The Qualiveen® questionnaire is the only validated tool for the assessment of health related quality of life in relation to lower urinary tract function available today. It is available in French, English, Portuguese, and German. Recently, a short form of the questionnaire has been developed in English.

The fate of patients with spinal cord lesions is closely related to bladder function. Therefore, treatment of bladder dysfunction cannot entirely be based on patients' QoL, but objective criteria have to be fulfilled. In a recently published study, QoL assessment has been correlated with objective urodynamic data. In this study, including patients performing intermittent catheterization, continence was a key point for patient satisfaction with their urologic situation. Intermittent self-catheterization was well tolerated if detrusor overactivity is well controlled. A treatment regime leading to favorable urodynamic data and to continence correlated with a better QoL in these patients. Prospective longitudinal studies with a long term follow up, evaluating patients with different kind of bladder evacuation at regular intervals are needed to enable us to counsel patients safely.

S8

How bladder and bowel problems can influence the life of a disabled person

Michael Cogswell

Former member of the GB Sailing team
UK

Michael Cogswell was injured in a skiing accident completely fracturing his spine at T5. Michael will talk about how bowel and bladder incontinence is the most disabling issue affecting the lives of the spinally injured. He will describe how he manages his own incontinence and how it affects him everyday and the impact on his life as an international sports person. In particular Michael will describe how anal irrigation has made a significant difference to his continence and his quality of life.

S9

Classification and epidemiology of neuropathic pain following SCI

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Denmark

Neuropathic pain is defined as "pain arising as a direct consequence of a lesion or disease affecting the central somatosensory system", and spinal cord injury (SCI) is among the diseases with the highest risk of developing neuropathic pain. Neuropathic pain affects 40-50% of people with SCI and has a major impact on the patient's quality of life since it may be severe, chronic, and difficult to treat. It is therefore not surprising that chronic pain is ranked as one of the most disabling consequences of SCI. Neuropathic pain following SCI is divided into at-level and below-level pain, where "level" refers to the level of the spinal cord that was injured. At-level pain is a central or peripheral neuropathic pain caused by the damage to the spinal cord and/or dorsal root and includes neuropathic pain associated with cauda equina damage. Below-level pain is a central neuropathic pain arising as a direct consequence of damage to the spinal cord. SCI patients may experience other types of neuropathic pain not directly related to their SCI, such as compressive mononeuropathy. SCI neuropathic pain may be spontaneous and described in terms such as burning, pricking, squeezing, or shooting. Some patients also have severe allodynia, where light contact with e.g. clothing or a cold object is painful. Onset of pain may be immediate or delayed up to several months after the injury. Any prolonged delay in neuropathic pain onset should prompt an examination for other causes such as syringomyelia.

S10

Pathophysiological mechanisms of neuropathic pain after SCI

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Several peripheral, spinal and supraspinal pathophysiological mechanisms related to changes in nociception or neuropathic pain have been identified in both animal experimental models and clinical studies in patients following SCI. Many of these

mechanisms have been proposed to mediate both non-evoked ongoing and evoked neuropathic pain. In the peripheral nervous system (PNS) changes in the expression of thermal transduction ion channels in dorsal root ganglion below the SCI have been identified, while abnormal activity of injured afferents has been suggested to play a role in at level SCI neuropathic pain. In the central nervous system (CNS) spinal and thalamic neuronal hyperexcitability to both innocuous and noxious stimuli has been described, often in parallel with an upregulation in sodium ion channels. Neuroinflammation measured by an increase in microglia activity and associated chemokine receptors has also been identified at the spinal and thalamic level. Finally changes in somatotopic cortical representation may mediate increases in neuropathic pain following SCI. The pathophysiological basis as to why only 40-50% of patients develop neuropathic pain after SCI is still not understood, which may be explained by the presence of specific physical factors associated with the injury. Therefore a better diagnosis of the pathophysiological mechanisms associated with neuropathic pain after SCI will help to improve future treatment strategies.

S11

Treatment of neuropathic pain following SCI

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Sweden

The current treatment of neuropathic pain following SCI is notoriously difficult. Only a few well-designed treatment studies have been performed and the number of participants in these studies is often low which makes general interpretation of the results difficult. Larger randomized studies have shown efficacy for amitriptyline and pregabalin and these substances are often recommended as first-line agents for SCI neuropathic pain. When tricyclic antidepressants (TCAs) are not tolerated, serotonin noradrenaline reuptake inhibitors (SNRIs) such as duloxetine may be used. Tramadol has also been found to relieve SCI neuropathic pain and, as with opioids, maybe considered as second-line drugs or for break-through or intermittent pain where long-term treatment is not indicated. Adverse events commonly affect compliance. Since neuropathic pain is quite refractory to treatment, many patients continue to experience pain that is inadequately relieved up to a long time after injury, and treating it often requires a multidisciplinary approach including concomitant treatment for anxiety, depression, and psychological distress. Treatments involving non-pharmacological options are also often requested by patients but very few studies have been published within this field. Treatment with Transcutaneous Electrical Nerve Stimulation (TENS) and acupuncture might represent useful complementary treatment programmes. Cognitive behavioural therapy and hypnosis are also useful in some patients. Transcranial direct current stimulation relieved SCI pain in a sham-controlled trial and new trials on single and repetitive transcranial magnetic stimulation suggest transient efficacy in central pain and a possible predictive role for the efficacy of implanted systems for motor cortex stimulation.

S12

General guidelines for the conduct of SCI clinical trials and factors influencing the interpretation of human study data

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There are several challenges to conducting SCI clinical trials. First, in order to “believe” translational data, preclinical findings must be independently validated/replicated. The second challenge is to identify which type of SCI is most appropriate for the chosen clinical target. The third challenge is the number of confounding factors that can jeopardize trial outcomes, but investigators can control. These factors include: unsuitable protocol design or statistical analysis, PI bias or placebo effects, inappropriate/unreliable/insensitive clinical endpoints, lack of independent blind assessments of outcomes, and a lack of appropriate control subjects. Other challenges, sometimes beyond the control of the investigator, include: prior emergency/primary care, as well as the onset, type and extent of rehabilitation activity, all of which should be controlled or at least assessed for their influence on outcomes. The fourth challenge is the outcome tools and measures must be specific for the therapeutic target being examined. Additionally they must be: sensitive enough to detect distinct but subtle changes in activity or function, reliably used by trained examiners, and for pivotal (phase 3) trials they should be able to measure a functional capability that is clinically meaningful. The fifth challenge is the degree of “spontaneous” improvement in sensory and motor function over the first year after injury, especially for people having incomplete SCI. Valid clinical trial programs require: suitable pre-clinical (or prior clinical) evidence for potential benefit of a therapeutic intervention, randomization of an appropriate number of participants to experimental and control groups, blinded assessments over a sufficient recovery period, and an appropriate sensitive and accurate outcome tool to reliably detect a significant difference between experimental and control groups.

S13

Clinical trials for spinal cord injuries

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Animal studies have shown many promising therapies for spinal cord injury (SCI), including cell transplants and drugs that promote repair after SCI. I will review some of these promising therapies for SCI and the clinical trials that are being done or are being planned, including: the potassium channel blocker Fampridine, the Nogo antibody, the rho blocker Cethrin and other rho antagonists, the enzyme chondroitinase, phosphodiesterase enhancers such as rolipram and lithium. The mechanisms by which these drugs act, the rationale for combining them with other therapies such as cell transplants, will also be discussed.

S14

Stem cell transplants after SCI: What is the preclinical evidence for benefit and what are the sources of transplant materials?

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France

There exists presently no efficient curative therapy for spinal cord injury (SCI). One of the possible strategies involves the use of stem cells transplants. The RESCUE European Project has studied over the last three years the possible sources and benefits of human stem cell transplants in the severely injured rat spinal cord. Mesenchymal stem cells were discarded as they were unable to differentiate into neural cells once transplanted, and did not improve the anatomical and functional outcome. Neural stem cells, either immortalized in permanent lines or transfected with proneural genes were found to improve the functional outcome of SCI rats. For the latter, it was found that they did not transform into differentiated neural cells integrated in neural circuits after transplantation, but rather favoured the regeneration and sprouting of intrinsic descending fiber systems. Moreover, this influence, thought permanent, and highly significant, occurred through a short temporal window, since most of the cells had disappeared from the cord after one month. Finally, control, non-transfected cells of the same origin were found to worsen the function vs medium-injected animals.

We conclude that cell transplantation per se can be harmful to the injured spinal cord, and that great care should be taken to obtain a highly significant improvement of the functional outcome on appropriate preclinical models before going to clinics.

S15

Active rehabilitation strategies to promote neural plasticity and functional recovery after SCI

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After a spinal cord injury (SCI) an improvement in various neurological and functional measures can be observed. This improvement can be caused by various mechanisms. Physical activity is assumed to enhance plasticity within preserved neural circuits (like the central pattern generator or CPG) and the formation of collateral sprouting above and below the level of lesion. In this way, the epicenter of the injury can be bypassed and supplementary pathways (like propriospinal) can contribute to the recovery of function. Furthermore, compensation, i.e. changes in function that can be achieved without any change in the neurological deficit, for example, by adapted or new movement strategies, can play a role. At present, there are no indications that repair mechanisms, such as remyelination or regeneration that reconnect damaged spinal tract fibers, occur, as the latency of transcranial magnetic evoked potentials or somatosensory evoked potentials remains stable after SCI.

A nice example how knowledge about training and functional improvement derived from animal experiments can be translated to the human condition, is bodyweight supported treadmill training. Spinalized cats were trained on a treadmill and after some weeks, they regained locomotor ability. At present, many rehabilitation centers apply, besides

"conventional" physical therapy, bodyweight supported treadmill training to their sensory-motor incomplete patients. While such a training, especially when combined with robotic devices, enables a high number of repetitions and prolonged training duration, previous studies have not found superior effects of such training interventions. This could be due to various factors, for example, the appropriate selection of patients who might profit from this intervention and the lack of knowledge concerning the "rules" for training, i.e. when and how to intensify training. As recently also robotic devices for the upper extremity have been introduced in the field of SCI, the question needs to be answered how therapists can optimize functional recovery of the upper and lower extremity, by combining conventional therapy with new devices and training possibilities. Answering this question should be a target for the SCI rehabilitation community within the coming years.

S16

History of bladder catheter

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Italy

History of bladder catheterisation dates back to 2600 years ago. The oldest witness can be found in the Indian surgical text Sushruta Samhita (600 BCE), where gold, silver, iron and wood tubes are described which were lubricated with ghee (liquid butter) for evacuation of urine, management of urethral strictures, instillation of medication, and assistance in lithotomy. The Roman encyclopedist Aurelius Cornelius Celsus in his *De Medicina* (circa 30 CE) lists bronze and lead pipes for urethral catheterization. The eruption of the volcano Vesuvius (79 CE) buried, among others, a surgeon's house in Pompeii where during the excavation a variety of straight and curved bronze urethral catheters were found. Extensions of the use of urethral catheters were suggested around 100 CE by Rufus of Ephesus (bladder drainage of spinal cord injury patients) and by the gynecologist Soranus of Ephesus (bladder catheterization before the delivery). In the same century, Claudius Galen of Pergamus (138-201 CE) employed S-shaped metal catheters. At the end of the first millennium the Persian physician Avicenna (980 -1037 CE), in his *Cannon of Medicine*, described the first flexible catheters made from stiffened animal skin which he used with soft cheese as a lubricant. The American inventor and scientist Benjamin Franklin, in a letter written in 1752, described a flexible silver catheter he designed for his older brother John, who suffered from bladder calculi.

In 1860, Auguste Nelaton (1807-1873), physician to Napoleon III, introduced a vulcanized rubber catheter with a sidehole near its tip which is still used today, as is the two-ways self-retaining balloon catheter devised by the US urologist Frederic Foley (1891-1966). In the seventies of last century intermittent catheterisation was proposed by the founder of spinal cord Medicine L. Guttman with the aseptic technique and by Jack Lapides with the technique. The latter stood the test of time.

In 1983 Astra-tech marketed the LoFric, the first hydrophilic catheter for CIC, based on the intuitions of S. Stroger and H. Valimaa.

S17

How to optimise the outcome of CIC?

Jean-Jacques Wyndaele

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Belgium

Intermittent catheterization (IC) is nowadays widely used for the urological management in patients with neurogenic bladder as from spinal cord lesion. The goals of the technique are to empty the bladder regularly without leaving permanent foreign material, to have a urodynamically safe bladder with sufficient capacity and low pressure, to keep continence and to avoid infections and other complications.

Urinary tract infection is the most frequent complication though mostly subclinical. Catheterization frequency and the avoidance of bladder overfilling are amongst the important prevention measures. Asymptomatic bacteriuria does not need to be treated with antibiotics. Longterm antibacterial prevention bares a risk of development of resistance. Previous treatment with indwelling catheters is a risk factor for chronic infection and urinary sepsis.

Prostatitis is more frequently present than often thought. Epididymitis and urethritis are rare. Urethral bleeding is frequent in new patients and occurs regularly in one third on a longterm basis. Trauma from catheterization occur regularly but lasting effects are more limited. However, the prevalence of urethral strictures and false passages increases with longer use of IC. The use of hydrophilic catheters might be able to lower the urethral complication rate but additional prove through comparitive studies is needed. Other complications as hydronephrosis, vesico-ureteral reflux, and bladder cancer seem to relate rather to infection, bladder trabeculation, detrusor pressure or neuropathy than to IC itself. Spinal cord injured patients using clean intermittent catheterization would generally exhibit a reduced quality of life in all health domains.

Between the most important prevention measures are good education of all involved in IC, good patient compliance, the use of a proper material and the optimal application of a good catheterization technique.

S18

Bladder and mind -Even Wittgenstein needed to pee

Claes Hultling

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A big crisis in life changes the prerequisites for the rest of the life. Things are not like they used to be. The new situation requires a different mindset. The new mindset takes its origin from this crystallisation point or a defined philosophical face.

Even if your tragedy is a divorce, a lost child or a broken neck the energy that this crisis constitute can be used to guide your mind, your soul and your body forward. A tremendous lot of people around the world today are offered various types of pharmaceutical drugs such as Prozac, Sipramil, and Zoloft in order to "feel better". My perspective differs from that. I think that you have to exercise your grief when this happen and then make use of philosophical counselling to gain strength.

"Plato not Prozac" is a title of a book written by an American philosopher named Lou Marinoff. He started APPA, American Philosophical Practitioner Association" in 1999, and

this society has in a very fruitful way implemented philosophy in the therapy for people in various types of crises.

When you are subject for a spinal cord injury and unable to void in a natural way, you are forced to use alternative methods to empty your bladder. One of them is intermittent catheterization, which is a good and safe and reliable technique, but in order to get acquainted with this technique you are not only to overcome how to introduce a catheter into your urethra, but also mentally to handle this very matter. That is not always an as easy task as the pure practical technical manoeuvre is, but nevertheless the mental part is often an overlooked fact.

We are offering a crash course in philosophical counselling for urotherapists who need to understand the mental implication it constitutes when you have to embark on to intermittent catheterization.

S19

Understanding the neurogenic bladder

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Spinal cord injury (SCI) rostral to the lumbosacral level eliminates voluntary and supraspinal control of voiding leading initially to an areflexic bladder and complete urinary retention, followed by a slow development of automatic micturition and neurogenic detrusor overactivity (NDO) mediated by spinal reflex pathways. However voiding is commonly inefficient due to simultaneous contractions of the bladder and urethral sphincter (detrusor-sphincter-dyssynergia, DSD). Electrophysiologic studies in SCI animals revealed that NDO depends on the reorganization of synaptic connections in the sacral spinal cord and the emergence of a spinal micturition reflex pathway activated by capsaicin sensitive C-fiber bladder afferent nerves. Sufficient clinical evidence exists to support the view that a comparable process occurs in man following a spinal lesion resulting in extensive efforts to therapeutically reduce the C-fiber afferent input using intravesical or intramural administration of neurotoxins (capsaicin, resiniferatoxin or botulinum toxin).

Changes in the electrical and chemical properties of C-fiber bladder afferent neurons including alterations in ion channels and transmitter expression contribute to NDO. This neuroplasticity seems to be mediated by the actions of neurotrophic factors such as nerve growth factor (NGF) released within the spinal cord or the urinary bladder. The production of NGF increases in the bladder after SCI and chronic administration of NGF into the bladder of animals induces bladder hyperactivity and increases the excitability of bladder afferent neurons. On the other hand, intrathecal application of NGF antibodies to neutralize NGF in the spinal cord suppresses NDO and DSD in SCI animals. Human studies support a role of NGF and plasticity of C-fiber bladder afferents in NDO.

In conclusion, NDO is attributable to a reorganization of spinal reflex mechanisms as well as a change in the properties of peripheral afferent nerves. A greater understanding of the pathophysiological mechanisms underlying NDO should facilitate the development of new treatments for neurogenic lower urinary tract dysfunctions.

S20

Imaging the Injured Cord in the Sub-Acute and Chronic Phase

Richard Hughes

Stoke Mandeville Hospital

UK

MRI scanning is now an integral part of the assessment of acute spinal cord injury and in conjunction with clinical indicators may help in prognosticating the injured patient.

In the acute and subacute injury phase spinal MRI can demonstrate the extent of cord oedema, cord haemorrhage, cord disruption and the presence of ongoing thecal compression.

Resolution of these cord MRI changes can be accurately and reproducibly followed with interval scanning. In patients who demonstrate neurological deterioration in the subacute or chronic clinical setting, MRI can give early indication of complicating processes such as subacute progressive ascending myelopathy (SPAM), traumatic cyst formation, propagating syrinx formation or cord atrophy. MRI is a non-invasive and reproducible method to monitor progress of these lesions. The extent of cord atrophy, scarring and tethering is demonstrable in the late phase.

In asymptomatic patients, the role of interval screening scans and their frequency is unclear - we will discuss our experience and protocols.

MRI has struggled in the presence of spinal metalwork but modern magnets and dedicated imaging methods can overcome most metal artefacts, facilitating post-operative scanning in patients who have undergone spinal fixation. Newer imaging techniques include diffusion weighted MRI and tractography which can add structural and functional information - the role of these techniques is evolving and will be reviewed in this talk.

S21

Imaging the Bony Spine in the Late Phase Post Injury

Rowena Warwick

Stoke Mandeville Hospital

UK

The decision of when to mobilise a patient with a spinal cord injury who has sustained fractures to the spine can be difficult. Vertebral union following fractures or incorporation of graft can be particularly difficult to assess. Altered sensation causes further limitation in clinical assessment. It is essential that any fractures are united and that the spine is stable. Any complications relating to surgical metalwork need to have been resolved.

Imaging has much to offer in this decision making process, from plain films to computed tomography and magnetic resonance imaging in the assessment of metalwork, alignment and union of fractures. Computed tomography provides a basis for highly accurate and precise assessment of the three-dimensional structural parameters of bone. The use of Magnetic Resonance Imaging (MRI) to evaluate for occult fractures and the presence of non-union in other bones can be extended to the spine. Fracture lines, continuity of marrow signal and the presence or absence of bone marrow oedema as evidenced by signal change on MRI may indicate progression of fracture healing.

S22

The role of Interventional Radiology in the management of patients with spinal cord injury

Wei Chuen Liong

Stoke Mandeville

UK

Interventional Radiology uses minimally invasive, image-guided techniques to deliver treatment for a variety of conditions that otherwise require open surgery. These techniques can be particularly useful in the management of spinal cord injury (SCI) patients, who are at higher risk of developing certain complications.

1) Pressure ulcers: Angioplasty and stent placement to treat stenoses in arteries supplying the ulcerated area improves blood flow and may encourage healing. At our centre, we have also performed angioplasty and stent placement to improve inflow of blood into muscles (eg gracilis) subsequently used by plastic surgeons to cover pressure sores in the sacral area.

2) Renal calculi and obstructive uropathy: SCI patients are at high risk of developing renal complications. Percutaneous nephrostomy, antegrade ureteric stent placement and percutaneous nephrolithotomy are all interventional radiological techniques useful in managing these complications.

3) Vertebroplasty is a percutaneous, minimally invasive technique used as an alternative to surgical fixation to stabilise vertebral fractures.

4) Ultrasound and CT guided drainage of pleural effusions, abdominal and pelvic abscesses and other collections.

5) CT guided botulinum toxin injections into the psoas muscles to treat spasm.

6) The reduced mobility of SCI patients increases their risk of venous thromboembolism. If such patients cannot be anticoagulated, caval filter placement reduces the risk of pulmonary embolus.

The clinical indications and radiological techniques will be discussed comprehensively, and relevant illustrations will be provided.

The aim of this presentation is to increase awareness of the availability of Interventional Radiology techniques to assist in the management of SCI.

S23

Imaging of the Renal Tract in Spinal Cord Injury

Tom Meagher

Stoke Mandeville Hospital

UK

Complications from the renal tract in patients with spinal cord injury are no longer a major cause of mortality but continue to be a significant cause of morbidity. Issues in imaging of the renal tract are principally concerned with surveillance for renal or bladder calculi or evidence of outflow obstruction which may lead to nephropathy. There is a wide variation in approach to routine surveillance with little evidence base but some consensus. Imaging has an increasingly important role in the acutely unwell patient with complicated infection. Most acute infections of the renal tract do not require imaging, but in patients with severe sepsis imaging is important to exclude conditions requiring intervention such as pyonephrosis and to exclude other causes of infection.

New imaging modalities developments offer significant benefits in evaluation to spinal cord injured patients with complex renal tract problems. New multislice CT systems use

increasingly low radiation dose techniques which is of particular importance in this population with a young median age. This is particularly helpful in evaluation of complex stone disease.

MRI looks a promising tool for evaluation of renal infection. This may have a role to play in the future in difficult cases where ultrasound is unhelpful and radiation should be minimised.

S24

SCI including respiratory, Bowel and Cardiovascular Issues

Roger Bodley

Stoke Mandeville Hospital

UK

This talk will review the role of modern imaging techniques in assessment of multisystem disease in the spinal injured patient including aspects of high resolution CT, CT pneumocolon, imaging venous thromboembolism.

S25

Clinical Perspectives on Imaging Strategies in Chronic Spinal Injury

Ali Jamous

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UK

S26

Use of Special surfaces in the prevention of pressure ulcers

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The natural history of a person suffering from a spinal lesion of traumatic origin can be divided into several phases:

- The first is the acute phase immediately following the trauma
- The second is the one that follows (if required) the surgical stabilization of the lesion
- The next steps are not predictable in advance because these people, like every individual, will meet at acute and chronic illnesses that affect with more or less decisive, their quality of life.

Moreover, if the outcome of the trauma is a paralysis more or less extended, this results in a state of potential and often real decay of part of the muscle-skeletal system. This also creates special postures and movements and stresses in parts of the body (eg arms) that before the trauma were accustomed to being used otherwise.

This condition requires a special and "non-traditional" attention to the prevention of pressure ulcers that are a frightening event for them, because of possible complications and dangerous that they may cause.

The adoption of pressure relief surfaces then becomes a fundamental choice in these people.

Without any doubt these people are immediately at risk of injury from bedsores, and this condition will be lasting, so it is necessary to account that all types of surfaces may, from time to time, be adopted on the basis of their conditions and goals of care.

We examine the possible choices on the market today, strengths and weaknesses of everyone, and some useful tools and behaviors that can be adopted.

S27

Histological evidences of the effectiveness of negative pressure therapy

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Lancerotto L. - Pandis L. - Salmaso R. - Pietramaggiore G.

"Difficult" wounds are becoming one of the most significant challenges for health systems. A major novelty in the field of wound care was the introduction of negative Pressure Therapy (NPT), about 10 years ago.

NPT is now accepted and used worldwide, and has become one of the most common treatments for "difficult" wounds. Even if its efficacy is well accepted by clinicians, the mechanism of action through which it exerts its effects is still unclear. This is a limit to a definitive demonstration of its efficacy, to the assessment of the conditions in which it is most useful, and to its improvement. We are performing an histological/ultrastructural study on biopsies of human "difficult" wounds treated with NPT to evaluate overall changes of biological activity and characteristics of the tissue over time, of which we present the preliminary results. In particular we are focusing on the effects on inflammation, vascularity and nervous tissues, and on the quality of the scar tissue obtained. 15 patients with "difficult" wounds were treated with NPT as commercialized by KCI. Punch biopsies of wound bed were collected at day 0, 3, 6, 12, 24, and at NPT stop.

NPT induces reduction of the oedema and inflammation, appreciable at day 3 and evident at day 6. Inflammation becomes confined to a superficial layer of 1.0 mm thickness, with the most active part in the 500-600µm at close contact with the foam. Vessels reorganize towards the surface, a rich network developing in this area. Underlying tissues are cleansed of inflammatory cells and move to the remodeling phase of healing. Collagen undergoes reorganization and shows the characteristics of well arranged scar with regularly undulate bundles, normal cellularity and vascularity and signs of fibroblasts activity. Preliminary results support the coexistence of superficial pro-inflammatory/proliferative effects with "stabilization" of deeper layers.

S28

Overview of Prevention of SCI due to Road Traffic Crashes

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Road traffic crashes represent the leading cause of spinal cord injury (SCI), an injury associated with high rates of mortality and morbidity. As road traffic crashes are forecast to grow considerably, principally in low and middle income countries, systematic prevention efforts are required. This presentation will outline the role of the safe systems approach in reducing road crashes and highlight the need for transfer to developing countries. Within this context, the role of engineering, educational and enforcement activities in preventing crashes and spinal cord injuries is examined. In particular, methods

seen to be successful in the prevention of rollover crashes, the influence of seat design and restraint systems in SCI, and methods to prevent crashes and mitigate injury for vulnerable road users is examined. This presentation will conclude by highlighting a number of challenges to the continued success of road safety globally.

S29

Biomechanics of the Pediatric Spine

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Cervical spine injuries due to tensile neck loading often have fatal consequences. Injuries to the cervical spine include craniocervical dislocations, odontoid fractures, and various injuries to the lower neck. Very little is known about injury tolerance of the adult cervical spine during exposures to inertial accelerations associated with impact, and virtually nothing is known about muscle and joint injury tolerance of the pediatric cervical spine. In this study, a computer model of the head-neck musculoskeletal system was used to determine whether helmet wearing increases the risk of neck muscle injury in children. The model was three-dimensional, and represented the cervical spine as a 9-segment, 24 degree-of-freedom articulated linkage jointed together by 8 intervertebral joints. Twenty-two muscle bundles were used to represent the lines of action of 18 muscle groups on each side of the neck, totalling to 44 muscle actuators. The model was used to calculate the forces developed by the neck muscles in two- and four-year-old children with and without a helmet attached to the head. The model simulations were performed with the head and neck held static under the force of gravity alone. The calculations showed that neck muscle forces are small in young children for conditions of static loading. Peak forces developed by the neck muscles were less than 3% of the maximum isometric strength of the neck musculature. The calculations also showed that neck muscle forces are increased by only a small amount when children wear helmets. For a 2-year-old, the forces developed by the neck muscles increased by no more than 10% when a helmet is worn, compared to the values predicted by the model when no helmet is worn. The results of this study suggest that helmet wearing poses virtually no injury risk to the muscles of the neck in young children under static loading conditions.

S30

Spinal Cord Injury Epidemiology: In which cases a prevention device could be used?

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Numerous studies have documented the most frequent causes of spinal cord injury; however, there is only limited information about the detailed circumstances surrounding each injury-producing event. Such information is essential to developing cost-effective interventions aimed at prevention of new spinal cord injuries. Detailed information will be presented on the most common circumstances surrounding motor vehicle crashes, gunshot wounds, falls, and sports-related spinal cord injuries. Discussion will focus on devices and strategies that have proven to be successful in the past as well as those unproven but most likely to be successful in prevention of new spinal cord injuries given available research.

S31

Spinal Cord Injury incidence in Europe.

Rupert Kisser

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European Association for Injury Prevention, Injury Data Programme, Amsterdam

Austria - Holland

Targeted prevention programmes need sound epidemiological information, in particular about external circumstances as activities, settings, and products associated with certain types of injuries or risk groups. Since usual health statistics do not collect this kind of information, many EU Member States have set up a specific monitoring of external circumstances of injuries, based on national samples of patients in emergency rooms (European Injury Database "IDB"). An analysis of the IDB data led to an estimated number of 13.000 spinal cord injuries annually in the EU-27 (incidence of about 26 per one million people). Most interesting are the opportunities of the IDB system to underpin, guide and evaluate injury prevention programmes. Break downs by age and gender, injury type, involved settings or products are discussed. In an exemplary way, the challenges in road transport are summarized. Well established as well as promising new approaches for the prevention of SCI are presented.

S32

Spinal Cord Injury incidence in Sport.

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Canada

Sports related injuries could vary from beginner abrasions to life altering consequences, such as severe brain and spinal cord injuries (SCI). It is known that particularly contact sports may present an immediate cause for concern with respect to severe injuries including SCI. However, equal consideration should be given to activities where collisions with inanimate objects are possible. Fortunately, a relatively small number of all injuries sustained while participating in sports occur to the spinal cord. The reported incidence of sports related SCI varied dramatically between countries. Annually 10,000 to 12,000 people in the United States sustain a SCI, only about 8% to 10% (annual incidence ~ 0.5/100,000 population) of these injuries are considered to be sports related and represent the fourth most common causes of SCI in the US. This is very similar with the published data from Canada, UK, Australia and Brazil. However, a recent study of epidemiology of SCI in China reported only 1.1% sports related SCI. There is also some evidence that up to 4% of sports related SCI could be fatal. Additionally, there are different patterns of sports related SCI that result from specific sports around the world: in the US it is a football; in Germany it is diving; in Japan it is gymnastics; in Australia and South Africa it is soccer and rugby. Although the occurrence of sports related SCI is rare, it is crucial to emphasize the use of protective equipment and adherence to proper techniques and tactics by athletes during sporting events.

S33

Neurosurgical perspective on prevention: what are the spinal cord weak points?

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Abstract: The spinal cord is prone to trauma, however the magnitude of the impact itself is not the only crucial issue. Reflecting the unique microanatomy of the spinal cord, sensitive structure might be more accessible to trauma than others. The spinal cord anatomy anticipates any movement with regard to the spinal canal, its bony covering. The consequences are often devastating. The vascular specifics, their clinical impact and their behaviour to trauma will be discussed. Moreover free CSF circulation is indispensable for the spinal cord and even minor trauma can lead to severe late complications, Syringomyelia to be mentioned. What can be done to prevent these susceptible structures in the light of expected trauma of any kind? Prevention issues will be discussed from the neurosurgical point of view. Reviving CSF passage or making the spinal cord able to rotate are only some points to discuss in order to demonstrate that surgical intervention can change spinal cord physiology.

S34

Biomechanics of SCI and example of a marketable device: Leatt Brace.

Cornel de Jongh

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The cervical spinal unit has a unique biomechanical structure in that it has a lordotic shape which allows for energy absorption and force vector redirection in less severe pure axially directed impacts to the head. When excessive, the bending and rotation of the cervical spine translates into bending moments possibly accompanied by high tensile axial forces within the cervical spine with sufficient magnitude to cause spinal fractures and possible subsequent spinal cord damage. Whilst it is difficult to single out the weakest point of the cervical spine or to a lesser degree the thoracic spine, injury statistics paint a clear picture of tendencies towards weaknesses in specific levels. Predicting weak points in a biomechanical sense is aided by knowledge gained through cadaver studies. A detailed spinal simulation model incorporating the abovementioned spinal properties is briefly presented. The second part of the presentation will focus on a marketable prevention device, the Leatt-Brace® Moto GPX. Its design rationale and the rigorous tests to which it was submitted will be presented and discussed. Some statistics on the likelihood of injury reduction with the use of the Leatt-Brace® Moto GPX will also be presented, indicating its efficacy in the field.

S35

Report of Injury Prevention Sub-Committee on Global Mapping in SCI

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Cripps R.A.; Lee B.B.; Weerts E.; Brown D.

This will provide a report to the ISCoS membership about work being undertaken by the Injury Prevention subcommittee on global mapping of the epidemiology of SCI.

The International Perspectives on SCI (IPSCI) project goals are to

- assemble and summarize information on spinal cord injury, in particular the science and epidemiology
- document the evidence base for all aspects of the science and experience of spinal cord injury
- make recommendations based on this evidence

To assist this we have had a small working group collating material to

- determine best data format for SCI
- obtain best available data for SCI
- choose best mapping formats/software
- provide mechanism for periodic reporting via WHO for injury/SCI
- publish a report including maps of injury patterns

At this point this information can only be collated from the world literature, with the drawback that this is variably reported, on an often undetermined population base and using differing data standards. We will present the best information that we could find, building on recent work published by Ackery et al and Wyndaele.

The subcommittee will make recommendations about

- publication of data through IPSCI and Spinal Cord
- options for ongoing reporting through a standardised source, and
- possible funding sources for data management.

S36

YIPES!: Youth Injury Prevention Education @ Shepherd.org - YIPES an Education and prevention program for young people

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Spinal Cord Injury: "Without a cure, prevention is the best management strategy"

Douglas Brown MD, ISCoS 2007

Everyone is frustrated with seeing teenagers paralyzed for life, not because of a disease that they had no control over, but because of poor decisions teens make, with life changing consequences. Come help us discuss ways to get safety messages to kids in a form they will listen to in this new age of communication.

We are trying to look at the ways that teenagers injure their spinal cords and see if there are ways that we can identify the most dangerous components of what teenagers do.

Teenagers will do what teenagers always

do: drive too fast with their friends, ride without seatbelts when their parents aren't there, dive into shallow pools, lakes, and oceans, experiment with alcohol and drugs, play contact sports, make poor decisions. Each activity has its more dangerous components, how can we direct kids away from them?

American football is an excellent example: banning spearing reduced SCIs.

This involved studying the problem (SCIs in American football), identifying the main dangerous component ("spearing," the deliberate use of the top of the helmet as the initial point of contact), getting the message out (educating coaches and players against spearing), and changing the rules (spearing was banned and penalized).

The number of SCIs in high school and college dropped from 34 cases the year before the rule was changed down to 5. This is our role model.

At Shepherd Center, in Atlanta, Ga., the most common causes of SCI in teenagers admitted to the Adolescent SCI Service are automobile accidents (42%), gunshot wounds (12%), diving/water sports (11%), and motorcycle/all terrain vehicles (11%). These four activities thus account for 76% of our injuries.

At our presentation at the 2008 ISCoS meeting, a question from the audience asked if we questioned the kids about what they could have done differently to have prevented their injury from happening. We had not, it was a great suggestion, and we have started doing that.

We are not only asking what they would have done differently, but also ask them what they would tell their friends to keep them from being injured, and now we have to get their words out. We want our patients to be our spokespersons for safer behavior. Hopefully teenagers will listen to teenagers when they hear and see what has happened. Our challenge is to get the injury prevention message to teens in a way they will look at and understand by using a "vehicle" in the social networking areas of the World Wide Web through Face book, YouTube and Twitter. We would like to share our ideas and hear your ideas as well.

S37

Report of Sub Committee on Prevention of SCI in Water Activities - Diving Injuries: are they really preventable? A sisyphean challenge?

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USA

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

Spinal cord injuries from diving accidents occur around the world, they are not unique to any geographic area or culture. The incidence rates vary, the numbers in pools versus natural bodies of water vary, what does not vary is the tragedy and the concept that each was a preventable injury. In fact, just about everyone agrees that they are indeed preventable, but are they really?

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

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

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

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

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

One finally begins to wonder if diving injuries really are preventable!

We will show examples of prevention videos, education programs, cartoons, booklets, each with something to offer, but are they effective, and are they reaching the target group?

Can we still agree that "Even a single case must be considered unacceptable"?

If so, how can we better increase awareness that "Any dive can result in a lifetime of

severe disability, or death”?

S38 Catastrophic rugby injuries

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The spine traumas are the most serious and dramatic injuries that can happen on the rugby fields.

Even if luckily the ratio between the number of spine traumatized players and the number of active athletes is low, the consequences (clinical and social) can be devastating.

These traumas have been known since more than a century on the rugby field.

In November 1869 the Times of London reported of a playing accident where “ a gentleman named Lomax ... was severely injured at the spine during a scrum.”

Although generally rare, spine traumas become relevant in relation with the catastrophic consequences for the athlete and the community.

The end results depend from the degree of damage of the spinal marrow and can vary from non-permanent damages (completely recoverable) to the permanent tetraplegy (approximately 5-10 %) to death.

The great interest and relevance in the medical research of the last 30 years was because of the huge increase that these kind of injuries had in the 70's and 80's.

The epidemiological data present in the medical literature is not very comparable as regards the way of collecting information from various sources.

It is anyway evident the both the frequency and the gravity of these kind of injuries are very seriously considered in the Rugby world.

From a biomechanical point of view they are hyperflexion traumas, with or without rotation.

The most common origin of spine traumas depend on the various playing phases and can be classified as follows:

- Scrum
- Tackle
- Breackdown area.

Amongst the various prevention measures undergoing at various level (from National Federations to International Rugby Board) we can mention:

- Law variations (Scrum engagement, spear tackle)
- Development of safe techniques for players, referees, coaches and trainers.

The goals of our paper underline the commitment of all Rugby people (players, referees, coaches, trainers, phisiotherapists, doctors, managers, officers) as well as everybody involved in the training, with the importance of these trauma aspects and of their possible consequences, making sure that a correct first aid management can reduce to the minimum the final result.

We therefore strongly suggest that all the potential personnel involved in the game must be formed for the first aid phase, specially having clearly in mind the things “ not to be done ”.

The wrong approach to such injuries, as already mentioned, can have life lasting consequences for players, family and the whole community.

S39

Prevention of SCI due to high falls

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During the year 2007, 42.088 falls (cod. 51) were reported at INAIL as we point out in this spreadsheet:

Line of business	Accident		Mortal accident	
	Falls	Falls from high places	Falls	Falls from high places
INDUSTRY	83.965	20.545	122	48
- Manufacturing industry	46.732	10.125	44	9
- Construction	33.159	9.647	70	37
SERVICE INDUSTRY	109.243	21.543	79	23
- Transport	22.537	4.801	36	13
TOTAL	193.208	42.088	201	71

Mortal industrial accidents decreased of 7,2% during the year 2007 in comparison with 2006.

The occupational injury incidence among foreign workers is higher than among italian workers (44 vs 39 injuries denounced out of every 1.000 workers).

According to statistics, the 9,8% (94 cases) are subjects with spinal cord injuries more or less complete and with different grade of residual ability, that doesn't allow the injured person to return to work and requires, if it is possible, occupational reintroduction.

In this way, INAIL and Centro Protesi in particular are actively involved in accident prevention programs.

S40

Prevention of SCI due to low falls in older fallers

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The incidence of vertebral fractures and other forms of SCI is increasing. The epidemiology is more complex than the in non-vertebral fractures of the extremities. Often it is not clear if fractures are caused by a fall or are mainly due to osteoporosis. This is possibly one of the reasons why fall prevention has not focused on SCI as one important aspect. Most trials have developed generic interventions targeting populations identified by functional limitations or age. More than 120 RCTs on fall prevention have

been performed worldwide. The recent Cochrane review demonstrates that the preventive efforts are moderately effective. Using a classification system developed within the Prevention of Falls Network Europe (ProFaNE) it can be shown that the difference in the results is associated with risk stratification, content, intensity, frequency and duration of the intervention. These generic programs differ not only in their complexity but also in their dissemination potential and cost. There are no published specific studies to prevent SCI in older fallers, yet.

The most successful intervention programs have included sustained progressive balance and strength exercise. In frail populations multifactorial programs have led to decreases of falls of up to 40%. The paper will analyze the current evidence and pitfalls of fall prevention.

New research findings including the recording of real falls demonstrate that falls with a backward direction are much more common than previously thought. The prevention of falls leading to SCI is an understudied area that will need multidisciplinary approaches to decrease the incidence but also the consequences of falls.

S41

Natural Disasters and building construction. The Sichuan earthquake

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On May 12, 2008, an 8.0 earthquake on the Richter scale hit Sichuan province in Central China. Over 87.150 persons died or were missing, more then 4.3 million wounded, an estimated 97 000 persons sustained serious injury that affected their quality of life. Regarding SCI injured, around 120 were recovered from the rubble and benefitted from acute care and rehabilitation.

Spinal Cord Injury occurrence after the devastating earthquake resulted in an awareness among specialists in China to inquire about ways to consider preventive measures decreasing situations that can expose persons living in the earthquake zone to hazards leading to severe injuries

The intensity of the earthquake that occurred in densely populated and urbanized areas impacted severely on the infrastructure of the region such as hospitals, factories, schools, high rise buildings. The time of onset of the quake happened during the day when most habitants of the region were inside the infrastructures. Risk reduction and preparedness in such cases are not the only aspect in these scenarios. Foreseeing real serious consequences should also be part of the Overall risk reduction and mitigation efforts.

The combination of these events resulted in a high casualty rate, concentrated on dwellings that housed high concentration of people, trapping a high number of victims under the rubble.

As to the importance of specific building codes that increase resistance to earthquake effects, it was obvious that the intensity of the specific earthquake in Sichuan would have provoked important damage to infrastructure anyway. Implementation of existing building codes to make infrastructure resistant to earthquake effects was gradually introduced in China, at different periods of economic development and varying moments were

technology of architecture and urbanization became mainstream in that part of China . It is still debatable why some infrastructure was more affected than the other in the same region. The damage that was caused by the numerous aftershocks could also be mitigated by better building design preventing collapse of unstable structures that hampered rescue efforts.

It is important to know that reconstruction efforts done by the local authorities take the opportunity to improve building codes (for public building and schools in particular) that can prevent future earthquakes , reducing the risk of collapse of structures essential to early rescue efforts (like hospitals and civil engineering institutions vital for early support to the population after an earthquake) as well as reducing the injuries and deaths that could ensue after structures collapse.

As for the long term vision that needs to look at the " prepare or react " dilemma , the importance of the community in understanding the effects an earthquake can have on them before – in the aftermath and in the long term aftermath is key to reducing significantly the negative impact of such natural disasters.

OPENING LECTURES

OL1

Functioning outcome measures, their combination, and the concept of ability realization, for the care and research of spinal cord injuries

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Israel

Background: SCI-ARMI measures performance of patients with spinal cord lesions (SCL), controlling for the effect of neurological status. It can be used to assess and predict the rehabilitation outcome. The total SCI-ARMI score is calculated using a formula based on the observed SCIM score (SCIMob) and the ASIA motor score (AMS).

Purpose: Improve the accuracy of SCI-ARMI formula using data from patients who were not included in previous studies, calculate formulas for specific functional areas, and examine the improvement in ability realization through rehabilitation

Methods: SCIM scores and AMS were obtained from 185 SCL patients. Their correlation was used to calculate improved SCI-ARMI formulas. The formulas were used to assess the differences between admission and discharge SCI-ARMI.

Results: The highest observed SCIM scores in each AMS percentile (SCIMho) were highly correlated with AMS ($r=0.938$; $p<0.0001$). The calculated total, self-care, sphincter management, and mobility outdoors SCI-ARMI values were higher at discharge than at admission irrespective of gender, lesion level, or lesion severity ($p<0.01$).

Conclusions: Progress has been achieved in SCI-ARMI development. The measure can now predict rehabilitation outcome in several areas of function, and ability realization has been shown to be related to rehabilitation.

OL2

Spasticity - What's the Catch?

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Spasticity is common after damage to upper motor neurone (UMN) system. High proportion of patients with UMN lesion report problematic spasticity that restricts their daily activities with negative impact on their quality of life. It poses great difficulty to both patients, with respect to functionality and clinicians, with respect to management. Spasticity is a multidimensional phenomenon both perceptually and physically. Physically it is a combination of reflexive elements, e.g. behaviour of stretch reflex, and non-reflexive elements such as mechanical properties of muscles, tendons and joint structures. Clinicians' perception of spasticity, as measured with clinical measures, is a result of both these aspects without making any distinction between them. Outcomes of clinical measures of patients' perception of spasticity with associated hinder and discomfort are influenced by personal and environmental factors.

Management of spasticity requires reasonably sound assessment, both subjective and objective. Objective methods concern neurophysiologic and biomechanical factors and use of surface electromyography (sEMG) along with mechanical transducers and goniometers give reasonably accurate information. However, these methods require laboratory setting and are not easily applicable in clinical settings; hence, subjective

methods, such as Ashworth or Modified Ashworth scale from the clinicians' point of view, and Visual Analogue Scale (VAS), from the patients' perspective are used. But, as mentioned earlier, these subjective measures take various factors in to consideration and do not represent the reality of spasticity. Studies have shown discrepancies between the objective measures of spasticity and the subjective measures.

When considering management of spasticity, there appears to be an implicit causal relationship between spasticity and restricted functionality. At present, there is no 'Gold Standard' for the assessment of spasticity. sEMG appears to accurately represent reflex activity of the neuromuscular system and VAS represents patients' perspective. A combination of various measures appears to be a way forward. A consensus from the clinical community is required.

OL3

Participation and quality of life among youth with spinal cord injury

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Kelly E.; Anderson C.; Klaas S.; Russell H.; Daharsh E.; Gorzkowski J.; Zebracki K.

Purpose: To determine the relationship between aspects of participation and health-related quality of life (QOL) among youth with spinal cord injury (SCI).

Methods: Youth ages 7-18 years who had been injured at least one year and were receiving care within three specialty hospitals completed the Children's Assessment of Participation and Enjoyment, Pediatric Quality of Life Inventory, and Revised Children's Manifest Anxiety Scale. Caregivers completed a demographics questionnaire. Injury-related information was gathered from medical records. Analyses included hierarchical linear regression.

Results: 175 youth were enrolled: mean age was 12.77 years ($SD=3.12$), 54% were male, 63% were Caucasian, 73% had paraplegia, 56% had complete injuries, and mean age at injury was 6.90 years ($SD=5.30$). Participating in more activities was related to increased school QOL ($p=.028$). As youth participated with others outside of family or participated further from home they experienced higher emotional ($p=.023$, $p=.024$, respectively), social ($p=.046$, $p=.020$, respectively), and overall psychosocial ($p=.045$, $p=.016$, respectively) QOL. After controlling for current age and youth anxiety, participating in more activities significantly predicted higher school QOL ($p=.021$), and participating with a broader group of people significantly predicted higher emotional QOL ($p=.011$).

Conclusion: There are relationships between diversity of activities and with whom youth participate and aspects of QOL. Results suggest that exposure to more types of activities and increased social networks can increase QOL among youth with SCI.

OL4

Neurogenic Bladder and Urinary Incontinence

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The main symptom of neurogenic bladder dysfunction is urinary incontinence.

Because the dysfunction is not always marked very clearly there is a high number of undiscovered cases. Urinary incontinence, inappropriately and insufficiently treated, produces high follow-up costs and a reduction of quality of life as well as life expectancy. In the last 30 years more accurate neurourological diagnostic techniques have resulted in patients being treated according to their individual needs and at an earlier point in time. The special diagnosis of neurogenic bladder dysfunctions is time consuming, technically complex and requires neurourological experience.

The most important diagnostic tool is (video-)urodynamics, being the basis for specific therapeutic measures. It is the only examination that gives classification and a qualitative and quantitative assessment of the existing dysfunction.

The therapeutic principle from a neurourological point of view, which has emerged over the last 25 years, is very simple: Even though emptying the bladder completely is inevitable (with or without technical support), a low pressure storing phase is obligatory and of primary relevance. Non-physiological high and/or steeply ascending pressure during the storing phase always may lead to a reduction of bladder capacity, to incontinence and finally to retention and irreversible damage of the upper urinary tract. To identify and avert this set of problems in time is Neuro-urology's primary task. The patient's main focus – the urinary incontinence – can be reduced to a large extent with the above mentioned concepts. In addition, the pharmaceutical industry has developed numerous drugs in the last decades, which can decrease the detrusor hyperactivity sufficiently. For the majority of patients this approach together with intermittent self-catheterization helps to achieve a balanced bladder function and continence over the course of years.

In principle other forms of urinary drainage are possible, but clearly less successful and only indicated in special cases.

The surgical possibilities to balance the neurogenic bladderfunction and to improve the incontinence are numerous. They range from in special cases still relevant, sphincterotomy to deafferentation and from electrostimulation to augmentation. Worldwide consensus is that the conservative, low-invasive therapeutic measures (including Botulinum-Toxin) meet most patients' requirements sufficiently.

Periodic check-ups to monitor secondary complications are necessary.

Basic urological examinations including ultrasound of the upper urinary tract alone can achieve good results over the course of years.

In summary, the basis for therapeutic measures in neurogenic bladder dysfunction should be the improvement of storage capacity, e.g. through reduction of detrusor hyperactivity and complete emptying. Time and effort to achieve this goal do not always have to be extensive. The results regarding life expectancy and quality of life, taking into account the prevention of secondary complications and the long-term reduction of follow-up costs, are convincing. Life expectancy for SCI-patients should not, regular and adequate urological care provided, be significantly limited any more due to the urological complications.

ORAL SESSION

01

Assessing orgasm in men with spinal cord injury

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Objectives: As few instruments are available to assess orgasm, this study developed a questionnaire on the sensations associated with ejaculation and orgasm in men with spinal cord injury (SCI) and based a neurophysiological model.

Material and methods: 87 men with SCI were tested with natural stimulation, vibrostimulation (VS) and midodrine treatment (5 and 25 mg).

Results: Overall 92% of SCI men achieved ejaculation and reported associated physiological sensations. Significantly more sensations were reported during positive tests leading to ejaculation, than negative tests involving sexual stimulation only. On average, 5,96 cardiovascular sensations were reported at ejaculation as opposed to 2,60 with sexual stimulation only, 9,60 muscular sensations reported at ejaculation as opposed to 2,47 with sexual stimulation only; 7,13 autonomic sensations as opposed to 3,32; and 4,99 autonomic hyperactivity as opposed to 1,09. Responses triggered during VS alone were compared to those reported during VS combined to midodrine. On average, 2,08 more cardiovascular responses were reported with VS as opposed to midodrine, 2,80 additional muscular responses were reported with VS as opposed to midodrine, 1,59 additional autonomic sensations were reported with VS as opposed to midodrine; and 0,82 additional autonomic hyperactivity were reported with VS as opposed to midodrine.

Conclusion: The results confirm the usefulness of the questionnaire to assess orgasm in men with SCI and further show that orgasm is possible for most SCI men despite their lesion. The experience of orgasm appears to vary as a function of natural autonomic stimulation, but not necessarily pharmacological autonomic stimulation.

02

Hollywood to Hospital

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Using Film in Spinal Cord Injury Professional Education.

The use of visual media not just to entertain but to educate is increasing. Undergraduate courses use film to explore the role of doctors, to teach ethics, humanities and social inclusion. This review explores these topics with the multidisciplinary spinal team

Method: Google and Medline search performed for SCI, disability film. Guidance obtained on reviewing films for educational purposes. MDT pilot group review film. Over 30 films identified but only 20 obtained. Group discussions documented after film.

Results: All films had a use. Recurrent themes identified - initial awareness these are not technical teaching films but films to explore professional and personal emotions. Staff portrayal was consistently damning. Outcomes were polarised to either recovery or death with the concept of living well with injury poorly expressed. Important themes to the film industry appear consistent no matter what language or culture the film portrayed.

Conclusion: Film is an excellent medium for people to share experiences and to encourage discussion regarding many issues surrounding the emotional and social aspects of working with SCI patients. Many films evoked challenging concepts regarding staff behaviour in a manner which was less threatening than direct patient contact and allowed

the team time to reflect into different aspects of their work. The group experience helped the team gain insight to each others work and improved team morale. Time to watch films is considered main adverse finding but overall the use of film should be promoted and continued.

03

SCIREhab: Documenting the Amount and Type of Interventions in Spinal Cord Injury Rehabilitation and their Variation among Patients

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Purpose: SCIREhab is a five-year research project designed to document the SCI rehabilitation process and determine which interventions are associated most strongly with positive outcomes at one-year post injury.

Methods: In the first year of project enrollment, 602 initial rehabilitation patients with traumatic SCI (265 with paraplegia, 337 with tetraplegia) consented at six collaborating centers in the United States. All clinicians in seven disciplines used custom-programmed hand-held computers to document time spent on 89 defined rehabilitation activities during each patient session.

Results: Clinicians documented 155,874 sessions with the 602 patients totaling 98,979 hours of treatment. The average length of stay was 55 days with an average of 14.7 hours of therapy being delivered per week (6.7 physiotherapy, 6.2 occupational, 0.5 speech, and 1.9 recreational) plus 1.1 hours each of psychology and social work, 0.5 hours of specialty classes and clinics, and 3.1 hours of individual patient education by registered nurses. Substantial variation was found in the amount of treatment time provided by each discipline and even greater variation was found in the 89 activities, with two to five fold differences in the interquartile range of time spent on many activities.

Conclusions: SCIREhab has documented the details of how clinicians spend their time with SCI patients by discipline and activity. The variation found in treatment time and rehabilitation activities provides the opportunity to determine which patterns are associated with better outcomes; this is the next phase of SCIREhab.

04

Sensory options for a brief screening SCI examination

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Purpose: Estimates to perform a full Standards' SCI examination typically range from 20 to 45 minutes. The keys are strength scoring, the last normal sensory level and anorectal examination, thus allowing determination of the neurological level of injury (NLI) and the ASIA Impairment Scale (AIS) classification. Eliminating a full sensory test would reduce the time for the examination and decrease fatigue for the patient while still potentially allowing an accurate AIS and NLI determination for clinical purposes and screening subjects for research projects.

Methods: 3034 cases with a full SCI examination were used from the European Multicenter SCI Study. The left NLI, right NLI, the overall NLI and AIS were recalculated separately with the last normal LT or PP level.

Summary: The mean difference in the NLI with only LT for sensation was -0.2317 (S.D. 0.8344) levels and with only PP, -0.1708 (S>D 0.8294) levels. The mean difference for the left and right NLI ranged from -0.0573 to -0.0593 for PP only and -0.0665 to -0.0613 for LT only. The AIS classification error rate (using motor and anorectal examination data) was 0.61% with either LT only or PP only. PP only resulted in a NLI within one level 91% of the time versus 87% with LT only.

Conclusions: PP was slightly superior over LT if only one sensory modality is used to determine NLI and AIS. While probably less than ideal for research purposes, using a simplified sensory exam could be useful for simple clinical purposes and screening subjects.

05

Conversion in ASIA impairment scale during the first year after traumatic spinal cord injury

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Purpose: The aim of this study was to assess the course of the ASIA Impairment Scale (AIS) following a SCI, and to discern the nature and functional importance of any changes in the classification that occur.

Methods: Assessments were performed in a European cohort of SCI patients within two weeks and at one, three, six and twelve months after the initial injury.

Results: Overall, about 70% of the 191 patients initially diagnosed as AIS A did not convert, as did 90% of the 69 AIS D patients. When only evaluating patients with complete datasets ($n = 90$), 68% did not convert, while the AIS category improved in 30% of patients and deteriorated in 2% of patients. The AIS conversions were mainly caused by a change in the last sacral segments (40%), motor improvement (31%), sensory improvement (19%) and a change in the neurological level of the SCI (10%). When the AIS remained unchanged between successive assessment points, there was no change in the number of muscles graded three or more (NMG3+) in 73% of the transitions. An improvement in AIS was associated with a gain in NMG3+ in 49% of the transitions, while an aggravation in AIS was accompanied by a loss in NMG3+ in 10% of the transitions.

Conclusions: These results, documenting a substantial amount of spontaneous AIS conversions, should be taken into consideration when designing clinical trials to assess the effects of potential new treatments for SCI.

06

One year follow-up of monotraumatic vs. polytraumatic paraplegic patients - Is polytrauma a confounding factor of the functional outcome ?

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Purpose of the study: To evaluate the impact of the severity of the trauma on the neurological and functional recovery. A comparative clinical cohort study was performed including a group of paraplegic patients with an isolated vertebral fracture and with multiple injuries.

Methods: A retrospective analysis of the Heidelberg EMSCI database (www.emsci.org) led to the inclusion of 31 paraplegic patients (NLI T1-T12) who were assigned either to a monotrauma (PTS 1) or a polytrauma (PTS³2) group. The ASIA Impairment Scale (AIS), LEMS (lower extremity motor score), PP (pin prick) and LT (light touch) and the Spinal Cord Independence Measure (SCIM) were obtained at 4 distinct time points over one year after trauma according to the EMSCI protocol. Data was analyzed using Mann-Whitney U test ($\alpha < 0.05$).

Results: The changes of LEMS, PP and LT showed no significant differences in both groups over the whole evaluation period. Between 3 and 6 months the SCIM revealed significant differences ($p=0.031$), but almost the same SCIM-score was reached one year after trauma. Polytraumatic paraplegics showed a significantly delayed increase of SCIM between 2 and 6 weeks compared to monotraumatic patients followed by a higher functional gain between 3 and 6 months. The mean length of primary rehabilitation in the polytrauma group was 5.5 months vs. 3.6 in monotrauma.

Conclusions: Our results suggest that the prognosis of polytraumatic paraplegics in terms of neurological recovery is not inferior to those with monotrauma. Multiple injured patients need a prolonged hospital stay to reach the functional outcome of monotraumatic patients.

07

Is determination between complete and incomplete traumatic spinal cord injury clinically relevant?

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Study Design: Prospective multi-center longitudinal cohort study.

Objectives: To validate the prognostic value of the acute phase sacral sparing measurements with regard to chronic phase independent ambulation in traumatic SCI patients.

Setting: European Multicenter Study of Human Spinal Cord Injury (EM-SCI).

Methods: In 432 patients, acute phase (0-15 days) American Spinal Injury Association (ASIA)/International Spinal Cord Society (ISCoS) neurological standard scale (AIS) grades, ASIA sacral sparing measurements, which are 1) S4-5 light touch (LT), 2) S4-5 pin prick (PP), 3) anal sensation and 4) voluntary anal contraction; and chronic phase (6

or 12 months) indoor mobility Spinal Cord Independence Measure (SCIM) measurements were analyzed. Calculation of positive and negative predictive values (PPV/NPV), univariate and multivariate logistic regressions were performed in all 4 sacral sparing criteria. The area under the receiver-operating characteristic curve (ROC) ratios of all regression equations were calculated.

Results: To achieve independent ambulation 1-year post injury, a normal S4-5 PP score showed the best PPV (96.5%, $p < 0.001$, 95%CI:87.9-99.6). Best NPV was reported in the S4-5 LT score (91.7%, $p < 0.001$, 95%CI:81.6-97.2). Use of the combination of only voluntary anal contraction and the S4-5 LT and PP sensory scores (AUC:0.906, $p < 0.001$, 95%CI:0.871-0.941) showed significantly better ($p < 0.001$, 95%CI:0.038-0.128) discriminating results in prognosticating 1-year independent ambulation than with use of currently used distinction between complete and incomplete SCI (AUC:0.823, $p < 0.001$, 95%CI:0.781-0.864).

Conclusion: Out of the four sacral sparing criteria, the acute phase anal sensory score measurement does not contribute significantly to the prognosis of independent ambulation. The combination of the acute phase voluntary anal contraction and the S4-5 LT and PP scores, predicts significantly better chronic phase independent ambulation outcomes than the currently used distinction between complete and incomplete SCI.

08

Comparable predictive value for walking ability of early tibialis motor evoked potentials and total motor score in incomplete cervical SCI

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Objectives: To determine if initial assessment of total ASIA motor score (tMS) or motor evoked potentials from anterior tibial muscle (tMEP) allows better prediction of ambulatory capacity 6-12 months after SCI; find discriminative cut-off values for tMS and tMEP for prediction.

Methods: European Multicenter Study of Human Spinal Cord Injury (www.emsci.org); assessments at 2-4 weeks after incomplete cervical SCI were obtained of tMS and tMEP and compared to walking ability at 6-12 months, according to Spinal Cord Independence measure (SCIM). ROC-curve was constructed to discriminate between patients with and without walking capacity. Best discriminative values for tMS and tMEP were derived to calculate positive predictive (PPV) and negative predictive values (NPV) for both parameters.

Results: Seventy-five of 119 patients reached walking ability; predicted probability was excellent in discriminating non-walking from walking patients (AUC for tMS: 0.92; for tMEP: 0.82). Best discriminative values determined from ROC curves were 50 points for tMS and 0.2mV for tMEP. The prediction of walking ability reached a PPV of 93.3% for tMS > 50 and PPV of 90.5% for tMEP > 0.2mV, respectively, and a NPV of 67.8% for tMS and of 67.9% for tMEP. Combining the tMS and tMEP did not increase PPV (90.3%) while NPV clearly increased to 85.1%.

Discussion: Both assessments are highly valuable to predict ambulation in incomplete tetraplegic patients. While PPV was comparable for both tMS and tMEP, NPV was clearly improved by a combined assessment. Additional information can be provided by

additional assessment of tMEP if tMS is low.

O9

Falls in ambulatory patients with spinal cord injury: validity and reliability of the berg-balance scale

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Purpose: To investigate if the Berg Balance Scale (BBS) can discriminate patients with a propensity to fall. Additionally, to determine whether the BBS is associated with mobility measures, fear of falling and muscle strength, and to assess inter-observer reliability.

Methods: Participants were measured using the BBS, the Spinal Cord Independence Measure, the Falls Efficacy Scale (FES), the Walking Index for Spinal Cord Injury, the ten-meter walk test, and the standard neurological classification including motor scores (MS). Falls were recorded retrospectively for the previous month and prospectively for the last, four months. To determine inter-observer reliability, BBS performance was videotaped and analyzed by additional physical therapists. Associations between BBS and the number of falls, measures of mobility, FES and MS were calculated using Spearman correlations. The inter-observer reliability was quantified using Kendall's coefficient of concordance and intraclass correlation coefficients (ICC).

Results: Forty-two participants were included of who 26 sustained one or more falls. BBS performance correlated with measures of mobility, FES and MS ($r_s = -0.83$ to 0.93 , $p < 0.001$), but not with the number of falls ($r_s = -0.17$, $p = 0.28$). The inter-observer reliability was excellent, both for single items (0.84 to 0.98 , $p < 0.001$) and for the total score (ICC: 0.95 , $95\%CI$ 0.910 - 0.975).

Conclusions: The BBS proved to be reliable and to relate well with other mobility measures, fear of falling and muscle strength. However, it was unable to estimate the risk of falling.

O10

Responsiveness of dermatomal somatosensory evoked potentials (dSSEPs) and electrical perception thresholds (EPTs) in cervical spinal cord injury (SCI)

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Dermatome somatosensory evoked potentials (dSSEPs) provide a comparable neurophysiological readout to conventional SSEPs, but also an opportunity to track changes in sensory function corresponding to individual dermatomes (i.e. a single spinal segment) above, at, and below the level of spinal cord injury (SCI). This study aimed to determine the responsiveness and reliability of dSSEPs and electrical perception thresholds (EPTs) to monitor recovery after cervical injury.

Initial and follow-up SSEPs and EPTs recorded from cervical dermatomes (C4-C8) of patients with traumatic tetraplegia (C3-C8, AIS A-D) during the first year after SCI were reviewed ($n=17$). Follow-up examination of 68 initially unaffected dSSEPs ($n=17$)

revealed no significant change in latency ($\Delta=0.0\pm1.5\text{ms}$, $p=0.9$) or EPT sensitivity ($\Delta 0.1\pm0.8\text{mA}$, $p=0.3$). In 37 initially delayed dSSEPs ($n=13$), latency significantly decreased on follow-up examination ($\Delta=3.2\pm2.0\text{ms}$, $p<0.01$) without a corresponding increased sensitivity for EPT ($p>0.05$). dSSEPs initially abolished could be recorded in 11 dermatomes ($n=5$) on follow-up examination at delayed latencies. The abolished-to-recordable dSSEPs were predicted by the initial and follow-up EPT.

The results demonstrate the reliability and responsiveness of dSSEPs from cervical dermatomes in patients with tetraplegia. Within the same patient, the interpretation of unaffected, delayed, or abolished cervical dSSEPs may be of considerable advantage to tracking and/or predicting functional changes in spinal segments. This may be potentially useful to monitor safety in early phase (I/II) clinical trials and demonstrate potential efficacy of interventions where clinical assessment might be not sensitive to reveal subtle effects.

O11

Appraisals, coping and psychological outcome measures in a european sample

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The purpose of this study was to examine self reported quality of life and psychological wellbeing in a multi centre study of persons with spinal cord injury during the acute phase of rehabilitation. The study also measured appraisal and coping strategies as a way of investigating the impact of such resources on outcome, and to ascertain the stability of such processes across time.

All newly acquired injuries were approached in selected British, Swiss, Swedish, German, Austrian and Irish spinal centres. Participants were asked to complete a questionnaire booklet at 6 weeks post injury and again at 12 weeks post injury. Individuals included sustained their injury between the ages of 16 and 65 and fluent in the language of the recruiting country. Two hundred and eighty one participants completed the questionnaire pack from 14 European spinal centres.

Significant increases were found in psychological wellbeing, functional independence, psychological and physical quality of life, and SCI specific quality of life ratings between the two time points. There was a significant increase in perceived manageability and significant changes in appraisal and coping strategies employed. Sense of Coherence, Perceived Manageability and Quality of Social Support were responsible for high proportions of variance in the outcome measures.

Appraisals and coping strategies may impact on long term psychological wellbeing of SCI population and measurement during acute stages may assist in identifying 'at risk' patients and provide guidance for therapeutic intervention.

012

Screening tools for assessing and diagnosing neuropathic pain: can they be of use in the diagnostic work-up in individuals with spinal cord injury

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Purpose: To test the usefulness of the Swedish versions of four neuropathic screening tools in a cohort of individuals with spinal cord injury (SCI) and pain; Douleur Neuropathiques 4 questions (DN4), Neuropathic Pain Questionnaire (NPQ), Leeds Assessment of Neuropathic Symptoms and Signs (LANSS), and painDETECT (PD-Q).

Methods: So far 33 individuals (of 40 scheduled) with SCI of more than 1 year duration and pain of more than 6 months duration have been enrolled in the study. The analysis includes testing of reliability (test-retest) and validity (sensitivity, specificity and percent agreement).

Results: Preliminary results reveal test-retest reliability between 64 and 100% for the four instruments. Sensitivity to the screening tools varies between 38 and 92%; specificity between 71 and 100%, and percent agreement between 52 and 88%.

Conclusion: This study will reveal if any of the screening tools will be useful in the diagnostic work-up in individuals with SCI-related pain. So far DN4 seems to be the most useful instrument showing good psychometric properties.

013

Effects of intrathecal ziconotide and baclofen on pain and spasticity in subjects affected by spinal cord injury

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Intrathecal baclofen administration by an implantable delivery system (ITB therapy) reduces spasticity and pain due to spasms in spinal cord injured (SCI) subjects, but in some cases neuropathic pain persists. A new analgesic drug, ziconotide, is now available for intrathecal delivery. The aim of the present experience is to study if the ziconotide addition to baclofen for intrathecal administration reduces this remaining neuropathic pain. **Methods.** Three SCI subjects, (ASIA: level D11 Frankel C, level C5 Frankel D, level D6 Frankel A) were exposed to ITB treatment with a continuous infusion respectively of 650, 650 and 320 µg/die obtaining a clear spasticity reduction but a strong neuropathic pain persistence. Ziconotide was added to baclofen beginning with a low flux, 1.5 µg/die, gradually increased up to 2.3-4.7 µg/die. The pain amount was recorded using a VAS scale graded from 0 to 10. **Results.** All subjects experienced a pain reduction respectively from 7 to 5, 5 to 0 and 9 to 3. In addition a spasticity decrease was observed; in two subjects we needed to reduce the baclofen flux from 650 to 600 and from 320 to 270 µg/die because of excessive hypotonia. Adverse effects were a light headache which resolved spontaneously after three days in one subject and fatigue in another one. **Conclusions.** Ziconotide can be mixed in pump with baclofen to obtain a pain reduction;

adverse effects are similar to the described treatments with ziconotide alone. In this experience ziconotide potentiates the antispastic effect of baclofen.

O14

Functional surgery for foot deformities in sci patients

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Literature provides evidence on the greater efficacy of the instrumental gait analysis compared to the routine orthopaedic examination in the assessment of patients with spasticity, such as cerebral palsy, and stroke for surgery. Fewer references are available for incomplete SCI patients.

A clinical and instrumental assessment was performed in the present study in order to identify SCI patients who could improve their gait performance through an orthopaedic surgical intervention.

Fourteen SCI patients ASIA Impairment Scale (AIS) C/D were enrolled up to now. Eight of them had indication for surgery of the foot. Main problems impairing stability and walking were equinus/varus foot and toe deformities. Assessment of muscular strength, range of motion, presence of contracture/retractions, entity of spasticity (Ashworth), presence of pain, WISCI II scale and 6 minutes walking test were used as clinical measures. Gait analysis through lower limb kinematics (Vicon 612, Oxford Metrics, UK) using a dedicated protocol (Leardini et al, 2008) and dynamic EMG (Zerowire, Aurion, Italy) were used as instrumental measures. Patients were assessed before surgery, at 4 and 12 months post op. Reduction of pain/discomfort during walking, modification of orthopaedic shoes or orthoses, and increased range of motion were the main clinical results. Gait analysis was shown to be an essential tool in objectively identifying muscle dysfunction in foot deformities compared to clinical assessment. Foot kinematic analysis provided evidence of the efficacy of surgical interventions on foot motion during walking. Functional surgery of the foot in SCI patients, when sustained by appropriate clinical assessment and objective gait analysis, improves gait performance.

O15

What do people with spinal cord injury value most: priorities as a function of self efficacy

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Purpose: To examine the relationship between self-efficacy (SE), or a person's belief in his/her ability to perform a particular task or behaviour in the future, and consequences of spinal cord injury (SCI), such as loss of motor and sensory function, bladder, bowel and sexual dysfunction, chronic pain, risk of depression, and poor vocational prospects.

Methods: A community sample of people with SCI recruited by advertisement were asked to complete measures of SCI-related SE (MSSES), community integration (CIQ),

mood states (POMS) and health-related quality of life (SF-36), in addition to ranking ten priorities (arm function, balance and trunk control, bladder and bowel control, emotion and mood, pain relief, return to work, sensory function, sexual function, social interaction and walking) on visual analogue and categorical scales.

Results: The group comprised 24 males and 1 female, mostly 10-15 years post-injury with 8 persons having tetraplegia and 17 having paraplegia and mean age of 48.5 ± 10.7 years. SCI persons with higher self-efficacy showed improved community integration outcomes, while people with low SE experienced significantly higher levels of depressive mood and fatigue ($p < 0.05$). Persons with high SE ranked bowel/bladder control, sexual function and walking as significantly more important compared to people with low SE, whose highest priority was arm function ($p < 0.05$). Although a lower priority, people with low SE ranked regaining social and work functions as more desirable compared to those with high SE.

Conclusion: Self-efficacy and negative mood are important influences over how a person with SCI views their world and determines functional priorities.

O16

Changes in need for assistance in long-standing spinal cord injury

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Aim: To evaluate changes in the need for assistance over a sixteen year study period in a sample of people with long-standing spinal cord injury (SCI) and to identify potential risk factors.

Method: Logistic regression was used to model the odds of self-reported need for more assistance since previous follow-up.

Results: Of 282 participants enrolled in 1990, 122 completed the 2006 follow-up. There was an increased need for more assistance during the study, from 22.6% in 1990 to 28.9% in 2006. In univariate analyses, age, follow-up year, time since injury, death during study, decreased strength, decreased physical independence, change in equipment, not feeling healthy and poor quality of life were all significantly associated with increased odds of needing more help. In the multivariate model, the age effect remained a significant predictor with the same magnitude odds ratio (OR) as in the univariate model ($OR = 1.07$ per unit increase, $p < 0.05$). Change in equipment also remained significant ($OR = 1.91$, $p < 0.05$), while follow-up year, time since injury, death and feeling healthy did not. Better quality of life, greater physical independence and no loss of strength continued to be associated with decreased odds of the outcome ($OR = 0.52$; $OR = 0.986$ and $OR = 0.39$ respectively, $p < 0.05$).

Conclusions: An increased need for assistance was reported over the follow-up period. The multivariate analysis indicated that the time effect was mainly due to the natural ageing process.

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017

Physical Activity Recall Assessment and Metabolic Syndrome symptoms in men with Spinal Cord Injury

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Purpose: to assess the relationship between physical activity habit and health status in men with Spinal Cord Injury (SCI).

Methods: Fourteen men with traumatic SCI (ASIA Impairment Scale A-D, level C5-T7, aged 28-59years, 9.1 ± 9 years post injury) were assessed for symptoms of the metabolic syndrome (MetS). Abdominal circumference and resting arterial blood pressure were measured. A blood test was taken for triglycerides, high density lipoprotein and fasting glucose based on the National Cholesterol Education Program (NCEP). Participant completed the Physical Activity Recall Assessment for People with SCI.

Results: Blood tests showed that 21% (3/14) of the participants showed definite MetS based on NCEP criteria, 42% (6/14) showed two MetS symptoms and 14% (2/14) have one MetS symptom. Fifty seven percent (8/14) of the participants suffered from central obesity (waist circumference >102 cm). Only 3 participants were healthy. Surprisingly unhealthy subjects (with 2 or more MetS symptoms) spent more time ($p < 0.05$) to perform moderate activity of daily living (ADL) than healthy subjects (0 or 1 MetS symptom). In healthy and unhealthy groups, time spend to moderate or intensive leisure activity during the past tree days were low (30 ± 28 min and 25 ± 23 min, respectively).

Conclusion: MetS symptoms are very common in SCI men as 63% show at least 2 abnormal test results. The preliminary data suggest that ADL could not protect the SCI population from MetS symptoms. It is imperative to promote specific physical exercises which can be performed regularly and lead to aerobic energy expenditure.

018

Training people with chronic spinal cord injuries to sit unsupported: a randomised controlled trial.

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The purpose of the trial was to evaluate the effectiveness of a six-week task-specific training program on the abilities of people with chronic spinal cord injuries to sit unsupported. Thirty adults with spinal cord injuries between T1 and T12, of at least 1 year duration, participated in this randomised, assessor-blinded trial. Participants in the training group ($n = 15$) performed up to one hour of task-specific training three times a week for six weeks. Participants in the control group ($n = 15$) did not receive any training or additional therapy. Primary outcome measures were the Canadian Occupational Performance Measure (COPM), and tests of Upper Body Sway, Maximal Balance Range and donning and doffing a T-shirt (the T-shirt test). The between-group mean difference (95% CI) for the Maximal Balance Range was 64 mm (95% CI 20 to 108 mm; $p = 0.006$). There were no significant between-group mean differences for the COPM and the Upper

Body Sway and T-shirt tests. This trial shows preliminary support for intensive task-specific training for improving the ability of people with chronic spinal cord injuries to sit unsupported. Further study is warranted to determine the real-world implications of the observed treatment effects.

O19

Modular rehabilitation: a client-centred task-oriented training to improve arm-hand-skilled-performance in cervical spinal cord injured persons

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Introduction/objective: Persons with cervical spinal cord injury (C-SCI) receive an extensive package of therapy aimed at, among others, arm-hand-skilled-performance (AHSP). Recent developments emphasise the importance of individual goal setting. Also, there is a tendency to condense and modularise rehabilitation programs. This study evaluates a client-centred training module to improve AHSP on self-selected goals in C-SCI.

Methods: In this clinical intervention study, persons with a C-SCI completed a training module either during or after rehabilitation. The Canadian Occupational Performance Measure (COPM) was used to identify 3 individually chosen goals related to AHSP. These goals were defined using the Goal Attainment Scale (GAS) and trained 3 days/week, in 3 sessions of 30 minutes/day for 8 weeks. The training module was focussed on patients' individual needs, combining principles of motor learning and training physiology. GAS measures and COPM measures (Satisfaction and Performance) were used to evaluate outcome before training (TR1) directly after training (TR2) and at follow-up (3 months post-training) (TR3).

Results: First results from 10 persons show a clear improvement ($p < 0.025$) in the individual tasks between TR1 and TR2 and between TR1 and TR3 as measured by the COPM Satisfaction (median 3.3(TR1), 7.7(TR2), 8.4(TR3)) and Performance (median 3.1(TR1), 7.8(TR2), 7.8(TR3)) and the GAS (median -2(TR1), 1.7(TR2), 1.7(TR3)). Also, a tendency toward improvement on general skills as measured by the Van Lieshout Test (VLT) and the FIM is observed.

Conclusion: Initial results indicate that individual goal setting in a task-oriented training module may lead to substantial improvement in AHSP in C-SCI persons.

O20

Efficacy of balance rehabilitation in spinal cord lesion patients

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Background: recent studies demonstrated that in chronic spinal cord lesion patients balance is one of the main factors determining walking level and performance. The aim of the present pilot study is to evaluate the efficacy of a balance rehabilitation protocol. Patients and methods: Six patients with chronic, stabilised spinal cord lesions underwent

a balance rehabilitation protocol based on the use of the baropodometric platform as a biofeedback tool.

Measures: Walking Index for Spinal Cord Injury, Berg Balance Scale, Tinetti Scale, Dizziness Handicap Inventory, Activities-Specific Balance Confidence Scale, Six Minute Walk Test, Ten Meters Walk Test, Timed Up Go. Furthermore patients underwent a kinematic evaluation of walking and an evaluation of balance by means of baropodometric platform. Each evaluation was performed at the beginning of the study, every ten rehabilitation sessions and 1, 2 and 3 months after the end of the protocol. Balance rehabilitation protocol: daily session of visual biofeedback by means of baropodometric platform; 5 days / week; duration of each session: 20 minutes.

Statistic: ANOVA for repeated measures.

Results: all patients showed significant amelioration of both baropodometric and stabilometric parameters. This amelioration was paralleled by an amelioration of kinematic data, of balance scales and of walking level and performances. These results were maintained at follow-up evaluations.

Conclusions: balance rehabilitation has been utilised in several neurological diseases. Here we demonstrated the efficacy of a balance rehabilitation protocol in spinal cord lesion patients. The amelioration of balance is paralleled by walking amelioration.

021

Are passive movements effective for the treatment and prevention of contractures? a randomised controlled trial

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Purpose: The purpose of this trial was to determine the effectiveness of an intensive 6-month program of passive movements on ankle joint mobility in people with tetraplegia.

Methods: An assessor-blinded within-subject randomised controlled trial was conducted. Twenty people with tetraplegia had one ankle randomised to a control group and the other to an experimental group. Carers administered 20 minutes of passive movements each day to participants' experimental ankles for six months. The control ankles were left untreated. The primary outcome was ankle joint mobility.

Results: The passive movements were largely administered as per the protocol with a mean adherence rate of 96%. Ankle dorsiflexion range of motion decreased by a mean (SD) of 2 degrees (4) in control ankles and increased by 2 degrees (4) in experimental ankles. The mean (95% CI) overall treatment effect was 4 degrees (95% CI, 2 to 6).

Conclusions: An intensive program of regular passive movements administered over a six-month period had a small effect on ankle joint mobility. This treatment effect was too small to be intrinsically worthwhile. However, if the same effect could be attained with two to three minutes of passive movements and if the effects accumulate with time, passive movements may be effective for the treatment and prevention of contractures if provided on a routine and long-term basis. The results of this study highlight the pressing need to re-evaluate some of our long-held assumptions about the importance of passive movements as part of routine care for people with spinal cord injury.

O22

Effect of intensive exercise therapy with and without gravity compensation on upper extremity function in subjects with chronic cervical sci

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Purpose of the study: Gravity compensation in the form of arm suspension is commonly used for training and facilitating upper extremity (UE) function in tetraplegics. The purpose of this study was to assess the effect of gravity compensation in addition to intensive exercise therapy on UE function in tetraplegics.

Methods: Explorative, descriptive study. Four tetraplegic subjects participated in the study. They followed a training program, comprised of one and a half hour training sessions three times a week for four weeks each, with and without the use of a gravity compensation device. Subjects were assessed before and after each period and after four weeks follow up. Study parameters were kinematics, electromyography (EMG) and functional tests.

Results: Increase in elbow extension was seen after training without gravity compensation in two subjects who had some triceps function. This effect was lost during follow-up. Further kinematic analysis showed no specific effects of gravity compensation. Number of repetitions during a reach and retrieval task increased after both training conditions and was still seen at follow-up. EMG analysis and functional tests showed no changes.

Conclusions: Intensive training of the upper extremity can be effective in tetraplegics even in the chronic phase. Based on principles of motor learning, training with gravity compensation could have a positive effect on UE function. However, this explorative study showed no specific effects of training with gravity compensation on kinematics, EMG and functional outcome tests. Further studies are needed to demonstrate potential benefits of this intervention.

O23

Development of international data sets for activities and participation

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The International Data Sets Project aims to facilitate comparisons of outcomes of SCI care and programs between sites, especially across international borders. Standardization of Activities and Participation (A&P) data is particularly challenging since these concepts have been defined in many ways by many people. Furthermore, the data set involves some issues that are not traditionally addressed in a clinical setting. The International Spinal Cord Society (ISCoS) and the American Spinal Injury Association (ASIA) appointed a working group to develop an A&P Data Set as part of the International Spinal Cord Injury Datasets. At a one-day meeting in Copenhagen, the starting points of the A&P basic and extended data sets were defined. The first draft of the basic data set includes items on mobility, self-care, occupation, social relations and leisure. In ongoing email

discussions, this basic data set is currently being refined by the working group. For extended data sets for certain A&P domains, the use of existing standardized measures, like the Spinal Cord Independence Measure for mobility and self-care, is being considered. The final drafts of the A&P data sets will be presented at the ISCoS conference. This presentation will provide an opportunity to discuss the development process and its results, and to obtain feedback from international participants who may be interested in using these data sets in the near future.

024

It takes two to tango revisited: the meaning of integration and participation for people with sci in europe - a comparison of Switzerland and Norway

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Purpose of the study: Social integration or participation are major objectives of spinal cord injury (SCI) rehabilitation. Since the understanding of these concepts by people living with SCI as well as individual strategies are rarely examined, the study focuses on the insider perspective of people with SCI in order to explore a) the meaning of integration and participation, b) respective determinants, c) strategies to achieve participation and integration, and d) to compare these issues between different European countries. The project is conducted on behalf of the European Spinal Cord Injury Federation (ESCIF).

Methods: Qualitative, guided interviews in selected European countries.

Results: Results from interviews in Switzerland and Norway will be presented. In both countries autonomy, acceptance, contribution and activity are important elements of a definition of participation/integration. Some participants distinguish between integration and participation, understanding integration as the wider construct which particularly embraces the societal perspective. Work is the major domain of participation/integration for Swiss people with SCI, which is not so clear in Norway. Environmental factors are seen as the most important determinants of participation/integration. Various strategies towards integration/participation are elaborated.

Conclusion: Particularly, integration is seen as a two-sided process to which the society as well as the individual should contribute. The comprehension of integration and participation by the participants overlaps with the results from studies focusing on other populations.

025

Comparison of the demographic characteristics and outcomes for patients admitted into specialist and non-specialist sci rehabilitation units

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There are few studies on the benefits of SCI patients admitted into specialist spinal cord injury rehabilitation units (SCIRU). This project planned to use a national rehabilitation

database to compare demographic characteristics and rehabilitation outcomes for both non-traumatic SCI (NT-SCI) and traumatic SCI (T-SCI) patients admitted into specialist SCIRU and non-specialist rehabilitation units (NSRU).

The Australasian Rehabilitation Outcomes Centre maintains a national database on inpatients admitted into almost all (130/145) public and private rehabilitation hospitals in Australia. Patients included if discharged between 1/1/2006 and 31/12/2006. Patients excluded if admitted for < 7 days, admitted only for assessment, or were a readmission. In 2006 there were 667 patients with SCI admitted (NT-SCI n=361, 54.0%; T-SCI n=307, 46.0%). NT-SCI patients were much less likely to be admitted into SCIRU (30.5%) compared to T-SCI patients (70.4%). Patients admitted into SCIRU tended to be younger ($P=0.000$), have a longer length of stay in hospital ($P=0.000$), and lower Functional Independence Measure (FIM) motor subscale on admission ($P=0.000$) than those admitted to a NSRU, for both NT-SCI and T-SCI patients. There were no differences between SCIRU and NSRU for discharge motor FIM scores or discharge to home, for both NT-SCI and T-SCI.

Our findings demonstrate that there are significant demographic and clinical differences in the characteristics of SCI patients admitted to SCIRU compared to NSRU. This study has not demonstrated significant statistical difference in the outcomes according to where patients receive their rehabilitation, although there are limitations to this project that will be discussed.

026

Predicting individual patterns of bone loss from baseline bone scans taken in the early stages of spinal cord injury

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Purpose: Cross-sectional peripheral Quantitative Computed Tomography (pQCT) data provide numerical models describing the decline in bone mineral density (BMD) in spinal cord injury (SCI). A comparison between predicted and actual values at four-months after injury enabled validation of the models, and supports the use of baseline scans in planning and assessing early therapeutic interventions.

Methods: Inpatients of the Scottish Spinal Injuries Unit with motor-complete SCI at C4 or below were recruited. Baseline pQCT scans were performed within 5 weeks and repeated at 4-months post-injury. Trabecular BMD (BMDtrab) was determined at the distal tibia and femur. Models from Eser et al. (2004) were used to predict the extent of decline in BMDtrab at 4 months, adjusted for each patient according to his/her baseline values. Paired-sample Student's t-tests were used (5% significance level) to compare actual with predicted 4-month BMDtrab values.

Results: BMDtrab (mean (SD), in mg/cm³) from 6 subjects (male, age 17-72 years, SCI level C4-T7, ASIA Impairment Scale A or B) at baseline was 272.11 (33.62) and 256.99 (31.55) at distal tibia and femur, respectively. Predicted 4-month values were 253.76 (33.06) and 239.26 (31.80), and actual values were 256.03 (39.39) and 241.98 (42.62) at the distal tibia and femur, respectively. There was no statistically significant difference between actual and predicted 4-month BMDtrab values in either the distal tibia ($p=0.758$) or femur ($p=0.800$).

Conclusions: Baseline pQCT scans can predict patterns of bone loss in SCI. These may be used to determine the timing and effectiveness of early therapeutic interventions against osteoporosis in SCI.

027

Weight matter: physical and psychosocial health of persons with spinal cord injury in relation to body mass index

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Objectives: to examine the relationship of body mass index (BMI) and health of persons with spinal cord injury (SCI).

Methods: 815 men and 217 women of age 42.4 ± 15.0 years (56.3% tetraplegic, 51.4% complete lesion, years since injury 8.1 ± 8.8), who received a follow-up interview between October 2006 and November 2008 at one of the 17 SCI Model Systems, were classified into 4 groups: underweight (≤ 18.4 kg/m², n=82), normal weight (18.5-24.9 kg/m², n=415), overweight (25.0-29.9 kg/m², n=304), and obese (≥ 30.0 kg/m², n=231) based on self-reported height and measured weight. Their health status was assessed by rehospitalization during the year, self-perceived health with responses from excellent (1) to poor (5), Diener's Satisfaction with Life Scale (SWLS), and Patient Health Questionnaire (PHQ). The severity of pain during the past 4 weeks was also reported ranging from no pain (0) to the worst ever pain (10). These outcomes were compared across the BMI groups using chi-square or ANOVA.

Results: The prevalence of overweight/obesity was 52% and underweight was 8%. Although the rehospitalization rate was similar across the groups ($p=0.41$), individuals who were underweight, overweight or obese felt less healthy ($p=0.002$), had more severe pain ($p=0.03$), and were less satisfied with life ($p=0.009$), as compared with those with normal weight. The depression was slightly more common in the obese than in the normal weight group (21% vs 16%, $p=0.14$).

Conclusions: When caring for persons with SCI, attention should be given to weight management as its impact on various measures of health status.

028

Severe degeneration of peripheral nerves after spinal cord injury: A European multicentre study in 345 patients

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Background: There are indications that peripheral motor axons degenerate after SCI. The objective of this study was to investigate the magnitude of this degeneration and to determine whether motor axons so affected exhibit recovery.

Methods: The function of the peripheral motor axons was investigated by recording compound muscle action potentials (CMAP) in 345 patients with cervical SCI. CMAP

amplitude changes in the abductor digiti minimi (ADM) and abductor hallucis (AH) muscles were investigated in group A-remain; patients with complete injury, group A-convert; patients with AIS A recovering to incomplete and group Incomplete; patients with incomplete injury.

Findings: Significant decreases in ADM and AH CMAP amplitudes were found in groups A-remain and A-convert. The decrease in average ADM CMAP was 25% in group A-remain and 30% in group A-convert. The decrease in average AH CMAP was 52% in group A-remain and 36% in group A-convert. In group A-remain and group A-convert, we found a partial, though significant, recovery of ADM CMAP amplitude occurring between 5 and 12 months post injury. In group A-remain, we found significant recovery of the AH CMAP amplitude.

Interpretation: Following SCI, motor axons below the level of the lesion exhibit severe degeneration. There is partial, though significant, recovery of CMAP during the second half year following SCI. The observed motor axon dysfunction is probably a result of transsynaptic degeneration. The peripheral motor axon dysfunction observed after SCI is of sufficient magnitude that it may affect muscle power and functional activities in patients with SCI.

Funding: Geneva International Foundation for Research in Paraplegia.

029

Critical illness polyneuromyopathy in patients with spinal cord injury

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Neuromuscular weakness due to critical illness polyneuropathy and myopathy (CIPM) is often present in patients hospitalized in the intensive care unit (ICU) with sepsis or multiple organ dysfunction syndrome (MODS).

EMG-ENG examination shows myopathic signs and/or a pure primary axonal degeneration, mainly of motor but also of sensory fibres. Fibrillation potentials and positive sharp waves were found with a reduction/absence of voluntary recruitment of the motor units.

The purpose of this study is to describe the presence of a picture like CIPM in patients with spinal cord injury (SCI). The clinical picture is characterized by neuromuscular weakness with hypo-areflexia and absence of spasticity and, normally, EMG alterations were present exclusively in the muscles under the level of spinal lesion.

In the last years, among the patients admitted to the Spinal Unit of Florence, 62 cases of CIPM were observed. These patients were requiring an ICU stay of some days and had presented severe infections or MODS or a combination. The spinal lesion was complete in 55 cases, incomplete in 8 cases; only 13 patients had cervical spinal cord lesion, being thoracic in the others.

Electrophysiological studies are the only method of clearly establishing the diagnosis.

The recognition of a CIPM-like picture is important because it can explain the limited benefits of the rehabilitation process in SCI patients. The explanation of CIPM being present only in the muscles below the lesion remains unclear, even if the mechanism of hypercatabolism can be suggested.

030

Dysphagia in spinal cord injury patients

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Introduction: The association of cervical spinal cord injury (SCI) and swallowing disorders has been recognized. The risk factors described are surgery to the cervical spine with an anterior approach, tracheotomy, mechanical ventilation and certain cervical devices. Studies about pathophysiology and clinical outcome of dysphagia in SCI patients are scarce.

Objective: To evaluate videofluoroscopic findings and clinical outcome of dysphagia in SCI patients.

Patients and methods: Twenty-nine consecutive SCI patients (86% male, mean age 55 years, 45% traumatic etiology; 100% tetraplegic, ASIA Impairment Scale (AIS) A 24%, B 14%, C 48% and D 14%) admitted in the SCI Unit with clinically-suspected dysphagia were studied. Videofluoroscopic examination was performed and clinical outcome was based on feeding mode at discharge.

Result: Videofluoroscopy confirmed dysphagia in 76% of cases with an alteration of the oral phase in 9% and in the pharyngeal phase in 100%. The abnormal findings in the pharyngeal phase were: alteration in the upper esophageal sphincter opening in 27%, pharyngeal residue in 41%, aspiration in 54% (being silent in 58% of them) and pharyngeal penetration in 14%. At discharge (mean evolution time 6 months), 64% were on a normal diet, 27% on a modified oral diet and 9% were fed exclusively by gastrostomy.

Conclusions: The most frequent pathophysiological mechanism of dysphagia in SCI was impaired pharyngeal phase. This resulted in frequent aspiration in most of the patients, being silent in almost half of them. There is a clinical improvement in most of the patients, with 91% of them being on oral feeding at discharge.

031

Expectations about work; young adult's experiences of work after spinal cord injury

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Purpose: The aim of this study was to explore the experiences and expectations about paid work among young adults with spinal cord injury.

Method: In-depth interviews were conducted with 8 participants with traumatic spinal cord injury between 20-34 years of age, who where 1-5 years post injury and had not yet returned to work after injury. Data analysis was performed using constant comparative method.

Results: Four main themes are presented; finding your own way to a day where work is possible, paid work in a climate of high expectations, at a crossroad; expectations for work and education, and finding a possible solution or not. The findings reveal high

expectations of ability to work but simultaneously difficulties to design a plan for return to work and lack of support in this process.

Conclusion: The participants in the study represent a vulnerable group in vocational rehabilitation due to their young age and recent injury. Without formal education or experiences of a job suitable considering their injury they are in need of tailored work support as a part of the general rehabilitation.

032

Level of stress: A study on caregivers of traumatic tetraplegic patients with Spinal Cord Injury in a rehabilitation centre in Bangladesh

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Objectives: To determine the percentage of caregivers suffering from stress while caring for patient with traumatic tetraplegic SCI.

To determine the level of stress varied among caregivers of complete and incomplete patients and caregivers of different gender and relationships.

Method: A prospective survey on the caregivers of patient with traumatic tetraplegic SCI was conducted in the inpatient unit (Spinal Cord Injury Unit) of the Centre for the Rehabilitation of the Paralysed (CRP) from January, 2007 to March, 2009. The stress level of 151 caregivers was measured using a stress measurement tool named the Caregiver Strain Index (CSI) following purposive comprehensive sampling. Face to face interviews were used to ask specific questions to the participants. The data of these samples were analysed by descriptive statistics.

Results: From this study it was found that more than 85% caregivers of traumatic tetraplegic patients with SCI were suffering from high levels of stress while they were caregiving to these patients. The mean score of these caregivers were 10.27 (standard deviation was 0.906). Caregivers of complete patients were more stressed (average score 12.14) than the caregivers of incomplete tetraplegic patients (average score 8.74). Female caregivers were more stressed (average score 11.68) than male caregivers (average score 9.17). Wives as caregivers of the patients reported more stress (average score 11.87) than caregivers of all other relations with the patients

Conclusion: The findings of the study justify the importance of addressing caregivers' stress by health professionals in the rehabilitation of patients with traumatic tetraplegic SCI.

033

Sexual dysfunction in Cauda Equina Syndrome

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Sexual Dysfunction and Cauda Equina syndrome

Objective: To investigate the effects of cauda equina lesions on sexual function.

Methods: Sexual function was investigated in 26 patients with long standing cauda equina syndrome. All had clinical and radiological findings supporting the diagnosis. The

International Index of Erectile Function (IIEF) was used. The responses were scored and sexual dysfunction categorized as absent, mild, moderate, or severe. The number of patients receiving help for sexual dysfunction was noted. Neurological examination of the trunk and lower limbs was done.

Results: Severe sexual dysfunction was reported by 30% of patients, moderate dysfunction by 22%, and slight dysfunction by 28%; normal sexual function was reported by 20%. Orgasmic function was slightly more impaired than erectile function and sexual desire slightly less especially in women. The patients' age correlated with sexual function. Findings of decreased sensation in the groin region were associated with sexual dysfunction. No patients had received medical attention for sexual dysfunction.

Conclusions: There is significant sexual impairment in patients with lesions of the cauda equina. This is correlated with findings of sensory symptoms. This issue has received no medical attention in our country

034

Sexual-urological dysfunction and psychological distress in female patients with spinal cord lesions (SCL)

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Objective: to study the correlation between the clinical features of SCL patients with sexual-urological disorders and psychological features. To evaluate the relationship between social variables and these two factors; to study the effects of psychological and sexual rehabilitation on sexual/urological-disorders.

Patients and methods: 80 female patients admitted between 2005 and 2008 for their first rehabilitation cycle, with a mean age of 44, 9 ± 17 , 4. The patients were separated in two groups for age ($>40/<40$) and time since lesion status ($>12/<12$ months). American Spinal Injury Association standards to assess neurological status; CBA-STAI X2 sheet 3 for anxiety, CBA-QD sheet 8 for depression; self esteem-motivation tests and Psycho-urological-sexual questionnaire. Statistic: ANOVA for Repeated Measures.

Results: Patients with a lower level of education and without psychosexual treatment showed a higher level of anxiety ($p = 0,005$) and depression ($p = 0,003$). Women with a relationship and/or children showed significantly ($p < 0.001$) lower levels of anxiety and depression and they were more motivated. With regard to the psychosexual variables, women with self-reported good sexual activity, sex-appeal and the presence of orgasm showed positive correlations with the self esteem and motivation but not with the level of anxiety and depression. These correlations were particularly strong in the group within the first year after the lesion.

Conclusion: Psychosexual rehabilitation in women with spinal cord lesions is important for their psychological status, especially in women who received the treatment within the first year after the lesion.

035

The Stockholm Thessaloniki Acute Traumatic Spinal Cord Injury Study (STATSCIS): Conditions and outcomes at one year post-trauma

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Study Design: Prospective, population-based study. This paper is part of the Stockholm Thessaloniki Acute Traumatic Spinal Cord Injury Study (STATSCIS).

Objectives: To investigate and compare medical consequences, medical complications and outcomes at 1 year post-trauma.

Settings: The greater Thessaloniki region in Greece and the greater Stockholm region in Sweden.

Methods: Incidence cohorts of TSCI cases were identified through STATSCIS in both study-regions. Out of 87 cases in Thessaloniki and 49 cases in Stockholm who comprised the incidence cohorts, 75 and 42 cases respectively were successfully followed-up at 1 year post-trauma.

Results: Despite the two groups appearing with similar demographic and core clinical characteristics on admission, several major differences in outcome were found. The most important of which was the case-mortality rate of 18.8% in Thessaloniki versus 0% in Stockholm. Significantly superior outcomes for motor complete cases at 1 year post-trauma were noted in Stockholm. Aspects of "anachronistic management" e.g. persisting tracheostomy and indwelling urethral catheter were significantly more common in Greek cases. The prevalence of major medical complications i.e. pressure ulcers, heterotopic ossification, bacteraemia/ sepsis was higher in the Greek group.

Conclusions: Overall outcomes including mortality were significantly inferior in Thessaloniki as compared to Stockholm. This should be interpreted in the perspective of our previous findings of a more or less total lack of centralised and specialised system of TSCI care in Thessaloniki region. This study provides strong evidence as to the urgent need of implementing such a system in Greece.

036

Annual follow up after SCI with a new ICF-based tool

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In Switzerland it is part of the concept to do regular ambulant check-ups of spinal cord injured patients after they have been discharged from hospital after their primary rehabilitation. Check-ups are done during the first 1-2 years to assist patients with the new situation at home, detect upcoming problems early and to continue the coaching of the rehabilitation process. On a long term basis this concept helps to recognize upcoming paraplegiological complications in time, to adapt therapeutical treatment and to maintain a good state of health.

We have created a new electronic tool which enables us to register different information of the yearly check-ups of spinal cord injured patients according to ICF-guidelines and to

visualize the long-term development in a net-diagram ("spider") to the patient. This helps us to involve the patient as a partner in defining the goals in order to work out the future aims and treatment.

Furthermore the yearly check-up is enlarged by recommendations regarding general medical health prevention. Searching in the latest literature we have adapted these general guidelines to special needs of spinal cord injured patients.

This tool also enables us to evaluate scientific questions which occur from the medical observation over a long-term period. We shall present a test score of approx. 150 patients demonstrating interesting aspects of their long-term development.

037

Long term follow up (mean 24 years) of post-traumatic lumbar syringomyelia

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Post-traumatic syringomyelia is an uncommon complication of spinal cord injury (SCI) that may result in delayed neurological deterioration. Early recognition and timely intervention may reverse or arrest further disability. There is a paucity of literature on lumbar syringomyelia and its long-term consequences. Medical notes of five patients with lumbar syringomyelia were reviewed for qualitative parameters. Age, mode of injury, level and severity of SCI, nature of bony displacement, management of fracture, residual deformity of spinal column, presenting symptoms of syrinx, time interval between the initial SCI and onset, extent of the syrinx, , bowel, bladder and sexual dysfunction or limb symptoms were ascertained. The initial neurological recovery after surgery, subsequent worsening of symptoms and further intervention and residual symptoms at final follow up are described. All had high velocity trauma with significant displacement of spinal column. Mean interval between the initial SCI and development of symptoms was 5 years. The nature of ascending sensory symptoms, pattern of associated muscle weakness above the level of initial SCI, the character and distribution of pain, autonomic symptoms like sweating, new onset bowel and bladder dysfunction are all described. Surgical management of the syrinx and its results were analysed along with follow up data over 20 years in each of these patients. Post-traumatic lumbar syringomyelia presented with worsening neurology and functional deterioration. Early detection and intervention was an important factor that gave good long term outcomes. Surgical interventions were effective in all the patients in this series, despite some of them requiring repeated procedures.

038

Physical therapy, occupational therapy and sports therapy in 3 Dutch SCI rehabilitation centers

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Purpose: To describe therapy for patients with SCI in 3 Dutch rehabilitation centers.

Methods: Therapists from 3 Dutch rehabilitation centers used the Spinal Cord Injury-Interventions Classification System (SCI-ICS) to record treatments provided to patients with SCI over a period of 4 weeks.

The SCI-ICS consists of 25 categories and 139 different interventions. Time spent on each intervention was used to describe similarities and differences in treatments between centers and types of SCI.

Results: Therapists ($n=53$) recorded 1640 treatments of 48 patients with 2594 interventions and a total time of 45927 minutes. Mean number of treatments (34.1) and mean time per treatment (28.0) did not differ per center or by type of SCI. In all centers, and for 3 types of SCI most time was spent on muscle power. The use of other categories varied between centers and types of SCI. For 5 categories (muscle length, hand and arm use, using and driving a handrim wheelchair, walking and moving around outdoors and washing oneself) a significant difference for center or type of SCI was found ($p<0.05$). Eighty four percent of the time was spent on exercises, 4.2% on assessment, 6.1% on equipment, 5.1% on education and 0.4% on interventions not specified in the SCI-ICS.

Conclusion: Therapy for patients with SCI can be described with the SCI-ICS. Differences between 3 Dutch centers were small. Between types of SCI, clear differences in time spent on specific interventions were found.

039

Traumatic and non traumatic spinal cord lesions: comparison of neurological and functional outcomes

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Objective: To compare the rehabilitation outcomes of non traumatic and traumatic spinal cord injury patients.

Patients and methods: 144 traumatic patients and 236 non traumatic (244 males and 136 females; mean age 46.1 ± 19.9 years; mean distance from the lesion 49.6 ± 39.8 days). American Spinal Injury Association standards were used to assess neurological status; Barthel Index, Rivermead Mobility Index and Walking Index for Spinal Cord Injury to assess functional status.

Statistical analysis: Poisson regression models with Relative Risks and 95 % Confidence Intervals adjusted for the following confounders: age, sex, lesion level and Asia impairment. A matching procedure was used to compare subsets of non traumatic patients with specific etiologies (neoplastic, vascular, inflammatory) and their traumatic counterparts.

Results: traumatic and non traumatic populations showed several significant differences with regard to age, level and severity of lesion. When adjusted for these factors traumatic patients showed a significant lower Barthel Index score at admission and a significant better improvement of the same index. The two populations were discharged with similar functional outcome. No significant difference was found with regard to the others outcomes. Similar results were obtained also when examining the specific non traumatic etiologies. At admission, traumatic patients show lower autonomy in daily life activities, which is probably due to the associated lesions that these patients often have.

Conclusions: spinal cord injury etiology does not seem to affect the rehabilitative

prognosis. Outcomes are more affected by lesion features and age than by etiology.

O40

Motor unit number estimation in cervical or thoracic SCI persons and rats

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Objective: to investigate changes in motor unit number estimation (MUNE) value of the medial gastrocnemius (MG) muscle in spinally transected rats and of the tibialis anterior (TA) muscle in SCI persons, and to correlate the MUNE with hindlimb motor function recovery.

Methods: This study consisted of clinic and animal research. Clinic Research: MUNE with 45 controls was performed by using an adapted multiple point stimulation method (AMPS). By using this, 20 patients with SCI (two groups, 10 subacute and 10 chronic) were examined longitudinally for three months during a series of repeated electrophysiological sessions. Animal research: Rats were subjected to spinal cord transection or sham surgery and then analyzed by MUNE and the Basso, Beattie and Bresnahan (BBB) behavioral scale at 7–56 days after surgery.

Results: Clinic Research: In the controls, the MUNE values were 188 ± 20 . In the subacute SCI group, the values were 40 ± 33 ($P < 0.01$ vs. young controls), and a continuous increase was seen during the follow-up period. In the chronic SCI group, the MUNE values were 173 ± 29 , similar to that in young controls. Animal research: The MUNE values were significantly decreased gradually and then returned to near pre-injury levels after 56 days. There was a U-shape relationship between changes in MUNE values and BBB scores after spinal transection.

Conclusions: Time-dependent changes in the functional motor unit number may occur in spinal segments caudal to the injury level, and MUNE could be a useful method to evaluate motor function recovery.

O41

Experimental spinal cord repair by CNS PNS connection

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Research was done on rats and monkeys. Four groups of monkeys were operated on by connecting the cortico-spinal tract above the cord lesion with the motor nerves of gluteus maximus, gluteus medius and quadriceps with good results checked by E.M.G. and histology.

Transfers of ulnar nerves to lower limb muscles was also done. One of the subjects was able to walk "on his ulnar nerves".

3 subjects were operated on by connecting the CST with peripheral nerves one of whom had undergone guillotine severance of the cord by dislocation of T8 is now able to walk with tripod sticks.

Research was done on animals to see whether it is the motor end-plate which changes its receptors from cholinergic into glutamatergic or if it is the upper motoneuron which

changes its neurotransmitter from Glutamate to Acetylcholine. Functional reinnervation of the muscle was shown by E.M.G. and immunostaining. Genes codifying for receptors as well as the neurotransmitter were searched for. Immunoblot test showed that the operated muscle contains vesicular glutamate transporter-1 (VGluT-1) whereas the control muscle still contains ChAT and VACHT. The muscles function due to alteration of the receptors of the motor end-plates under glutamatergic stimulation.

Furthermore this research demonstrated that the brain has a marvellous plasticity at the level not only of cortical areas but also of single neurons spread in different areas which fire like a teleassembly. What is more muscles receiving axons from neurons spread in the same areas function selectively without co-contractions.

042

New Insights into the Pathophysiology of Cervical Spondylotic Myelopathy from MRI Measurements of Cerebrospinal Fluid Flow and Spinal Cord Motion

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Objective: Conventional T1/T2 magnetic resonance imaging (MRI) of cervical spondylotic myelopathy (CSM) has limited ability to evaluate the impact of stenosis. In this study, the velocities of cerebrospinal fluid flow (CSF) and spinal cord motion (SCM) were measured by phase contrast MRI as indicators of stenotic severity.

Methods: 12 subjects diagnosed with CSM and 14 age-matched controls underwent MRI scans and tibial somatosensory evoked potentials (SSEPs). Phase contrast MRI was performed in the cranial-caudal direction at the level of stenosis in CSM subjects and C5 for controls, with 24 acquisitions across the heart cycle, 256×256×5 matrix, and 140×140×25 mm³ field of view.

Results: In controls, CSF velocity was closely related to the heart cycle, while SCM was minimal. In CSM subjects, CSF velocities were significantly slower than in controls ($p < 0.0001$), and in some cases SCM was increased in a pattern over the heart cycle but different from CSF flow. An increase in mean SC velocity was significantly correlated to a pathologic tibial SSEP recording ($p=0.008$), while independent from CSF velocity ($p=0.22$).

Discussion: While decreased CSF velocity in CSM has been noted previously, to our knowledge this is the first study to suggest that SC motion is also affected. Surprisingly, SCM was pathologically increased in stenotic areas and may reveal a novel pathophysiological mechanism in the development of CSM. While increased SCM was not related to changes in CSF velocity, it was related to spinal cord conduction as determined by SSEP recordings.

043

Minimally invasive expansive laminoplasty

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In situations with multilevel cord compression due to advanced cervical spondylosis, canal stenosis, and non-segmental ossification of the posterior longitudinal ligament (OPLL), a posterior approach allows a safe indirect decompression to be achieved without the morbidity of a long-graft anterior procedure. More recently attention has been paid to preservation of the posterior tension band as a supporting element for maintenance of long-term postoperative cervical alignment. We have developed a minimally invasive procedure, which is a double-door laminoplasty expanded by splitting the spinous process followed by implantation of hydroxyapatite spacers. This type of a laminoplasty is expected to be less invasive because of the preservation of the bilateral paravertebral muscles, which results in a relief of postoperative axial pain and is applicable to various pathological disorders besides decompressive procedures. In cases with cervical instability, a lateral mass screw and rod fixation is possible to add to this type of a laminoplasty. From 2003 to 2008, 72 cases were operated on by expansive double-door laminoplasty with hydroxyapatite fixation, of which 61 cases had cervical spondylosis with multilevel cord compression and 11 had extensive OPLL. 90% of cases showed satisfactory results with a few complications. In our surgical management of cervical spondylosis, disc herniation, and OPLL, 20 to 30 % are treated by expansive laminoplasty, while 70 to 80% are treated by microdiscectomy or corpectomy with cage fixation. We conclude that the expansive open-door laminoplasty with hydroxyapatite spacer via an interspinous approach is a less invasive and effective method for multilevel canal stenosis causing myelopathy.

044

The influence of the neurological level of injury in bone's mineral content and mechanical properties, lean mass and fat mass in paraplegia

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Purpose: To investigate the influence of the neurological level of injury (NLoI) in bone's mineral content (BMC) and mechanical properties, lean mass (LM) and fat mass (FM) among paraplegics

Methods: Thirty complete paraplegics were separated in group A (15 men, high paraplegia) and group B (15 men, low paraplegia) in comparison with 10 healthy men as control group (C). In all subjects stress strain index (SSI) at 14% (SSI2) and 38% (SSI3) of the tibia length and the difference δ SSI 3-2 (SSI3-SSI2), by peripheral quantitative computed tomography (pQCT, Stratec XCT 3000, Stratec, Pforzheim, Germany) and values of lower limbs' BMC, LM and FM (g) by whole body dual X-ray absorptiometry (DEXA, Norland XR 36, Norland Corporation) were measured.

Results: Bone strength parameters, BMC and LM were statistically decreased, but no difference was found in FM, compared to controls. A correlation between the duration of paralysis, age and δ SSI 3-2 was found in the group of low paraplegics ($r=0.53$, $p=0.027$ and $r=0.5$, $p=0.04$, respectively). Duration of paralysis was strongly correlated with FM in high paraplegics' lower limbs ($r=0.5$, $p=0.05$).

Conclusions: Because of the non significant duration of paralysis the paraplegic groups act different in mechanical properties of the tibia and lower limbs' body composition.

O45

Clinical trial of Myoelectrically controlled FES (MeCFES) for assisting hand function in subjects with tetraplegia - A study of usersatisfaction

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A) The tenodesis grip in subjects with medium level tetraplegia can be enhanced by Myoelectrically controlled Functional Electrical Stimulation. The objectives of this multicenter trial are: to estimate the percentage of potential candidates for the technique, the effectiveness as an orthotic device and the utility for activities of daily living (ADL).

B) A sample of 220 clinical records (C0-C8) were screened for inclusion (level:C4-C7, age:18-80 yrs. and medically stable). Eligible subjects were assessed by letting myoelectric signals from wrist extensors control stimulation of the finger flexors. A Hand Test, self assessment and performance questionnaires were administered. Subjects in whom the MeCFES improved grasping, were using the device in 12 occupational therapy sessions, while performing relevant self prioritised activities.

C) Forty seven subjects have been evaluated. Twenty-one had functional improvement of MeCFES. Fourteen subjects have completed the protocol. Five subjects are still training. Two responders dropped out of the study for logistical reasons.

Twenty six subjects haven't been enrolled because they were not innervated or did not have functional improvement.

D) Ten of the fourteen completed responders have obtained a functional gain and wished to continue using the MeCFES at home if it was available.

Preliminary data suggests that 44,6% of the tetraplegia population may benefit from the method and that 47,6% actually experience an improved ADL with the MeCFES device in its present prototype form.

O46

Inertial sensing in pendulum test of spasticity

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In the present study, we propose an alternative sensor for the pendulum test of spasticity. Spasticity or muscular hypertonicity is a complex motor disorder of the central nervous system associated with many diseases. For the clinical assessment of spasticity the modified Ashworth scale is used, but its reliability and objectivity have often been

discussed. The pendulum test, where the lower leg is dropped and allowed to swing passively in the manner of a pendulum, has been recognized as a relatively simple, robust, and practical objective measure of abnormal muscle tone in lower extremities. In the traditional form of the test, the goniometer is attached to the leg and the knee joint angle trajectory is measured during oscillations. The measured motion response is then related to a degree of spasticity.

The novel proposed sensor incorporates a set of inertial MEMS integrated circuits. It is attached to the lower leg and outputs the limb acceleration and angular velocity. From the measurements the level of spasticity is assessed as in the goniometer based approach. In the study, the pendulum test was evaluated in a group of five healthy subjects and six spastic patients. The knee angle was measured synchronously by inertial sensor and electrogoniometer (incremental encoder). The results were compared and associated with spasticity assessment according to the Ashworth scale and the EMG activity of the knee flexor and extensor muscles. The results show that considering accuracy the inertial sensor is comparable alternative to the electrogoniometer while it is more practical for usage.

O47

Chronic Pudendal Nerve Stimulation in incomplete spinal cord injury is able to reduce lower limb spasticity while treating neurogenic detrusor overact

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Background: We previously described a novel technique for suppressing hyperreflexic bladder contractions by stimulating the pudendal nerve in chronic fashion. Transcranial magnetic stimulation (TMS) is a noninvasive technique used to assess corticospinal excitability and plasticity of the central nervous system, the H-reflex can be utilized to assess modulation of spinal inhibitory interneuronal circuits, and can correlated to some degree with spasticity of spinal origin

Aim, Materials and Methods: To understand neuronal mechanisms of motor recovery and hyperreflexia after incomplete spinal cord injury (SCI) patients, motor-evoked potentials (MEP) and H-reflex of lower limb muscles were assessed in a group of 16 pts (9 female and 7 male, age range 18-69 years) with incomplete spinal cord injury and neurogenic detrusor overactivity before and after implantation of quadripolar lead for Chronic Pudendal Nerve Stimulation (CPNS). All pts completed voiding diary for evaluation of bladder capacity and episodes of incontinence. In each subject, lower limbs H reflex amplitude and Hmax/Mmax and the central motor conduction time (CMCT) was calculated, and single-pulse TMS before and after 1 month of CPNS to measure the amplitude of motor-evoked potentials (MEPs).

Results: In all pts H reflex homosynaptic depression increased, facilitation of CMCT increased bladder capacity e decreased numbers of episodes of incontinence occurred in each with CPNS in short and middle follow up suggesting its effectiveness in short- and long-term plasticity of the nervous system

048

Reduction of spasticity with repetitive transcranial magnetic stimulation in patients with incomplete spinal cord injury

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Background: Clinical signs of spasticity are frequent in patients after spinal cord injury (SCI). Damage to descending cortico-spinal pathways that normally exert spinal segmental control is thought to play an important causal role in spasticity. The aim of this project was to study whether the modulation of excitability of the primary motor cortex with high-frequency rTMS could result in modifications of limb spasticity in patients with incomplete SCI.

Methods: Patients with incomplete SCI were evaluated according to Modified Ashworth spasticity scale, Visual Analogue Scale, the Spinal Cord Injury Spasticity Evaluation Tool (SCI-SET) and neurophysiologically with various measures of cortico-spinal and segmental excitability. Fifteen patients received 5 days of daily sessions of active (n=10) or sham (n=5) rTMS (20 trains of 40 pulses at 20 Hz and 90 %MT intensity of biceps brachii muscle).

Result: A significant clinical improvement of lower limb spasticity was observed in patients with active stimulation but not with sham stimulation. This improvement lasted at least until one week after the end of treatment. H reflex amplitude with 0.9 threshold intensity was increased significantly after the first session of active but not after sham stimulation.

Conclusions: High frequency rTMS over the leg motor area leads to sustained improvement in spasticity in patients with incomplete SCI.

049

Intrinsic hand stiffness - underdiagnosed phenomenon in tetraplegia and spasticity

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Purpose: Intrinsic tightness due to spasticity in the hand is common in patients with incomplete tetraplegia. The clinical picture varies from a tightly clenched fist to intermittent stiffness in the intrinsic musculature. Intrinsic spasticity can be hidden by extrinsic spasticity. To reduce the intrinsic spasticity the patients underwent distal ulnar intrinsic release.

Methods: 18 tetraplegic individuals (44 fingers) with intrinsic tightness were operated on with distal intrinsic release where the procedure was modified to only include the ulnar side of the finger. Sufficient release was accomplished when the intrinsic tightness, according to Finochietto-Bunnell's intrinsic tightness test, was gone. Active motion was encouraged day after surgery. Patients underwent reconstructive hand surgery with the variation of distal intrinsic release as a single procedure to multiple procedures such as grip reconstruction with tendon transfers and tendon lengthenings. Range of motion

(ROM) pre-, per- and postoperatively was measured.

Results: The intrinsic tightness was completely released in all patients and the ROM was improved. In 17 patients the middle finger was involved. All patients achieved more than 90 degrees of passive flexion in the proximal interphalangeal joint with the metacarpal phalangeal joint maximally extended.

Conclusions: This study suggests that the distal ulnar intrinsic release procedure is a simple and valuable method to reduce intrinsic tightness instantly and to improve the hand function and grip control for patients who suffer from intrinsic spasticity. This procedure can be added to other procedures such as tendon lengthenings and transfers

050

Improved activity performance after surgical treatment of spasticity in the hand

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Purpose: To evaluate the differences in performance and satisfaction of activity and participation related goals after hand surgical corrections of spasticity induced deformities.

Methods: 10 persons living with tetraplegia produced 46 activity goals prior to hand surgery. There were three women and seven men. The activity goals were collected from interviews with COPM (Canadian Occupational Performance Measure) preoperatively and were followed up at 6 months post surgery. Each goal was rated for the current level of performance and satisfaction on a scale 1-10. Each goal was classified according to International Classification of Functioning, Disability and Health (ICF).

Results: In performance, the mean value for the group, independent of type of goals, increased from 3 preoperatively to 7 scalesteps 6 months post-operatively. In satisfaction, the corresponding change was from 2 to 7.5 scale steps. The goals were represented in 7 of 9 chapters in the ICF. Most of the goals were related to self-care (40%), ten percent was directly related to work and another 13 % was related to domestic life and interpersonal interactions.

Conclusions: Surgical correction of deformities induced by spasticity in the hand after SCI has major influence on the individuals' activity and participation related goals.

051

Identification of motor point for neuro-block in spasticity management

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Objective: to explore the nature of motor points in localization of neuro-block for spasticity management.

Methods: Two distinctive types of motor points were localized at the site with maximal muscle contraction induced by minimal electrical stimulation (group N) and at the site with nerve endplate potential identified with EMG (group P). The site with rich nerve fibers and endplate was analyzed by histogram. The site with minimal contraction induced

by maximal electrical stimulation without end plate potential was selected as the control (group C).

Results: The magnitude of stimulation was smallest in group N (0.10 ± 0.01 mA) followed by group P (0.39 ± 0.04 mA) and group C (0.73 ± 0.05 mA). In contrast, group N had the greatest quantity of nerve fibers and group C had the fewest. There was no difference between group N and group P ($P > 0.05$). Significant differences existed between group N and C ($P < 0.01$), as well as between group P and C ($P < 0.01$). Group P had the richest endplates followed by group N ($P < 0.05$).

Conclusion: The nature of two motor points is different but close. Electrical stimulation can be used for localization of chemodenervation injection.

052

Orthostatic hypotension among elite wheelchair athletes.

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Paralympic athletes endure tremendous physical stress during training and competition. Athletes with spinal cord injury (SCI) have unique disadvantages during competition, such as unstable blood pressure control. This study was conducted, during the international wheelchair rugby competition, to establish baseline cardiovascular parameters and prevalence of orthostatic hypotension among elite wheelchair SCI athletes.

Continuous systolic and diastolic blood pressure (SBP, DBP) and heart rate were recorded at rest and in response to a passive sit-up orthostatic test. All athletes were members of the international rugby teams who competed prior 2008 Beijing Paralympics. Examinations were performed 30 minutes after their last game. Athletes also filled out a questionnaire on cardiovascular dysfunctions.

A total of 21 Paralympic wheelchair rugby players with SCI were evaluated. The supine resting SBP varied from 121 to 80mmHg (average 105 ± 12 mmHg). Average resting DBP was 75 ± 9 mmHg. On assumption of sitting position, 30% of the athletes SBP decreased by more than 20mmHg (average -24 ± 14 mmHg), consistent with orthostatic hypotension. Furthermore, 6 athletes developed dizziness following the test.

Impaired autonomic control of the heart and blood vessels are among the primary causes of cardiovascular dysfunctions for SCI individuals. Our observations suggest that, despite continuous training, hypotension and orthostatic hypotension are still common among these athletes. These conditions could tempt wheelchair athletes to use "boosting" to increase BP and possibly improve their athletic performance. Investigations for sport-specific differences in cardiovascular control will be important to introduce autonomic evaluation as a possible component of classification of elite wheelchair athletes. (Endorsed by IPC Research Committee).

053

A new approach to improve fecal occult blood test (FOBT) for colonic cancer screening in patients with SCI

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It is established that people over 45 years old should undergo FOBT and, if positive, to have a colonoscopy for the prevention of large bowel cancer. The age of SCI patients admitted in the Spinal Cord Unit is characterized by a relevant range: more than 50% of our patients examined during 2008 were ≥ 45 years old. Since there is a higher prevalence of hemorrhoidal bleeding in SCI versus the general population, FOBT might often be falsely positive, resulting in unnecessary colonoscopies. During 2008, 24 patients suffering of anorectal diseases had a positive result of FOBplus®, a visual immunochromatographic quick test for the qualitative detection of human haemoglobin in stools sample by DIMA, Germany. Mucosal prolapse, fissure, proctitis, and lesions due to manual manoeuvres for defecation were found during proctological examinations. In these 24 patients fecal samples were obtained directly from the stools present in the sigmoid tract during a rigid rectoscopy, which was subsequently performed without any previous intestinal toilette. FOBplus® was repeated on these stool samples, which might not have been contaminated by any proctological bleeding disease, as they would occur otherwise in these patients. No occult blood was found in 16 patients, confirming that the previous test showed false positive results. In 8 patients FOBT resulted were positive: they underwent total colonoscopy, which showed evidence of pathology in all subjects: complicated diverticular disease in 2 and polypoid lesions in the other 6, with severe dysplasia in 2 cases. Our method significantly improves the FOBT specificity in patients with SCI.

054

A prospective examination of the menopause transition in women with SCI

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The purpose of this longitudinal study is to examine menopause and symptoms in women with spinal cord injury (SCI). Women with SCI ($N = 58$) and without SCI ($N = 61$) between 45 and 60 years completed four surveys of symptom bother across 4 years. Univariate tests and linear mixed models were used; all regression models controlled for time and included the interaction of menopause stage and group. Results indicated women with SCI transitioned through menopause at the same pace as their non-SCI peers ($X^2 = 0.001$, $p = 0.979$) and had their final period at similar ages (SCI: 50.0 ± 5.8 vs. non-SCI: 49.5 ± 5.6 years; $t = -0.456$, $p = 0.643$). Analysis of symptom bother indicated no significant interactions between group and menopause stage. Non-SCI women reported significantly greater vasomotor bother than SCI women ($F_{6,0}$, $p = 0.015$) with peaks in peri and early postmenopause ($F = 5.08$, $p = 0.001$). Somatic bother was significantly greater for SCI women ($F = 20.3$, $p < 0.001$) with no effect of

menopause stage. Psychological bother gradually declined over time for both groups ($F = 4.0$, $p = 0.008$) with no menopause stage effect. This is the first study to prospectively examine the menopause transition in women with SCI directly comparing them to their non-SCI peers. Results suggest similarity for the pace of the transition with greater bother for some symptom clusters and less for others. Most importantly, the absence of interactions suggests a similar pattern of experience across menopause stages.

055

Computational 3D modeling of cerebrospinal fluid dynamics for simulation of drug delivery and distribution

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Innovative therapies for spinal cord injury (SCI) are in development. A promising candidate is ATI355, a monoclonal antibody (mAb) against the Nogo-A protein administered into cerebrospinal fluid (CSF) by lumbar intrathecal (i.t.) injection/infusion. To optimize drug administration and distribution to target site, we investigated in silico human spinal anatomy and physiology.

A 3D computational fluid dynamics model of the spinal canal was developed based on geometry reconstructed from MRI data and dynamics controlled by transient Navier-Stokes equations. Driving forces for fluid transport (pulsating blood flow in the cranium and breathing) were modeled based on literature data. CSF flow simulations in the canal allowed prediction of local differences in dynamics. We found a good agreement with velocities measured by phase contrast MRI at five additional cross-sections.

The pulsating flow together with the specific spinal canal geometry resulted in convective transport of injected drug. Thus, even large molecules like mAbs with low diffusion rate distributed, yet anisotropically. Reduced transport in some transition zones was observed. We simulated the biodistribution of compounds in CSF as a function of time and space, injection site, and infusion modes, volumes and rates. Local transport velocities were comparable to those measured by CSF radionuclide scintiphotography using radiolabeled human serum albumin.

Modeling tools based on biophysics first principles allowed detailed analysis of transport phenomena. By providing a framework for integration of clinical data into a dynamic system physiology platform, this technology enables the simulation of different clinical scenarios to support decision making, turning model based-drug development to reality.

056

The effect of radiotherapy on the prophylaxis of heterotopic ossification in patients with spinal cord injury

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The heterotopic ossification (HO) is a major problem in the spinal cord injury (SCI)

patient: severity, precocity and poor results with drug treatment (side effects, time of use, rebound effect). The radiotherapy is a good method for OH treatment, but there is no data about its prophylaxis use. Objective: to evaluate the effect of radiotherapy in the prevention of OH on SCI patients. Methods: Nineteen patients with acute SCI and negative diagnosis of heterotopic ossification by bone cintilography (made till one month after injury) were randomized in two groups. The Study Group was composed by nine patients: two quadriplegics and seven paraplegics; seven ASIA A and ASIA B lesions and received an 8 Gy (single dose) of irradiation on the hips. The Control Group had eight quadriplegics and two paraplegics; seven ASIA A and ASIA B lesions and was not submitted to the intervention. After six months of clinical and radiological follow up, one patient of the Study Group and five patients of Control Group developed HO. There was no significant statistical difference in frequency and distribution in the two groups comparison, although there was lower incidence of heterotopic ossification in the Study Group. Conclusion: With this sample, it was not possible to prove the efficacy of radiotherapy to prevent HO.

057

Cortical Plasticity: effects of a BWSTT and FES training in spinal cord injured patients.

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Purpose of the study: To test the effects of Body Weight Supported Treadmill Training (BWSTT) and Functional Electrical Stimulation (FES) in spinal cord injured (SCI) patients. Participants: 6 thoracic level SCI patients, age 33-56 \pm 14 years, Asia Impairment Scale A.

Methods: PO22 Stimulator Fequa and BiacMed systems were used for FES walking.

Training: 1) Patterned Electrical Stimulation (PES) assisted isometric exercises for quadriceps muscles, 5 sessions/week for 3 weeks; 2) FES cycling, 3 times/week for 3 weeks; 3) FES walking at BWST (TR Spacetrainer), 3 times/week for 3 weeks; 4) over-ground FES walking training, 3 times/week for 4 weeks.

Main Outcome Measures: training was monitored at every step through 1) isokinetic dynamometer to test quadriceps isometric torque; 2) respiratory gases analyzer (VO2000, Medgraphics-USA) to test O2 maximal consumption and energetic cost of gait; 3) fMRI (Siemens AVANTO, 1,5 Tesla) was used to monitor post-training changes of motor activations during observation and imagery of lower and upper limb movements.

Results: At the end of the training we verified an increase of quadriceps torque (from 0,360 to 0,502 Nm/kg), of walking speed (from 0,17 to 0,20 m/s) and of aerobic performance, with a decrease of energetic cost of gait (from 25,76 to 19,94 J/Kg/m). fMRI results showed increased activations of visual as well as of motor and premotor areas during observation and imagery of lower limb movements.

Conclusions: These findings reflect positive physiologic and metabolic effects and, more interestingly, cortical plastic changes due to inputs as BWSTT and FES in SCI patients.

058

A Decade of Experience with Laparoscopic Intramuscular Diaphragm Pacing at a Single Institution: Replacing Ventilators in Tetraplegics

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Purpose: For high spinal cord injured patients with chronic respiratory insufficiency, the diaphragm pacing system (DPS) is an alternative to long-term positive pressure ventilation.

Methods: In prospective trials and then current practice, patients underwent laparoscopic activation mapping of their diaphragm to locate the motor point where maximal contraction occur and then electrodes were implanted. With diaphragm conditioning the patients were weaned off of the ventilator.

Results: A total of 47 patients were implanted, with one failure to pace due to a false positive phrenic nerve study. The average age was 34 years with a range of 10-72 years. Average time from injury to implantation was 5.3 years range of .4 to 25 years. The average hospital stay was less than 24 hours with no peri-operative morbidity. 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. All implanted patients were able to ventilate with the system above their basal needs for over 4 hours a day with over 50% utilizing 24 hours a day. The longest patient for over 9 continuous years. 68% of patients report decreased secretions with 100% recommending it for other patients.

Conclusions: Laparoscopic diaphragm pacing is safe and effective and should be offered to all patients with intact phrenic nerves.

059

High frequency spinal cord stimulation (hf-scs): a new method of inspiratory muscle activation in an animal model of spinal cord injury

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Objective: To evaluate a novel method of electrical activation of the inspiratory muscles to restore breathing in a dog model.

Methods: In 10 anesthetized dogs, the effects of HF-SCS (300Hz) on 1) inspired volume and 2) distribution of inspiratory drive to the diaphragm and inspiratory intercostal muscles (as assessed by single motor unit recordings, SMUs) were evaluated. Electrical stimulation (0.3-6mA, 0.2ms pulse width) was applied via a disc electrode positioned on the ventral epidural surface at the T2 spinal cord level. To mimic spinal cord injury, SCS was applied after spinal section at the C2 level.

Results: HF-SCS with low stimulus currents (3mA, 0.2ms) resulted in a mean maximum inspired volume of $0.93 \pm 0.01L$, a value which approximates the inspiratory capacity ($1.04 \pm 0.02L$) of these animals. Mean maximum firing frequencies of the diaphragm and

the external intercostal muscles (3rd intercostal space) as determined by SMU recordings were 10.3 ± 0.4 and 11.9 ± 0.4 Hz, respectively, values which are similar to those occurring during spontaneous breathing (10.8 ± 0.3 and 12.1 ± 0.5 Hz, respectively) at comparable inspired volumes.

Conclusions: With a single electrode, HF-SCS with low stimulus currents results in: 1) near maximum inspiratory muscle activation and 2) a physiologic pattern of motor drive to the diaphragm and intercostal muscles. This study represents the first demonstration of physiologic activation of the inspiratory muscles using electrical stimulation techniques and may provide a more effective method of inspiratory muscle pacing in spinal cord injured patients.

060

The effect of motor imaginary on cortical activation during robot assisted gait in normal subject

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Robotic-assisted gait training is expected to provide the opportunity to help restore the walking capabilities in spinal cord injury patients. However, it is not clear how the motor imaginary would change the cortical activation pattern during robot assisted gait. This investigation was performed to reveal whether the motor imaginary could change the cortical activation pattern during robot assisted gait in normal healthy subjects. The subjects consisted of 6 healthy volunteers. After a 30-sec resting stage, each subject walked on the treadmill with robotic assistance for 1 minute. The subjects moved their lower extremities in different ways (active assisted movement, passive movement, imagined leg movement, and imagined leg movement with actual passive movement). We measured the cortical activation of the motor area during gait by means of a near-infrared spectroscopic imaging system. Thereafter, 2-dimension topography indicated significant cortical activation was induced when the subjects moved their legs actively on the treadmill. Otherwise, when the subjects moved their legs passively on the treadmill, almost no activation was observed. A small degree of cortical activation was observed when the subjects imagine their leg movements.

The cortical activation was enhanced when the subjects imagine their leg movements with passive movement. Our results indicate that motor imagery only slightly contributes to the induction of cortical activation in the motor area in normal subjects. Passive leg movement during robot assisted gait is therefore considered to enhance this cortical activation.

061

Visual and motor related activity in sci and normal subjects: a magnetoencephalography study of plastic changes in the brain.

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a. There is considerable debate on the nature of plastic changes in the brains of individuals following spinal cord injury (SCI). We used tomographic analysis of magnetoencephalography (MEG) signals, producing millisecond by millisecond functional images, superimposed on co-registered MRI images to compare brain activity in three paraplegic and two normal subjects, in a GO/NOGO task.

b. Visual stimuli (arrows to the left or right) instructed subjects to move (green arrow) or inhibit movement of (red arrow) either a left or right index finger or the foot. Three critical cortical regions were assessed: the early visual cortex (V1/V2), the posterior parietal cortex (PPC) and the primary motor cortex (M1).

c. We found that for finger movement, the activity was similar in paraplegics and normals in all regions. For foot movement, the activity in V1/V2 was similar in the two groups but activity in M1 and PPC was significantly decreased in paraplegics compared with the normals for both GO and NOGO conditions.

d. This shows that in SCI patients, impairment is present not only in the motor cortex but also in the predominantly visual parietal areas, where visuomotor transformations are implemented. These findings have significant implications for spinal cord repair attempts, the development of Brain Computer Interfaces and possibly Functional Electric Stimulation for SCI patients.

062

Autologous incubated macrophage treatment in complete spinal cord injury: results of the multicenter trial

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Purpose: Determine efficacy for improving neurological outcome of autologous incubated macrophage therapy in patients with traumatic complete SCI.

Methods: Patients enrolled at one of 6 study centers were randomized in a 2:1 ratio to treatment or standard care control groups respectively. Treatment group subjects underwent harvest of blood and skin. The monocyte fraction was co-incubated with skin to produce autologous incubated macrophages which were injected into the spinal cord at the caudal boundary of the contusion within 14 days of injury. The primary outcome was conversion of initial ASIA Impairment Scale (AIS) from A to a final rating of B or better measured at 6 to 12 months. A Fisher's exact test was used to assess for differences between the groups in AIS and percentage of subjects with at least one AE.

Results: Enrollment was stopped prior to achieving the target of 61 due to financial reasons. 50 eligible subjects were randomized and 40 had sufficient data for efficacy analysis. 7 of 24 treatment (29.2%) and 10 of 16 control (62.5%) subjects converted

from ASIA Impairment Scale (AIS) A to B ($p=0.0531$). The number of subjects with one or more adverse events did not differ between the groups (94% treatment; 82% control; $p=0.33$).

Conclusion: The analysis failed to show a significant difference in primary outcome between the two groups. There was a trend for more improvement in the control group. The results of this study do not support the clinical use of autologous incubated macrophage therapy for complete SCI.

063

Development of criteria for unexpected neurological change in a phase 1 sub-acute, complete spinal cord injury study

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Purpose: Defining the magnitude of unexpected neurological change is an important element of interventional clinical trial protocols; therefore, criteria were established for an upcoming Phase 1 safety study of cells derived from human embryonic stem cells in subjects with sub-acute, traumatic spinal cord injury.

Methods: Following consultation with experts who hypothesized that change > 2 neurological levels (NL) from baseline would be considered unexpected, a retrospective analysis of placebo control subjects from the Sygen data base was conducted. The analysis focused on subjects likely to be included in early phase safety studies of interventional trials, i.e., individuals with complete SCI and NL from T2-T10. Absolute change in left or right pin prick (PP) and light touch (LT) at 4, 8, 16, 26, and 52 weeks post injury relative to the baseline exam (72 hours post injury) were calculated. In this population, changes in NL are based solely on the sensory exam.

Results: 57 subjects met the criteria for this analysis. The mean change relative to baseline was 1.48 (95% CI, 1.23-1.73) for PP, and 1.40 (95% CI, 1.15-1.65) for LT.

There were equal proportions of improvement, deterioration and no change for weeks 4-26. At the final exam (week 52), $>70\%$ of sensory changes were equivalent to baseline. The majority of exams demonstrated no change or a shift of < 3 NL.

Conclusion: The sensory exam in this analysis, in T2-T10 ASIA Impairment Scale (AIS) A subjects, was relatively stable across time. Generally, a change > 2 NL would be considered unexpected.

064

Therapeutic anti-nogo-a antibodies in acute spinal cord injury - first information on safety and pharmacokinetics

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Objectives: Following spinal cord injury (SCI) regeneration and plasticity in the adult central nervous system (CNS) of mammals are extremely restricted. The molecular impediments are proteins expressed in CNS myelin which inhibit neurite growth. One of

the most potent is Nogo-A, a membrane protein comprising multiple inhibitory domains that activate independent receptors. Monoclonal anti-Nogo-A antibody treatment has been shown to facilitate neuroregeneration in a non-human primate model of SCI.

Methods: An open-label, multi-center, multiple cohorts study to assess feasibility, acute safety, and pharmacokinetics of a continuous i.t. infusion as well as repeated bolus injections in acute SCI paraplegic and tetraplegic patients. Patients must have neurologically complete thoracic or cervical lesions.

Results: To date 25 patients received continuous i.t. infusions and 10 had repeated i.t. bolus injections. In the continuous i.t. infusion group a few catheter-related technical complications occurred and one patient suffered from bacterial meningitis. In contrast, repeated i.t. bolus injections were well tolerated to date. Otherwise, no clinically relevant deviations in vital signs, ECGs or laboratory parameters were observed. Pharmacokinetics revealed a slow decline in serum with a terminal half-life of about 2-3 weeks and approximately 2-3 days in CSF.

Conclusions: No ATI355-related safety concerns were reported to date. Continuous infusion mode of administration is challenging due to infection risks and device related complications. Pharmacokinetic data are supportive to switch to repeated i.t. bolus injections. The current study is suited to define the most appropriate treatment regimen for intrathecal application of the ATI355 antibody in acute SCI patients.

O65

Preclinical and phase 1 development of oligodendrocyte progenitor cells derived from human embryonic stem cells for the treatment of spinal cord injury

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Multiple preclinical studies were performed over a period of several years to evaluate the efficacy and safety of GRNOPC1, a cryopreserved population of differentiated cells containing oligodendrocyte progenitors derived from human embryonic stem cells.

Preclinical efficacy of both fresh and cryopreserved GRNOPC1 was evaluated with respect to locomotor function in rats that had received a contusion injury to the spinal cord at the T9-T10 thoracic level. Preclinical safety of GRNOPC1 was assessed in several extensive studies involving rats with thoracic contusion injuries and mice with intact spinal cords, and animals were followed up to 12 months post-injection.

In preclinical efficacy studies, GRNOPC1 improved hindlimb locomotor activity in rats when implanted 7 days after injury near the epicenter of the lesion. Fascicles of myelinated neural fibers were observed traversing the injury epicenter after GRNOPC1 injection, but not in animals injected with vehicle alone. The safety studies showed no evidence of teratoma formation 12 months after injection of clinical grade GRNOPC1, and demonstrated the absence of significant migration of the injected cells outside the spinal cord, allodynia induction, systemic toxicity or increased mortality in animals receiving GRNOPC1.

The results from 24 preclinical studies where over 850 animals were injected with GRNOPC1 were submitted as part of an Investigational New Drug (IND) application to the FDA. Preparations are underway to initiate a Phase 1 clinical trial to assess the safety

of GRNOPC1 in patients with subacute, complete (ASIA Impairment Scale A), thoracic injuries whose last fully preserved neurological level is T3 to T10.

066

Resistance to the physiological activities of fibroblast growth factor 23 (FGF23) following spinal cord injury (SCI)

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Background: The bone-derived phosphaturic hormone FGF23 is a master regulator of systemic phosphate homeostasis. The renal pathway involves C-terminal FGF23 binding to alpha-Klotho, the obligatory co-factor required for FGF23/canonical FGF receptor I(IIIc) interaction and signalling.

Aims: To evaluate, following SCI, how physiological variability in circulating FGF23 levels relates to biochemical parameters.

Design: Prospective, repeat measures

Methods: Male patients, 18-55 years, AIS-ISCoS A-D, C2-T12, all-cause trauma (three-26 weeks) and controls (CON) were recruited from the Royal Adelaide Hospital, South Australia. Exclusion criteria were: endocrinopathies, metabolic bone disorders, systemic or renal diseases, multiple traumas, or medical fragility.

Serial, fasting, blood specimens were collected between 0800-0900 hours and submitted for metabolic blood analysis. 1,25(OH)2D3 was measured using RIA (IDS, UK). The FGF23 N-terminal fragment was measured using ELISA (Kainos, Japan).

Parametric data were pooled and Student's t-tests applied.

Results: Nine patients (31 ± 11 yrs), 3 AIS A-B, and seven controls (36 ± 13 yrs, $P > 0.05$) participated. Normocalcaemia was maintained (SCI Se-ion. $\text{Ca}^{2+} 1.25 \pm 0.06 \text{ nmol.L}^{-1}$, CON $1.22 \pm 0.02 \text{ nmol.L}^{-1}$ $P > 0.05$). Differences between serum FGF23 levels were significant (SCI $76 \pm 21 \text{ pg.ml}^{-1}$, CON $51 \pm 18 \text{ pg.ml}^{-1}$ $P = 0.01$), as were those for phosphate (SCI $1.38 \pm 0.21 \text{ nmol.L}^{-1}$ CON $1.17 \pm 0.11 \text{ nmol.L}^{-1}$ $P < 0.001$) and 1,25(OH)2D3 (SCI $67 \pm 37 \text{ pmol.L}^{-1}$, CON $118 \pm 35 \text{ pmol.L}^{-1}$, $P < 0.001$).

Conclusions: The finding of paradoxically elevated circulating FGF23 concentrations in this metabolic set has highlighted the possibility that resistance, involving low-affinity FGF23/FGF receptor I(IIIc)/alpha-Klotho interaction, exerts a level of control on phosphate homeostasis. Whilst novel, it is as yet unclear whether this compensatory rise in the circulating FGF23 concentration is protective or harmful.

067

Comparison of child and parent reported activity performance and participation in children and youth with spinal cord injury

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The purpose of the research is to compare child and parent responses to a survey that

examines perceived difficulty in performance of daily activities and participation in expected child and youth roles. A prospective self-reported survey was completed on the computer by children and youth 8 years and older who sustained a traumatic SCI. Parents and children independently completed a computer-based survey. Survey included activity domains of mobility, self-care and daily routines. Participation was analyzed with regards to child's preference and level of participation as compared to peers. A total of 139 children with a mean age of 15.2 years (SD 3.5; range 8-21) completed the survey along with their parents. Scores in the three activity domains (mobility, self-care and daily routines) were all significantly higher for children than parents, indicating that children perceived that they functioned better in these domains than parents. Differences were in the range of 4-7% of the scale range. In contrast, we found no significant differences between parents' and children's perceptions of participation, both with regards to the child's preference and the level of participation of peers. Parent and children with SCI differ in their report of levels of functioning. These differences are found primarily in activity performance, which assesses the difficulty of completing discrete mobility, self-care and daily routine tasks. Surprisingly, ratings of participation in expected childhood roles with respect to child preference and peer performance are rated similarly by parents and children.

O68

International standards for neurological classification of spinal cord injury: utility of motor, sensory and anorectal exams with children

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The purpose of the study was to establish the utility of the International Standards for Neurological Classification of Spinal Cord Injury examinations in children and youths. A prospective cross-sectional multi-center reliability study involved administration of four repeated measures of the motor, sensory and anorectal examinations by seven raters. Intraclass correlation coefficients (ICC) and confidence intervals (CI) were calculated for inter-rater agreement for motor, sensory and anorectal scores. Among 210 children, 29 were unable to understand test instructions due to young age. The remaining 179 children were a mean age of 14.5 years, had sustained their SCI at a mean age of 10 years and were an average of 4.9 years since injury. When examined for the entire sample, inter-rater agreement for motor/sensory exams and anorectal responses was good (ICC and lower 95% CI values ≥ 0.88). Agreement was high for motor/sensory exams when examined as a function of age at exam, type of injury and AIS. Agreement for anal sensation was poor (ICC=0.49) for AIS "A" (N=99) and poor for both anal sensation (ICC=0.59) and contraction (ICC=0.49) for AIS "B" (N=36). For AIS "C/D" (n=44) anal sensation and contraction was good (ICC= 0.82) to high (ICC=0.98) but lower CI values were poor (≥ 0.48). Motor/sensory examinations have utility for children as young as six years with good-high agreement. Reliability of the anorectal examination is poor with children with AIS "A/B". Further validation of the anorectal examination is warranted; caution in interpretation and use is recommended.

069

A review of the musculoskeletal, urologic and pulmonary complications in 118 patients with pediatric spinal cord injury

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The aim of this study was to determine the prevalence of musculoskeletal, urologic pulmonary and other complications in children with spinal cord injury and their association with age, level and pattern of injury.

Method: Retrospective review of medical charts.

Result: The 118 patients who were analysed had a mean age at injury of 12,5 years and a mean follow-up of 4,75 years. Most common complications were scoliosis (38%), subluxation or contracture of the hip (19%), urinary tract infections (40%), chronic pneumonia (44%) and pressure ulcers (46%). Spinal cord injury without radiological alterations (SCIWORA). SCIWORA accounted for 42% of all traumatic spinal injuries in the 0-14 years age group and but only for 2% in the 15-18 years age group. Young age at injury was significantly associated with scoliosis, high injury level and respiratory complications. There was no significant association between paraplegia or tetraplegia and pressure ulcers.

Conclusion: Musculoskeletal, urologic, pulmonary and other complications are common in children with spinal cord injury. The most common complications are scoliosis, contracture and subluxation of the hip, urinary tract infections and pneumonia. To prevent these complications children at high risk have to be identified and treated early.

070

Spinal tumours in childhood. A single institution experience of ninety-seven cases

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Spinal tumours account for a small proportion of central nervous system malignancies in children. We admitted ninety-seven patients with spinal tumours over fifteen years, 7.7% of patients who presented over the same time with CNS tumours, and retrospectively reviewed the case notes with prospective follow up with the aim to assess the population, clinical presentation, tumour types, evolution in diagnostic assessment, decision making for treatment, surgical management, and results.

Mean age at presentation was 8.8 years (2 weeks-26 years) with two peaks of incidence: before eighteen months and after nine years.

Mean follow up was 31 months (1 month – 13 years). The most common reasons to seek medical advice were pain (44.5%) and focal neurology (41.8%).

All patients were studied with MR and CT scan: there were 32 intramedullary, 21 intradural extramedullary, 35 extradural and 9 paravertebral extracanal lesions. Low grade glioma was the most common primary (27%); only four cases of secondary tumours for CSF dissemination were recorded.

Goals of treatment were histology, decompression of spine and nerve roots, spinal stability

and were obtained through different strategies: complete or partial debulking with osteoplastic laminotomy, laminectomy or direct approaches, CT guided biopsy, embolization.

At last follow up 73.2% were improved; 15.4% had spinal instability.

Ten patients had died for disease progression.

Accurate planning based on neuroimaging, type of tumour and general medical condition leads to a good outcome in terms of preserving an adequate quality of life reducing the risk of spinal deformities.

071

Scoliosis development following childhood spinal cord injury

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Aim: To describe the development of scoliotic curves in people with paediatric onset spinal cord injury and to identify possible predictive factors.

Method: Sample included children born 1974-1992, injured before the 16th birthday and followed-up until 2008. Scoliosis was measured by Cobb angle.

Results: Of 76 people with radiographic data 50% were male, 69.3% had paraplegia and 56.7% had a complete lesion. In 38 (50%) the Cobb angle was greater than 40° which becomes clinically relevant when considering surgical correction. The mean maximal Cobb angle was 72°. Those with Cobb angles > 40° had proportionally more complete lesions ($p=0.008$) and were younger at time of injury; mean age 5.9 years compared with 10.4 for those with lesser angles ($p<0.001$). The mean age at the time of exceeding 40° was 11.8 years and the mean time post injury was 5.9 years. Further analysis showed that those injured younger (0-11 years) exceeded 40° Cobb angle at mean age of 10.7 years and at mean time post injury of 6.6 compared with 16.8 and 2.9 respectively for those injured in adolescence (11-16) ($p<0.05$). Multivariate logistic regression showed that only younger age at injury and completeness of injury were significant predictors of a scoliosis greater than 40° (odds ratio (OR)=0.828 per unit increase and OR=3.453 respectively, $p<0.05$).

Conclusions: Half the sample developed a scoliosis of 40° or greater; completeness and younger age at injury were the only significant predictors. Those with adolescent onset deteriorated more rapidly.

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072

Ischemic spinal cord lesion in children

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Ischemic spinal cord lesion in childhood is a rare condition. In literature few works treat its etiology, diagnosis, treatment and prognosis. Objective of this retrospective review is to assess the etiopathogenesis and outcomes of spinal cord ischemia in children based

on clinical and MRI findings.

We analyzed the clinical, laboratory, imaging and outcome data in 6 patients (3 males and 3 females -age range 2 months – 14 years) with post-acute spinal cord lesion admitted between 2004-2008.. Two children developed spinal cord infarction following repair of aortic coarctation. In four cases the etiology of ischemia is uncertain: in three cases thrombotic work-up revealed C677T mutation of methylenetetrahydrofolate reductase gene (MTHFR), probably contributing the ischemic feature; in one case cervical minor trauma, 48 hours before, preceeded acute onset of tetraplegia: angiography revealed only left vertebral artery hypoplasia without trombotic features. MR-imaging showed an ischemic lesion as a well-demarcated T2-weighted hyperintensity in 3 cases; in one case T2-weighted hyperintensity revealed transverse infarct, in another one central cord infarct, last one MRI evidenced conus medullaris lesion.

All patients underwent rehabilitation. Outcome, according to ASIA Impairment Scale, was in two cases respectively L1 and L2 A, in three cases respectively C5, D1 and D4 D, in the last one D11 C. All patients, except one, developed neurogenic bladder and bowel, requiring clean intermittent catheterization, bowel management. Two patients were treated with botulinum toxin A on bladder/uretra.

073

Threshold currents at the electrode-nerve interface of phrenic nerve stimulators are stable during patient survival time

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Inductively fed implanted nerve stimulators avoid the potential infection port of skin-penetrating wires and pain and burns of cutaneous stimulation (1). Electrically induced muscle fatigue has been solved. (2). The initial higher cost of phrenic nerve stimulation (PNS) or diaphragm pacing (DP) in contrast to mechanical ventilation (MV) is paid off within one year through reduction of respiratory tract infections. (3). However, fund suppliers still refuse funds doubting the long-term stability of the electrode-nerve interface. The pioneers of DP saw changes of threshold currents (TC) during the first months after implantation and reported stable TC after the first year. In 6 patients this has been confirmed over an average follow-up of 14,9 years(4). We used PNS since 1987 in 49 patients and found unchanged TC after the first year in 36 patients except in one patient older than 80 years of age. Mean follow-up after implantation of these 36 patients was 5.4 years (range 1-15.6).

Conclusion: PNS (DP) during patient mean survival time (3.4 years(3)) is not only cheaper than MV but also without hidden hazards at the electrode-nerve interface.

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074

Respiratory dysfunction of spinal cord injury (SCI) patients. optoelectronic plethysmography (OEP) evaluation

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Introduction: the OEP is a new, non invasive technology which allows evaluation of chest wall kinematics during respiration and cough. The aim of the study is to evaluate the OEP with a group of SCI subjects.

Patients and methods: neurological evaluation by means of American Spinal Injury Association standards. OEP study with evaluation of the following parameters: Tidal Volume, respiratory frequency, inspiratory and expiratory times and fluxes, thoracic and abdominal compartments volumes and percentage contributes to the total thoracic volume, inspiratory and expiratory vital capacity; FEV1; chest wall dynamic and distortion during cough.

Results: 5 patients with traumatic chronic SCI have been studied (age 28.8 years; time since lesion 44 months; lesion level: 3 cervical, 2 thoracic; ASIA Impairment: 3A, 1B, 1C). controls mean age was 28.6 years. With regard to chest wall kinematics, SCI patients showed a pattern similar to controls during quiet breathing in the sitting position , while in hyperventilation the total chest wall volume and the lower thoracic compartment volume were significantly lower in the SCI subjects than in the controls. These differences disappeared when examining patients and controls in the supine position. With regard to vital capacity the SCI patients' capacity was significantly lower than the controls in the sitting position. Again this difference disappeared in the supine position.

Conclusions: the OEP seems to be a valid and reliable technology to examine breathing kinematics in SCI patients. The present data indicate that paradoxically SCI patients have a better breath pattern in the supine position than in the sitting one.

075

Spirometric values importance in a decannulation protocol for quadriplegic tracheostomized patients:

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Abstract: Forced Vital Capacity (FVC) and Maximal Expiratory Pressue (PEmax) are spirometric tests mainly checked in quadriplegic patients to predict cough ability.

Materials and methods: Spirometric serial values (FVC, PEmax) were evaluated in 14 acute quadriplegic tracheostomized patients, during their hospitalization in Spinal Unit. (jan2005 feb2009). The exams were performed through the mouth and with a small size capped tracheostomic cannula, using a VMaxSensormedic spirometer. Only successfully decannulated patients were included.

We compared these results with spirometric values of 5 acute quadriplegic patients admitted to the Spinal Unit without tracheostomy.

Results: Serial spirometric controls showed no progression values of FVC values in five

subjects, while in all subjects there was remarkable progression in absolute values of PEmax . To remove tracheostomy, the accepted PEmax minimum value was 50 cm H₂O. The five quadriplegic non tracheostomized patients showed lower PEmax values compared with the above tracheostomized.

Discussion: To decannulate quadriplegic tracheostomized patients emphasis has been given in spirometric PEmax values, as an indirect index of adequate cough-ability. PEmax 50cmH₂O is the minimal accepted value in patients suffering neuromuscular diseases to allow spontaneous breathing, but no spirometric minimal values to remove tracheostomy in quadriplegic patients were found in literature.

This study emphasizes PEmax serial values can be more predictive than FVC for an objective respiratory function improvement of tetraplegic patients.

Conclusion: To decannulate quadriplegic subjects, it should be safer to follow an exhaustive protocol, shared with other medical specialists, in which spirometric tests have to be compared with clinical observation.

076

Effects of lower thoracic spinal cord stimulation (SCS) on expiratory muscle function in subjects with spinal cord injury (SCI)

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Objective: To evaluate the effects of a novel SCS technique to restore cough on expiratory muscle strength in subjects with SCI.

Participants/Methods: In 9 tetraplegics, three single disc electrodes were implanted on the dorsal epidural surface of the spinal cord at the T9, T11 and L1 spinal levels and connected to an implanted radiofrequency receiver. SCS was applied by activating an external transmitter. Post-implantation, each subject was instructed to apply stimulation every 30s for 5-10min, 2-3times/day and to use as needed for secretion management. Stimulus parameters were set at values resulting in near maximal pressure generation (30-40V, 50Hz, 0.2ms, 0.6s on time). Maximum airway pressure generation (P) was monitored at total lung capacity as an index of expiratory muscle strength.

Results: Mean P during spontaneous efforts was 21±2cmH₂O (range: 16-28cmH₂O). Initial combined stimulation with a 2-lead system (T9+T11 or T9+L1 or T11+L1) resulted in P of 82±15cmH₂O (range: 35-160cmH₂O). After 3-4 months of daily stimulation, P increased to 134±19 cmH₂O (range: 66-210cmH₂O) (p<0.05 compared to initial stimulation values), values which approximate the normal range.

Conclusions: Following spinal cord injury, the force generating capacity of the expiratory muscles is markedly reduced secondary to disuse atrophy. Expiratory muscle reconditioning with lower thoracic SCS, however, results in marked improvements in expiratory muscle strength. These findings also support the concept that this technique may provide a useful method to restore an effective cough mechanism in subjects with SCI.

077

Intrathecal baclophen may improve breathing as well as walking

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Spasticity following spinal cord injury (SCI) may be detrimental to function and may also impact lung capacity by inducing stiffness in the paralysed muscles in the thoracic trunk. On the other hand spasticity may sometimes be useful in walking in the ASIA Impairment Scale (AIS) D patients. Spasticity is sometimes treated by intrathecal baclofen (ITB). We have 23 patients on ongoing ITB treatment with a total treatment time of 163 years.

Methods: Retrospective chart review.

Results: Mean age at injury 38 years, mean age at implantation 44 years. The majority suffered from a cervical level of lesion (19), while 3 had a thoracic and 1 a lumbar level of injury. Mean dose was 294,6 (279,1-309,7 95 % CI) micromol/24 h. Two of the patients had a level of lesion of C4 AIS B and C2 AIS C respectively. The vital capacity of these patients increased significantly from 1,3 l/min to 2,05 l/min after receiving ITB ($p < 0,05$). Two patients had an AIS D lesion and are walking. Their mean dose is 47,6 micromol/24h and significantly lower than the AIS A-C group.

Conclusion: ITB could be of value to improve lung function in the very high cervical injured as well as could be of benefit in the AIS D walking patients. In the latter group the dose is significantly lower than the AIS A-C group.

078

Quantification of spasticity in incomplete SCI subjects during a pedaling movement and influence of training with FES

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The purpose of this study was to develop an improved method for quantification of spasticity that is quick and reliable and hence suitable for daily clinical therapy, and to assess the influence of FES pedaling training on spasticity of subjects with incomplete para-/tetraplegia.

A pedaling mechanism that is driven by a brushless servo motor is used for the measurements. The subjects legs are attached to the pedals, orthoses stabilize the ankle joint. In each measuring session the pedals are moved with constant angular velocity at 10/20/30/40/50/60rpm consecutively, 15 full rotations at each cadence. Resistance of the legs to the motor movement is measured and averaged at each speed, inertial components are subtracted. Comparison of the resistance before and after FES training shows the effect of the training on spasticity.

Measurements with three spastic subjects (average MAS 1.7) and three non-spastic subjects were done before and after a 30min FES pedaling training. Each patient did seven to fourteen measurements within two months, results were averaged. The results show that for the spastic group the resistance increased more with velocity before the FES training than after, on average the difference was 4.2W(60rpm), average MAS

dropped to 1.3. For the non-spastic group resistance was slightly decreased after the FES training over the whole range of velocities.

The proposed method allows quick and reproducible assessment of spasticity. Due to the cyclic movement the spasticity of both joints, knee and hip, is assessed together. First results induce that FES pedaling training reduces spasticity in SCI-subjects.

079

Extracorporeal shockwave therapy (eswt) for the spasticity management in children with cerebral palsy - preliminary results

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Study Purpose: To evaluate the response on cerebral palsy spasticity

Material & Methods: 34 spastic children (2-15 years old; mean: 6.625 years: 16 M, 18 F). We applied focused ESWT, targeting the mainly affected muscles (biceps brachialis, flexor carpi - radialis & ulnaris -, teres pronator; pectoralis major; cvadriiceps, semitendinosus, semimembranosus, biceps femoris, gastrocnemius, soleus) with the same parameters (energy: 0,15 mJ/mm2 ; shot dose: 500 shocks/ min; frequency: 10 Hz). Each patient received a unique therapy session; all had a single post therapy evaluation, 3 days afterwards.

Results: ESWT proved to be statistically efficient (on upper limb: biceps brachialis and on lower limb: adductors, gastrocnemius, soleus), reducing the Ashworth level by almost 1 point (with $p < 0.01$, means initial = 3.04, means final = 2.45) as the number of these muscles was large enough. Conversely, for the other muscles, their number was too small for reliable mathematical assessment. A significant correlation between the time elapsed from the spasticity occurring moment/ age, the quality of life and the degree of responsiveness ($p > 0.001$) was observed.

Conclusion: Shockwave therapy might efficiently improve spasticity in affected children. There are needed Further studies are needed to improve the methodology which mainly depends on the therapeutic effects. In preparation, a comparative group of children with post SCI spasticity will be evaluated.

080

Treatment of HIP ARTHRITIS in SCI patients

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Introduction: Sepsis of the hip remains a major complication of pelvic pressure ulcers in SCI patients. The authors report 33 cases of hip arthritis in 26 patients diagnosed and treated in the spinal unit of the University Hospital of Nantes between 1988 and 2009.

Method: In this retrospective study, the clinical and bacteriological data, type of surgery and perioperative care, and the occurrence of complications have been reviewed.

Results: Most of the patients had a post traumatic thoracic AIS A paraplegia. The location of pressure sore was trochanteric in 26 cases and ischial in 7 cases. In 13 cases, arthritis had been previously operated. Hip arthritis diagnosis was based on clinical

examination, C-reactive protein level, X-rays and MRI. The surgical procedure was a one-stage procedure including: a wide surgical debridement, a resection of all the necrotic tissue plus head and proximal femoral resection, and multiple biopsies for bacteriological analysis. A musculo-cutaneous flap linked to the site of the sore performed the closure of the wound. An adapted antibiotic treatment was systematically prescribed for at least 3 months. In most of the patients healing was obtained within 8 weeks. In six cases, the occurrence of a major complication required a new surgery. The mean length of stay in hospital was 9 months.

Conclusion: Hip arthritis must be systematically suspected in cases of chronic or recurrent pelvic pressure sores in SCI patients. Its successful treatment relies on a codified surgical procedure and perioperative care within a specialized and multidisciplinary framework.

O81

A technically reduced urodynamic measuring method compared with a conventional urodynamic study

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Purpose: The aim of this prospective randomised study is to show if a technically reduced purely mechanical urodynamic measuring method can yield results similar to a conventional urodynamic study.

Methods: A total of 20 patients were investigated, each with both measuring methods. 50% of the patients had neurogenic bladder dysfunction. The measurement was carried out via two 8Ch feeding tubes. Thus a continuous measurement of the intravesical pressure during artificial bladder filling was possible. In one of the measurements a computer-aided system was used as a pressure sensor, in the second a standpipe. Subsequently the pressures and the compliance of both measures were compared.

Results: The measurements displayed during artificial bladder filling and voiding similar intravesical pressures, no significant difference was found. Neither did the compliance measured in the technically reduced urodynamic study differ significantly to the one measured in the conventional urodynamic study. Between both techniques there were no differences in the detection of detrusor overactivity.

There was no significant difference between the parameters necessary for risk evaluation and the decision whether to initiate a therapy of neurogenic bladder dysfunction.

Conclusions: The study showed that using a low-priced urodynamic measuring method the same results can be gained as with an expensive computer-aided measuring method. Thus regions with limited financial resources have access to an affordable measuring method for neurogenic bladder dysfunction.

082

Effective treatment of neurogenic detrusor overactivity (NDO) by combined low dosed antimuscarinics

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Starting from September 2007 we introduced a protocol of treatment with antimuscarinics in patients with NDO with insufficient treatment outcome under monotherapy at high doses of oxybutynin (15 mg.a day) and trospium chloride (60 mg. a day) with introduction of a combined antimuscarinics treatment with the same drugs at low dosage.

All patients demonstrated NDO at bladder diary and urodynamic and started with oxybutynin 7.5 mg.(2.5 mg. every 8 hours) and trospium chloride 40 mg. (20 mg. every 12 hours)

Bladder diary was used as continuous control; urodynamic was repeated at 3 and 6 months.

21 pts. were enrolled after sub-optimal results with monotherapy

All patients used IC 4-6 times a day avoiding overdistension.

Results: Significant changes were noted at follow-up with incontinence decreasing from an average of 4 to 1 event per day.

Mean bladder capacity increased with combined treatment of 160 ml. from the value with monotherapy. At 3 months urodynamic testing demonstred an increase of reflex volume in all patients confirmed in 12 patients at 6 months.

None of the patients enrolled required different treatment for NDO and are satisfied. No subjective increase of side effects related on antimuscarinics were noted.

Preliminary results are encouraging especially in a group of patients who decide on further treatment with Botulinum toxin injection or neurostimulation nearer to their date of SCI.

Conclusion: A combination of antimuscarinic agents at low dosage is an effective treatment strategy in patients who have failed with high dosage monotherapy.

083

A novel wearable device for controlling urinary incontinence by conditional neuromodulation

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UK

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In spinal cord injury, incontinence is mainly due to neurogenic detrusor overactivity (NDO) exacerbated by sphincter dyssynergia. NDO can be suppressed using drugs which also improve bladder capacity. However these drugs have some bothersome side effects including dry mouth and constipation. This novel device has been developed with the aim of replacing drugs by trans-rectal electrical stimulation of the pudendal nerves triggered by electromyographic (EMG) activity of the dyssynergic sphincter. This technique is known as conditional neuromodulation.

A standard cystometrogram at 10ml/min was performed to record the bladder and rectal

pressures, while recording sphincter EMGs through the device. Software was pre-programmed to trigger the stimulation when the processed EMG exceeded a pre-determined threshold. Suppression of maximum bladder pressure and increase in bladder capacity were the outcome measures evaluated against control measures for significance using a Wilcoxon signed ranked test.

In all six subjects repeated conditional neuromodulation suppressed NDO and increased bladder capacity. The mean maximum detrusor pressure was reduced from 95cmH₂O to 31cmH₂O ($P<0.001$) and the mean bladder capacity increased from 115ml to 380ml ($p<0.001$).

This novel wearable conditional neuromodulation device prevented incontinence by significantly suppressing NDO and increasing bladder capacity by an average of 240%. Tests are now planned to assess its performance and durability during activities of daily living.

084

Continent cutaneous urinary diversion and neurogenic bladder. about 21 patients.

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France

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To evaluate the impact of a continent cutaneous urinary diversion (CCUD) on the functional benefits and improvement of Quality of Life in patients with neurogenic bladder. Retrospective study of 21 patients: SCI patients = 11, multiple sclerosis = 2, spina bifida = 3, cauda equina syndrome = 1, cerebral palsy = 1, non-neurogenic neurogenic bladder = 1, megacystis syndrome = 1. Mean follow-up: 33.7 months. Post-operative bladder management, incidence of complications, assessment of Quality of Life (Qualiveen questionnaire) have been evaluated.

18 patients perform clean intermittent self catheterization after surgery, 1 CIC by a caregiver. A non continent uretero-ileostomy was later performed in 2 cases. 19 patients are continent: 6 with Botulinum toxin type A (BTX-A) intradetrusor injections, 14 with anticholinergic drugs. For 5 patients, the Mitrofanoff or Monty procedure was associated with enterocystoplasty. During follow-up, 2 lithiasis, 6 stenosis of the Mitrofanoff channel occurred. The post-operative mean score of the Specific Impact of Urinary Problem (SIUP) index was 1.22: significantly lower in tetraplegics than in the tetraplegic group control. Quality of Life in tetraplegics is higher than in the group control.

CCUD is a suitable procedure in patients who are unable to perform independent CIC. It allows independent function and improves quality of life: decrease of bother with limitations, frequency of limitations and fear. An upper limbs surgery was performed in 5 tetraplegics to allow self CIC. We perform enterocystoplasty only if BTX-A injections and/or anticholinergic drugs fails to control a low bladder compliance or an overactive bladder.

085

Sacral neuromodulation in children with neurogenic bladder

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Purpose: Sacral neuromodulation (SNM) has been widely used in adults, recently in incomplete spinal cord injury too. A previous experience in children with neurogenic bladder dysfunction (NBD) suggested to consider SNM in incomplete lesions in order to improve efficacy. We present our preliminary result in selected children with NBD using neurophysiological tests.

Methods: We considered patients aged 12-18 years old, with NBD not responding to other treatment, incomplete neurogenic damage, ability and motivation of patients and relatives. Patients were selected using neurophysiological tests: pudendal somatosensory evoked potentials and bulbocavernous reflex. All patients performed urodynamics pre and post treatment, as well diaries and specific quality of life (QOL) questionnaire (Qualiveen). The 2 step implantation technique with local anesthesia was used: first with quadripolar electrode positioning in S3 and then, after a 2 weeks minimum observation period, permanent neurostimulator (InterstimII) implantation.

Results: 2 boys aged 15 and 16 yrs old, previously operated for anorectal malformation and sacrococcygeal teratoma were selected according to previous criteria. Spinal cord MRI was normal in both. Neurophysiological tests indicated a left side sensory damage in both. No surgical complications were observed. After implantation an increased voided volume and continence improvement was observed with urinary incontinence reduced. QOL scores showed a dramatic improvement (0.92 to 0.36, 0.49 to 0.25), while urodynamic data were significant in one patient only (end filling pressure reduced 48 to 15 cmH2O).

Conclusions: SNM seems to be a promising therapeutic modality for NBD in selected children with incomplete injury.

086

Application of Skin Traction for the Treatment of Grade-IV Pressure Sore: A Clinical Report of 160 Cases

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Objective: To report the results of skin traction in surgical closure of grade-IV pressure sore.

Patients and method: Between 2005 and 2009, a total of 160 patients with 235 grade-IV pressure sore(s) were admitted and treated surgically. Skin edges were brought closer together gradually by applying multiple parallel plasters to the surface of the skin. Meticulous wound preparation and debridement, accompanied by pre-operative and post-operative skin traction were adopted to achieve primary closure of sores with a diameter up to 10 cm. Further extension was possible but restricted by time and budget.

Results: 225 sores (95.7%) healed primarily and only 10 patients with a large pressure sore each needed a second operation. They were evacuation of haematoma and re-suturing during stay in hospital. Patients were followed up for an average of 22 months (2 - 51 months). Two patients had "recurrence" of minor sores due to long sitting. One was treated locally whilst in the other the sore was closed with minor surgery in RHB. Eight patients with a sore larger than 10 cm and 8 with extra heel sores were treated with split thickness skin graft. The mean stay in hospital was 45 (20-140) days. No patient needed flap surgery.

Conclusion: Grade IV pressure sore at the sacrococcygeal or greater trochanteric region up to 10 cm can be cured through primary closure assisted with parallel skin traction. This simple method has the advantage of minor trauma, high success and low recurrence rate. It is recommendable for wide clinical application.

087

New treatments for pressure ulcers - Don't forget the maggot therapy

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Introduction: Fly larvae can debride and help heal chronic wounds. Using these effects maggot therapy is experiencing a resurgence that can be used also for bedridden SCI patients with pressure ulcers.

Methods: 5 SCI patients (3 tetraplegic, 2 paraplegic, 2 females, 3 males) with 6 pressure ulcers were treated with applied maggots (Biobag® BioMonde®). Surface area, tissue quality and healing rates were monitored weekly.

Results: Patients readily accepted this less traditional treatment. No pain or other side effects could be seen. The maggots debrided most of the necrotic wounds within 3 to 5 cycles with 4 to 5 days treatment. Especially on the heels we found positive healing effects making no plastic surgery necessary.

Conclusion: The maggot – assisted wound healing with its "biosurgical" effects should belong to the repertoire of a SCI centre using new - and old treatments - for pressure ulcers.

088

The joint venture between a dermal substitute and platelet growth factors: a novel approach to cutaneous ulcer repair

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Introduction: Dermal matrix and topical blood factors represent a new modality of treatment for chronic cutaneous lesions.

Materials and methods: We have combined, for the first time, two methods: the use of dermal matrix as a "scaffold" and platelet growth factors as "biological mediators" to induce cell growth and differentiation .

Dermal matrix Integra (SIAD H.C., Integra lifesciences Corp., Plainsboro, NJ, USA) is a

double-bedded membrane system: an adsorbent matrix made by reticulated collagen fibres of bovine tendons and a glycosaminoglycan (chondroitin 6 sulphate) characterised by a controlled porosity and degradation rate, while a silicon film that controls the loss of humidity substitutes the epidermis.

Surgical procedure: CO2 laser (Smart Xide, Deka M.E.L.A.) application followed by the insertion of Integra pre-incubate with PRP over the ulcer's floor. Antiseptic advanced medications for the exudate's management were then used.

Results: Thirty patients were treated in 2007. Aetiology comprised diabetic, hypertensive, neuropathic, iatrogenic, pressure, venous, arterial). Five individuals were paraplegic, of whom 3 had the lesion on the external malleolus, one on the sacral area one on the external surface of a lower limb.

95.2% of patients responded positively. In thirteen patients (61,9%) there was a complete remission, in six (28.5%) there was a reduction more than 75% . In one (4.8%) there was a reduction of more than 50%. In one patient there was no improvement.

Conclusions: Integra associated with PRP may be considered a new mini-invasive approach for tissue repair in non responder ulcers.

O89

Electrical stimulation-Induced Gluteal and Hamstring Muscle Activation Can Reduce Sitting Pressure In individuals With Spinal Cord Injury

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Introduction: Despite preventive measures individuals with spinal cord injury (SCI) are at risk developing pressure sores.

Purpose: To evaluate the effect of ES-induced activation of the gluteal and hamstring muscles on the sitting pressure in individuals with SCI.

Methods: Pressure under the buttocks was measured in five men with SCI (41 ±13 yrs; lesion C5-T11) received ES (50Hz, 70mA) in their own daily-use wheelchair while sitting. They wore custom-made lycra shorts with electrodes over the gluteal and hamstring muscles. Two protocols were randomly applied consisting of 3 min of stimulation followed by a 17 min rest. Protocol A 1s:1s and protocol B a 1s:4s on-off duty cycle. Peak pressure under the buttocks and pressure gradient were calculated during rest and every hour while stimulating.

Results: For both protocols peak pressure decreased significantly during the 3-hr stimulation periods. The pressure gradient tended to decrease indicating an improved pressure distribution. Protocol B showed superior effects in general. For both protocols, the pressure reductions did not change significantly, indicating the there was no considerable muscle fatigue.

Conclusions: ES-induced activation of the gluteal and hamstring muscles in SCI decreases

peak sitting pressure and improves pressure distribution. Because stimulation did not result in muscle fatigue, this method may be used during daily life. The reduced sitting pressure during ESstimulation may reduce risk of pressure sores in SCI-individuals.

090

Evaluation of a new treatment and rehabilitation programme for patients with spinal cord injury and pressure sores

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Background: In 2002, a treatment and rehabilitation programme for patients with spinal cord injury suffering from pressure sores was established at three units in Stockholm: Department of Reconstructive Plastic Surgery Karolinska University Hospital, Rehab Station and the Spinalis Clinic. The programme includes preoperative preparations, surgical and peroperative management, postoperative care, and a step by step rehabilitation.

Purpose: This study was conducted to evaluate the efficiency of the programme regarding postoperative complications and the occurrence of recurrent or new pressure sores.

Methods: Patients operated in 2002-2007 were offered a study-specific follow-up, on average 35 months after surgery, including an examination and interview by a contact nurse. The operated area was photo documented. Information regarding postoperative variables was assessed through review of the medical records.

Results: In total, 51 patients were included in the programme and they were operated for 59 sores (42 ischial tuberosity, 9 sacral and 8 trochanteric). Two patients had systemic complications and three had local complications requiring medical intervention. Out of 45 patients alive at the time for follow-up, 43 joined the study. Two had a history of recurrent sore and one a new sore requiring operation. Four patients reported superficial recurrent sore problems not requiring reoperation. The remaining 36 patients (84 %) had no pressure sores.

Conclusions: This new treatment and rehabilitation programme seems to offer good primary healing results and prevention of recurrent or new pressure sores. A centralisation of the treatment of these patients or a wider use of this programme would be recommended.

091

VAC Therapy: Critical analysis between clinical and Histological results

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The aim of the article is the histological demonstration of the activity of Vac Therapy. We have considered two groups of 20 patients with pressure sores after traumatic spinal cord injury. We performed a biopsy from day 1 and second biopsy on day 15 (group 1 we used usual wound bed preparation, group 2 Vac therapy).

Every biopsy has been studied by Immunofluorescence with CD 34 for the new vessels, ACTINA for the new structured vessels and EGFR (epithelial grown factor). The results have demonstrated the activity of VAC therapy showed an improvement of 45% of the new vessels and 58% of the structured new vessels, and an improvement of the of

EGFR in the spectrophotometer methods of 62% compared to the control group. We consider these results fundamental in the understanding of the clinical effectiveness of Vac therapy in the rapid improvement of the wounds.

WORKSHOPS

W0

New Developments in Functional Outcome Measures for People with SCI: General Overview

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USA

We are exposed to increasingly frequent news about spinal cord lesion research into recovery interventions. While exciting and generating a great deal of hope, it is important to remember that neurologic recovery may not necessarily result in functional improvements. Further, to better assess true functional improvements for daily clinical use as well as for research, sensitive, valid and reliable instruments are essential. This workshop continues the work of the Functional Recovery Measures Work Group, which published a manuscript on available functional outcome measures in 2008. New developments in both medical and functional outcome measures will be discussed, focusing on the ASIA/ISCoS International Neurological Standards, the Functional Independence Measure (FIM) and the 5 additional mobility and locomotor items that have been proposed (5AML), the Spinal Cord Independence Measure (SCIM), the Valutazione Funzionale Mielolesi (VFM), Quadriplegia Index of Function (QIF), the Walking Index for Spinal Cord Injury (WISCI) and the 6-minute and 10-meter walk tests (6MWT and 10MWT). The audience will have a lengthy opportunity to discuss how these various instruments/scales relate to each other in the clinical and research settings, and how these tools help the clinical team assess changes, progress and functional potential.

W1

Use of the International Standards for Neurological Classification of Spinal Cord Injury as an outcome measure.

Ralph Marino; M. J. Mulcahey; A. Curt; A. Jackson

USA, Switzerland

The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) sensory and motor examination has been used in a number of clinical trials both to determine eligibility and assess outcome. This has led to a closer examination of the reliability and responsiveness of the examination and classification elements. This presentation reviews the strengths and weaknesses of the ISNCSCI. Reliability of the motor and sensory total scores has generally been high in adults and adolescents. Children younger than 10 are often distressed by the pin prick examination, and children younger than 4 cannot be tested reliably. Reliability is better in patients with complete than with incomplete injuries. Repeatability of scores, sometimes referred to as the smallest real difference has been examined in a few studies. The difference in scores that can be expected in stable patients is lower for motor and light touch than for pin prick scores. Responsiveness has not been systematically studied; nor has the minimal clinically important difference. A number of longitudinal databases have reported course and patterns of recovery based on initial level and severity with many similarities and a few notable differences. The use of the ISNCSCI classification to determine eligibility has raised questions regarding the motor level in higher cervical injuries, and the criteria for completeness in phase I high risk clinical trials. Alternatives to the ISNCSCI are being

developed to capture changes expected for a particular intervention.

W2

Update on the Functional Independence Measure (FIM), the Quadriplegia Index of Function (QIF), and the Spinal Cord Independence Measure (SCIM III)

Gordana Savic; Amiram Catz

UK, Israel

The Katz and Barthel indices, the Sister Kenny Institute self-care evaluation, the Modified Barthel Index (MBI), the Functional Independence Measure (FIM), the Quadriplegia Index of Function (QIF), and the Spinal Cord Independence Measure (SCIM) have been used for the assessment of daily activities performance after spinal cord injuries (SCI). FIM is the prevailing primary functional outcome measure for all types of disability, but at a pre-meeting course of the ASIA-ISCoS 2006 meeting in Boston, a multinational work group recommended that the latest version of SCIM (SCIM III) continue to be refined and validated and subsequently implemented worldwide as the primary functional recovery outcome measure for SCI. The work group also recommended that QIF may continue to be developed and validated for use as a supplemental tool for the non-ambulatory population with tetraplegia. FIM, which scores each of 18 daily task from 1 to 7 (total score 18-126) has been found appropriate for SCI patients, reliable, and valid: it consistently measures the burden of care. SCIM III, which was designed specifically for SCI and scores 19 daily tasks according to their weight relative to the overall activity (total score 0 to 100), has been found reliable, valid, and more sensitive than FIM to changes in SCI patients' functional status. SCIM is based on the concept that independent performance of daily tasks should be evaluated not only by its impact on the burden of disability but also on the patient's well-being. Updates on FIM, SCIM and QIF will be presented in detail.

W3

The 5AML (Five Additional Mobility And Locomotor Items)

Lisa Harvey

Australia

The Functional Independence Measure (FIM)® is widely used as a generic measure of functional status in people with all types of disabilities. For this reason it is often used by policy makers, funders and governments who are interested in one simple way to measure outcomes across all disabilities. While this was not the initial purpose of the FIM®, this use of it has created a problem for spinal cord injuries because the FIM mobility and locomotor items lack sensitivity and responsiveness for wheelchair-dependent people. The 5AML was designed to overcome this problem. It consists of five mobility and locomotor items that can be used in conjunction with the original FIM®. The items assess people's ability to independently move about in bed, get from the floor into a wheelchair, push a wheelchair on the flat and up ramps, and manoeuvre a wheelchair over a gutter. Each item is scored in a similar way to the original FIM®. The construct validity of the 5AML has been assessed by testing the ability of each item to discriminate between people with different types of spinal cord injuries. Item responsiveness has been assessed by analysing the ability of items to detect changes in

mobility and locomotor function over time. Subsequent factor analyses have revealed that the 5AML when used in conjunction with the FIM® provides a more sensitive measure of mobility and locomotor function, than the FIM® alone. We recommend the 5AML be considered as a simple adjunct for those committed to using the FIM®.

W4

The VFM (Valutazione Funzionale Mielolesi)

Mariangela Taricco

Italy

The "Valutazione Funzionale Mielolesi" (VFM) is an assessment tool developed specifically for SCI patients to measure functional status and document relevant modifications over time ("sensitivity to change") particularly for quadriplegics patients. VFM includes 8 functional domains referring to the traditional ADL, broken down into different number of tasks : Bed Mobility (5), Eating (6), Transfers (12), Wheelchair use (15), Grooming/Bathing (6/1), Dressing upper/lower body (4/4) , Social vocational skill (8), Standing (4), Walking (7). A 5-point scale "of each task" was chosen with "0" indicated lowest (total dependence) and "4" best performance (full independence). The VFM does not produce an overall summary score, but the scores of the 8 domains are internally compared cross-sectionally and/or longitudinally. The clinical validity of the scale is suggested by the strong correlation with lesion level: all domain scores were improved in quadriplegics, in paraplegics larger differences were observed in domains pertaining to bed mobility and transfers. VFM satisfies all psychometric criteria usually recommended. a) Inter-raters reliability was good in at least five domain and acceptable in two. b) Content validity : VFM includes all the basic ADL domains like Barthel Index, QIF and FIM, and has the largest number of tasks in domains particularly relevant for SCI patients (i.e. transfers, wheelchair use). Construct validity : high correlation coefficients within-domain and between different domain. Concurrent validity :VFM has comparable performance to the Barthel Index, moreover VFM appears to capture further variance within strata of the Barthel Index, thus suggesting higher sensitivity for quadriplegic patients.

W5

Update of walking capacity measures, the ten meter walking test (10MWT), Walking Index for Spinal Cord Injury (WISCI II) and the six minute walk test

Gordana Savic; John F. Di Tunno; Giorgio Scivoletto; Marco Molinari

UK, USA, Italy

Several recent publications summarized the recommendations of the 2006 update on walking measures for use in spinal cord injury (SCI) clinical trials and concluded "the most comprehensive assessment of ambulation would include evaluations of speed, endurance and functional capacity, and would require the use of a combination of tests, such as the ten meter walking test (10MWT) and Walking Index for Spinal Cord Injury (WISCI II)." The purpose of today's conference is to critically examine the published studies, since the last review in 2006 on the 10MWT, WISCI II and the six minute walk test (6MWT) and make recommendations for the future. A review of over 15 studies (2006-2009) reveals further examination of the validity, reliability and responsiveness of

the 10MWT, WISCI II and 6MWT in acute, subacute and chronic subjects. Several literature reviews of walking/gait analysis in SCI may go beyond the scope of the proposed topics, but have relevance to future objective testing of walking function and will be cited. The recent recommendation to combine tests will be discussed by the panel and in addition, the importance of linking domains of body structure (lower extremity motor scores), capacity (10MWT, WISCI II) and performance (Spinal Cord Independence Measure (SCIM) walking subtests). Formal voting on conclusions will not be employed as in 2006.

W6

Recommendations from the Functional Recovery Measures Work Group and updates from new research on functional outcome measures

Kim Anderson
USA

It is important to acknowledge that neurologic recovery does not always translate into functional recovery. Thus, outcome measures that assess functional status relevant to SCI are important to develop and test in the clinical setting. One such tool is the Spinal Cord Independence Measure (SCIM), which is a functional recovery outcome measure designed specifically for SCI that can be applied to the entire range of injury levels as well as to non-traumatic spinal lesions. A committee of international experts recommends that the latest version of the SCIM (SCIM III) continue to be refined and validated for use as an important functional recovery outcome measure for SCI. A multi-center validation study of the SCIM III is currently being conducted in the United States and preliminary data will be presented. Recently, the concept of identifying a Minimal Clinically Important Difference (MCID) has come to the forefront of clinical research. For SCI, the Canadian Occupational Performance Measure (COPM) may serve as a useful tool to measure MCID in clinical trials. The COPM was designed for occupational therapists to use to assess client-identified problems in the areas of self-care, productivity, and leisure. Two scores are generated, one for performance and one for satisfaction with performance. The COPM can be used to identify longitudinal changes in performance on self-selected problems and to capture the degree of satisfaction associated with those changes. The possibility of using, or adapting if necessary, the COPM as a primary outcome measure in pivotal clinical trials for SCI will be discussed.

Wrap-up, open discussion with audience

Amie Jackson; Eric Weerts; Ralph Marino

Discussion of the scales and instruments presented and their utility in various settings, particularly in developing countries. Discussion/debate of the potential that these scales have to improve treatment and outcomes for people with SCI.

W7

Pathophysiology of NDO: what happens in the central nervous system?

Antonella Giannantoni
Italy

Pathophysiology of NDO: what happens in the central nervous system. Lower urinary tract functions to store and periodically release urine depend on neural circuits in the brain

and spinal cord. At least three areas in the brainstem and diencephalon are specifically implicated in micturition control: (1) the pontine micturition center (PMC) in the dorsomedial pontine tegmentum, which directly excites bladder motoneurons and inhibits indirectly, via inhibitory gamma-aminobutyric acidergic and glycinergic interneurons in the medial sacral cord, the external urethral sphincter motoneurons. (2) the periaqueductal grey (PAG) which receives bladder filling information; and (3) the pre-optic area of hypothalamus involved in determining the beginning of micturition. Brain imaging investigations showed the role of PAG as a relay centre, with evidence also for 'cross-talk' between the PAG and PMC. The cingulate cortex is part of the limbic system with interconnections with other key areas, including insula (visceral sensory function), hypothalamus and prefrontal cortex, the latter with an inhibitory role during micturition. Experimental models of neural injury show normal storage of urine is dependent on 1) spinal reflex mechanisms activating sympathetic and somatic pathways to the urethral outlet and 2) tonic inhibitory systems in the brain suppressing the parasympathetic excitatory outflow to the urinary bladder. Voiding is mediated by inhibition of sympathetic-somatic pathways and activation of a spinobulbospinal parasympathetic reflex pathway passing through a micturition center in the rostral pons. Brain damage can induce bladder overactivity by reducing suprapontine inhibition. Damage to axonal pathways in the spinal cord leads to the emergence of primitive spinal bladder reflexes triggered by C-fiber bladder afferent neurons.

W8

Pathophysiology of NDO: what happens in the bladder wall?

William C. de Groat
USA

W9

Antimuscarinics and NDO

Understanding neurogenic detrusor overactivity in SCI: a journey from the bladder wall to the brain

Enrico Finazzi Agrò
Italy

The first line treatment of neurogenic detrusor overactivity in spinal cord injury patients are antimuscarinic drugs. Despite large clinical use, their efficacy and safety in SCI patients is frequently based on the results of preliminary, open studies rather than randomised clinical trials. Antimuscarinics are efficacious in many patients but they have side effects and the dropout rate is quite high. Their usually recognized mechanism of action is a block of the muscarinic receptors of the detrusor muscle, and whether they act predominantly on the M2 or M3 receptors seems to have little influence on their clinical efficacy. Many drugs are commonly used. Trosipium chloride is a quaternary ammonium compound non-selective for the muscarinic receptor subtypes. Tolterodine is a potent antagonist of the muscarinic receptor. It appears to show tissue selectivity for the bladder over the salivary glands. Solifenacin succinate is a competitive muscarinic receptor antagonist. The recommended dose of solifenacin is 5 mg (which can be increased to 10 mg if well tolerated). Oxybutynin has antimuscarinic, muscle relaxant, and local anaesthetic actions. The therapeutic effect of the immediate release formulation

on detrusor overactivity is associated with a high incidence of side effects and its dose should be titrated. Side effects are typically antimuscarinic (dry mouth, constipation, blurred vision, drowsiness).

W10

Vanilloids and NDO

Massimo Lazzeri

Italy

As a potential alternative to current drug therapies, urologists are placing their trust in afferent blockade by targeting afferent nerves that control the micturition reflex because preventing the micturition reflex that initiates overactive bladder, seems more desirable than inhibiting detrusor smooth muscle contractions. Modulation of the afferent arm of the micturition reflex emerged from studies on the effect of capsaicin on sensory nerves. Capsaicin targets the transient receptor potential vanilloid-1 (TRPV1), which is expressed on small-to-medium size afferent neurons (C-type and, partially, A- and B-type). Acute exposure to capsaicin depolarizes and excites the sensory fibers expressing TRPV1 receptors. As excitation is followed by a refractory period, repeated, long-term, high dose exposure to capsaicin desensitizes, defunctionalises and ultimately damages peripheral terminals, which become unresponsive. In other words, capsaicin exerts long lasting reversible suppression of sensory nerve activity which is dependent on dose, exposure time and interval between instillations. Intravesical instillation of repeated low doses of capsaicin showed inhibitory modulation of urinary bladder afferent nerves and had therapeutic benefit in neurogenic detrusor overactivity. At the turn of the century, several independent and sponsored trials were started using resiniferatoxin (RTX), the ultra potent capsaicin analogue, to treat LUT disorders. Recently, in an interesting study 54 patients with detrusor overactivity who were refractory to anticholinergics were randomly treated with 4 weekly intravesical instillations of 10 nM RTX or vehicle. Three months after the treatment cycle a significantly higher percentage of patients receiving RTX had excellent and improved results; treatment remained effective at 6 months in 50% of patients. Interest was again fuelled in these drugs but to date, no natural or synthetic TRPV1 agonist/antagonists are available on the market.

W11

Botulinum Toxin A in Spinal Cord Injury Patients

Giulio Del Popolo

Italy

Patients with neurologic bladder may have a variety of dysfunctions: underactive or overactive detrusor and/or sphincter. Anticholinergics are usually the gold standard to treat neurogenic detrusor overactivity (NDO). Adverse effects and lack of efficacy are the two main causes of failure. Neuro-Urologists can offer different solutions such as slings or artificial sphincter for sphincter deficiency, while in the recent past invasive surgery, bladder augmentation, was the only available treatment option for patients with intractable NDO. In the last decade new therapeutic approaches as sacral neuromodulation or botulinum toxin type A (BTX-A) injection are available. BTX-A is a non-invasive treatment in patients with NDO refractory to anticholinergic therapy. BTX-A

injections into the detrusor muscle is a very effective method for treating urinary incontinence secondary to NDO the duration of effect seems to be at least 6 months. For NDO, evidence-based medicine level 1 studies are available for efficacy and improvement of QoL. Many studies of repeated injections have been published showing that, at least at medium follow-up, the toxin remains as effective as after the first injection, and there is no evidence of change in bladder compliance or detrusor fibrosis. Long-term observational studies are necessary. The commonly reported dose appears to be well tolerated, since few adverse effects have been reported. But for SCI patients with spontaneous voiding lower dosage must be taken in consideration, as well as the option to inject distal sphincter to improve voiding function.

W12

Neuromodulation in Neurogenic Detrusor Overactivity

Michele Spinelli

Italy

In the history of treatments of neurogenic bladder due to spinal cord injury electrostimulation represents the "real physiologic" approach able to restore micturition cycle. In last 20 decades the approach to neurogenic bladder has been based to achieve the normal functions of micturition cycle but nothing at all is able to reach a complete restoration of filling and voiding phases. Sacral anterior roots stimulation (Brindley system) is able to reach a direct stimulation of sacral roots as a prosthesis for voiding, but the price to pay is to perform a posterior rhizotomy today too invasive and refused by the patients. Analyzing current options in the treatment of overactive neurogenic bladder due to UMN the principal goal is to achieve continence reestablishing a low pressure reservoir, avoiding incontinence. During the 24 hours the main action of the reservoir is the storage function and the thesis is related on this topic. Penile and clitoris stimulation and bladder inhibition via pudendal nerve is historically a good way to treat neurogenic bladder. Results in daily application of external penile electrostimulation in overactive bladder are poor in long term. The experience in implanting leads to obtain neuromodulation of "sacral area" with Interstim system demonstrated, by an implant in S3 a prevalent activity in modifying the afferent pathway and brain activation in areas related with the control of the bladder. The activity of sacral neuromodulation in overactive neurogenic bladder in SCI patient due to incomplete lesion shows long term poor results. Pudendal nerve chronic electrostimulation using a quadripolar lead seems to be promising in long term experience in obtaining a larger capacity and inhibition of bladder contraction but best results are obtained in incomplete lesions when patients are able to feel urgency and have time to apply stimulation "on demand". The experience in complete lesion with "reflex incontinence" where urgency or others symptoms are not present before the contraction did not obtain clinical results. In last years we assist to a lot of effort to obtain the best system to restore filling and voiding phases and future is related on the best sites of modulation, best parameters and best patterns of pudendal nerve stimuli able to obtain control of reflex incontinence and to obtain voiding.

W13

Surgery for NDO

Antonio Carbone

Italy

Neurogenic detrusor overactivity (NDO) is a serious dysfunctional condition associated with significant lowering of quality of life and capable of severe damage to upper urinary tract. The definitive diagnosis of it is made by urodynamic or video-urodynamic investigation combined with pelvic floor electromyography. It is estimated that in 1/3 of patients suffering from NDO conservative and/or pharmacological of treatments fail. Operative procedures start to be considered when conservative and pharmacological approaches or other mini-invasive surgical procedure give scarce symptomatic improvement and unsatisfactory control of bladder pressures.

Sacral deafferentation (SDAF) and sacral anterior root stimulator implantation (SARSI) represent organ-preserving techniques and can be proposed for paraplegics suffering from NDO with urinary incontinence (UI).

Patients not responsive to conservative or pharmacologic treatments and not eligible for sacral deafferentation may be treated by augmentation cystoplasty. This surgical approach is necessary in subjects with bladder fibrosis (which is the expression of chronic severe and irreversible bladder damage) but kidney function of at least 25% and acceptance of self intermittent catheterization (CIC) are considered essential prerequisites as normal hand dexterity to perform CIC. Bladder myectomy (autoaugmentation) is alternative to augmentation cystoplasty but bladder fibrosis is an exclusion criteria.

In patients complicated with bladder neck insufficiency or external sphincter deficiency secondary to paralysis or surgical procedures artificial sphincter implantation may be considered.

NDO surgery is recommended in highly selected cases which always require preliminary instrumental sophisticated investigations (especially urodynamic and video-urodynamic and neuro-physiological evaluation) to be correctly assessed prior to surgery.

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W14

Developing international standards for the assessment of autonomic dysfunctions following spinal cord injury.

Andrei Krassioukov

Canada

It is well known that autonomic dysfunctions, including abnormal cardiovascular control, are common consequences of spinal cord injury (SCI) in humans. However, the International Standards for Neurologic Assessment commonly referred to as the ASIA

exam, only evaluate motor and sensory functions following SCI. In order to improve the evaluation of autonomic function in individuals with SCI, and in the future to assess the effects of therapeutic interventions, the American Spinal Injury Association (ASIA) and International Spinal Cord Society (ISCoS) established a committee to develop a set of definitions and classifications for disorders of autonomic function following SCI. Four major areas were identified: bowel, bladder, sexual, and general autonomic dysfunctions. For each area a comprehensive set of definitions was identified. It was recommended that these dysfunctions should be assessed and documented by clinicians. For example, when considering general autonomic dysfunction, the following should be recognized and assessed: level of arterial blood pressure, orthostatic hypotension, autonomic dysreflexia, arrhythmias, temperature dysregulation, sweating dysfunctions, and broncho-pulmonary dysfunctions. Members of the committee propose that in the future, in addition to already established motor and sensory assessment standards, the assessment of autonomic functions will be part of the clinical evaluation of individuals with SCI.

W15

Documentation of Sexual Capabilities after SCI

Marcalee Alexander Sipski

USA

The preferred methods to document the effects of spinal cord injury on autonomic responses include the use of the International Standards for the Documentation of Autonomic Function and the International Spinal Cord Injury Data Sets. These new systems were developed by an international group of experts based upon clinical and research expertise. With regards to sexual function and responses these complimentary systems now provide the clinician with succinct yet comprehensive methods with which to determine and document the effects of specific spinal cord injuries on sexual responses. In this presentation I will discuss methods to incorporate these new preferred assessments into routine clinical practice. Through case studies, completion of the autonomic standards and international data sets with regards to sexual will be demonstrated and reviewed for both males and females. Areas which will be discussed include capability for psychogenic and reflex erection or lubrication, ejaculation and orgasm.

W16

Autonomic Standards for SCI Patients: Bladder Dysfunction: Up to Date

Michael Kennelly

USA

Because of the increasing prevalence of individuals living with SCI, there is a demand for effective data collection systems to facilitate comparisons regarding injuries/lesions, treatments and outcomes between patients, centers and countries. Such data should be in the form of common International Data Sets collected on individuals with SCI. Therefore it is increasingly important to have comparable data so that the services affecting the outcome of SCI can be assessed and compared worldwide to effect best practice.

The purpose of this presentation is to present a standardized format of collecting and

reporting urologic measurements including urodynamic study in daily practice and urinary tract imaging investigations required to conform to the purpose and vision of the International SCI Data Sets. In addition an update on the current urologic autonomic standards will be discussed in detail. These standardized data sets should then make it possible to systematically stratify, evaluate and compare results from various published studies across the world.

W17

Autonomic Data Sets

Fin Biering-Sørensen

Denmark

The International Spinal Cord Injury (SCI) Data Sets on Autonomic Function include the Lower Urinary Tract, Bowel, Female and Male Sexual Function, but also the Cardiovascular, Pulmonary and the Sudomotor/Thermoregulation Function. The last three areas are still under development and in review.

The recognition and management of the cardiovascular dysfunctions and pulmonary complications following SCI represent important clinical issues. Not least because pulmonary complications and cardiovascular disorders are the most common causes of death in individuals with SCI, and therefore it is important to record basic information in daily practice when following individuals with SCI.

The International SCI Basic Cardiovascular Data Set includes:

Cardiovascular history before spinal cord lesion (collected once)

Events related to cardiovascular function after spinal cord lesion

Cardiovascular function after spinal cord lesion within the last three months

Any medication affecting cardiovascular function on the day of examination

Objective measures: Time performed, Position during testing, Devices in use during testing, Pulse, Blood pressure

The International SCI Basic Pulmonary Data Set may includes:

Pulmonary conditions present before spinal cord lesion (collected once)

Smoking history

Pulmonary complications and conditions after the spinal cord lesion

Current Utilization of Ventilatory Assistance

Previous diagnosis of sleep apnea

Pulmonary function tests performed after the spinal cord lesion (most recent results):

Forced vital capacity (FVC), Forced expiratory volume in one second (FEV1), FEV1/FVC ratio, Peak expiratory flow (PEF)

Sudomotor/Thermoregulation Function Data includes:

Thermoregulation and sudomotor history after spinal cord lesion within the last three months: Hyperthermia; Hypothermia; Hyperhidrosis; Hypohidrosis

Objective measures: Time performed, Temperature

W18

Bowel dysfunctions

Klaus Krogh
Denmark

Bowel symptoms including constipation, fecal incontinence, and abdominal pain affect the majority of individuals with spinal cord injury (SCI). Until recently, no generally accepted standardized classification or clinical assessment of neurogenic bowel dysfunction existed. Like other autonomic functions bowel function after SCI depends on whether the lesion is supraconal, or located at the conus or cauda equina. However, the enteric nervous system located within the bowel wall makes the innervation of the bowel fundamentally different from other organs. International standards have been developed to document remaining autonomic function after SCI. The International bowel function basic and extended SCI data sets are mainly symptom based and allow assessment of the severity of bowel dysfunction after SCI. The International bowel function basic SCI data set is simple and mainly intended for clinical use. The extended data set is more thorough and mainly intended as a research instrument. Outcome measures in SCI have been reviewed by the spinal cord outcomes partnership endeavor (SCOPE). Furthermore, a number of scores for constipation or fecal incontinence exist, but few have been evaluated in individuals with SCI.

This presentation provides an overview of instruments for description of bowel function after SCI including a rationale for their use.

W19

Pathophysiology of Spastic Paresis - Rationale For Focal Interventions

Jean-Michel Gracies
France

Spastic paresis follows chronic disruption of the central execution of volitional command. Motor function in patients with spastic paresis is subjected over time to three fundamental insults, of which the last two are avoidable: (1) the neural insult itself, which causes paresis, i.e., reduced voluntary motor unit recruitment; (2) the relative immobilization of the paretic body part, commonly imposed by the current care environment, which causes plastic rearrangements (adaptive shortening) of the soft tissue left in a shortened position; and (3) the chronic disuse of the paretic body part, typically self-imposed in most patients. Chronic disuse causes plastic rearrangements in the higher centers that further reduce the ability to voluntarily recruit motor units i.e. that aggravate baseline paresis. Thus, in the context of worsening soft tissue contracture, a first vicious cycle of paresis-disuse-paresis sets in.

Muscle contracture is one of the factors that cause excessive responsiveness to stretch, which in turn aggravates contracture. In the subacute and chronic stages of spastic paresis, stretch-sensitive (spastic) muscle overactivity emerges as a third fundamental mechanism of motor impairment, along with paresis and soft tissue contracture. Excessive responsiveness to stretch also impedes voluntary motor neuron recruitment, a concept termed stretch-sensitive paresis. There are some pathophysiological differences between spasticity of cerebral and of spinal origin, which may explain some of the typical clinical features of the two types of paresis. These differences will be reviewed.

None of the three mechanisms of impairment (paresis, contracture, and spastic overactivity) is symmetrically distributed between agonists and antagonists, which generates torque imbalance around joints and limb deformities. Thus, each may be best treated focally on an individual muscle-by-muscle basis. Intensive motor training of the less overactive muscles should disrupt the cycle of paresis-disuse-paresis, and concomitant use of aggressive stretch and focal weakening agents in their more overactive and shortened antagonists should break the cycle of overactivity-contracture-overactivity.

Objectives:

1. Understand the three fundamental insults to the neural and musculoskeletal system subserving movement after damage to central motor pathways.
2. Understand the fundamental pathophysiology of movement impairment, which is the imbalance of muscle length and recruitment around joints.
3. Understand the three critical focal interventions that may restore balance: motor training to strengthen voluntary command on the weaker agonists; intensive stretch and focal injections of blocking agents to lengthen and relax the more overactive agonists.

W20

Assessment of spasticity - A Review

Anand Nene

India

Spasticity is a well known complex phenomenon, associated with an upper motor neurone (UMN) lesion, and can be defined as a sensorimotor disorder presenting as intermittent or continuous involuntary activation of muscles. It can lead to major disability affecting all aspects of a person's daily life. One report estimated that the prevalence at one year post stroke of spasticity amongst initially hospitalised patients was 38%. Adequate management of spasticity is therefore a major challenge in rehabilitation of these patients, requiring valid, sensitive and reliable assessment methods so that appropriate treatment can be given and response measured.

Assessment of spasticity can be classified into clinical, biomechanical, and neurophysiological methods. The Ashworth Scale is the most widely accepted clinical method, but it is subjective and characterized by insufficient methodological quality. As a consequence, there is a clear need for more objective, robust measurement tools for clinicians to assess a variety of treatment interventions and reliably monitor patients' progress. Neurophysiological and biomechanical based methods may be more suitable for this purpose. Neurophysiological methods use surface electromyography (sEMG) to record the responses of the muscle to movement (both active and passive) or mechanical or electrical stimulation. Biomechanical methods focus on resistance to movement about a joint. Extensive reviews of the literature showed that these methods are predominantly laboratory based and have hardly been applied in the clinical environment. Much of the technology is experimental and would require adaptation, standardisation and validation before it could be used in routine clinical practice.

W21

New Measurement Approaches

Judith Fleuren
The Netherlands

Introduction: There is an urgent need for valid, reliable and easy-to-use measurement tools for spasticity, as current methods seem unsatisfactory concerning at least one of these characteristics.

Objective: Exploring available and new measurement methods, to contribute to the development of a comprehensive set of clinically applicable measurement tools for spasticity.

Methods: In patients with spasticity of spinal or cerebral origin, the following tests were investigated: Measurement of reflex muscle activity with surface electromyography (sEMG) during standardized test situations and during daily activities; Measurement of resistance against passive movement with dynamometry or manually; Measurement of subjectively perceived spasticity and spasticity-related discomfort.

Results: During passive and active movement tests in poststroke patients, a moderate negative correlation ($\rho = -0.51$, $p = 0.03$) was found between rectus femoris stretch reflex activity and active range of motion. During voluntary movement other manifestations of spasticity, such as pathological co-contraction, were found to play a role. In motor complete SCI patients, self-ratings of the degree of spasticity were poorly associated with spasticity, in terms of involuntary muscle activity, assessed with long-term sEMG recordings (explained variance 27%). Perceived degree of spasticity and experienced spasticity-related discomfort were only moderately associated ($\rho = 0.53$, $p < 0.01$).

Discussion: Although still under development, the new methods seem promising as quantitative assessment methods covering different aspects of spasticity. The use of sEMG during active tasks or during daily life activities provides a new approach to quantify patients' functional abilities. Self-ratings on spasticity should be added to the assessment set as well.

W22

Treatment algorithm for spasticity in adults

Govert Snoek
The Netherlands

Introduction: Spasticity in Spinal Cord Injury can have an adverse effect on mobility, independence and quality of life. Guidelines are needed to assist physicians in treating patients with spasticity.

Objective: To support a consistent approach in patient care for spasticity in adults.

Method: A European group of interdisciplinary experts in managing adult patients with spasticity met to review current clinical treatment pathways for spasticity and summarize the findings in a treatment algorithm.

Results: an algorithm was developed which will be presented and be available on hand outs. Key elements:

- distinguish between spastic and non spastic contractures
- assess hindrance (and therewith focus of therapy) caused by spasticity in WHO-ICF

terms

- consider also potential benefits of spasticity before starting therapy
- treat spasticity trigger factors
- apply proper physical therapy
- distinguish between focal and general spasticity in further treatment approach
- o focal spasticity can be treated with local denervation and in selected cases with surgical procedures
- o first step in general spasticity is use of (combinations of) oral spasmolytic drugs
- consider Intrathecal baclofen therapy in patients with severe non focal or multi focal spasticity who experience unacceptable side effects or inadequate response to oral medication or focal treatment.

Discussion: the algorithm can be helpful in information and communication about spasticity and assist in determination of optimal therapy for spasticity.

W23

Spinal Spasticity; Patients Perspective

Bakul M Soni

UK

Defining spasticity has proved challenging as underlying neurophysiological basis is yet to be clearly understood.

Lance (1980) defined it "Spasticity is a motor disorder characterised by a velocity-dependent increase in tonic stretch reflexes (muscle tone) with exaggerated tendon jerks, resulting from hyperexcitability of the stretch reflex, as one component of the upper motor neurone syndrome.

Spinal cord lesion leads to generalised spasticity which is measured by variety of objective instruments e.g. Ashworth score, spasm score, pendulum tests. There are objective and validated tests and are relevant from clinician an objective point of view. That said, many individuals with incomplete spinal cord injury use spasticity as useful tool for their usability.

There is a great deal of paucity in literature which takes in account of negative effects of spasticity on personal care, comfort, pain, sleep, driving, body image, medical complaints, posture, mobility, activities of daily living and overall quality of life. We present here evaluation and outcome from perspective of intrathecal baclofen therapy. The treated group suffered with "overwhelming and intractable spasticity".

There is a need to develop an outcome measurement instrument from the patients perspective.

W24

Introduction to Multi-professional Team in Spinal Unit and review of basilar rules for Working in Team

Laura Valsecchi

Italy

Working in Multi-professional Team is a basilar methodology to realize a complete rehabilitative project in Spinal Unit.

Needs and expectations of a new global rehabilitation for people with spinal cord injury

have determined the necessity of working in a multi-professional team.

New scientific progresses have developed new approaches in medical, rehabilitative, nursing, social and psychological areas. Due to the new progress in health-care expertise many people are living longer and in better conditions, although often with severe disability.

For these reasons in Spinal Unit Multi-professional Team develops an individual rehabilitative project for every patient.

There have been important transformations: from Rehabilitation Department to Centre for Global Rehabilitation, such as Spinal Unit, which includes:

- complete and individualized independence achievement program for every patient
- new professional roles for health-care and social practitioners
- new methods and treatments

Part of our research in Working in a Multi-professional Team was devoted to realize an important document, with this landmark:

The methodology of Working in Team follows programs and projects with the aim of attaining the best health and social conditions for patients and their families.

To achieve these objectives and to improve this organization is necessary:

1. Choose health and social professionals
2. Select goals inside the Team
3. Realize Clinical and Functional Assessments
4. Develop a Social Project
5. Introduce basilar rules
6. Choose tools and schedules for independent living of the patient
7. Planning different meetings

To implement this new methodology it is fundamental take a deeper look into the organization, to know new roles of practitioners, new tools and all the expertise achieved in the last years in our Spinal Unit.

W25

The role of the Nurse serving on the Team. Organizational models for better quality assistance (Primary nursing, Case manager, Goal planning)

Paola Pignotti

Italy

The quality of assistance/nursing must be the primary objective of every health assistant/nurse. For M. Manthey high quality assistance means assistance that is individualized for each patient, carried out with care, competence in the most complete continuous way. In order to reach such an objective, it is vital that the members of the Team at the Spinal Unit perform their activities in cooperation with the other practitioners and must put programming methodologies of health care into act while at the same time keeping the entire rehabilitation process in mind of each single case.

The best organizational models of nursing recognized at the international level are the following:

1. Primary nursing

2. Case manager

3. Goal planning

1. Primary nursing is an organizational system programmed for assigning the nursing responsibility of each patient to a single nurse.

2. Case management is made up of the responsibility of the patient and the supervision from the moment that he/she is admitted to hospital to when he/she is discharged. The objectives are reducing the length of stay and costs, improving the efficiency and effectiveness of nursing care, coordinating resources, deciding the appropriateness of eventual operations and monitoring results.

3. Goal planning is the operative methodology of the nursing rehabilitation team that foresees an important involvement of the patient and single nurses/workers within the decision making process.

One of the cornerstones of the GP (goal planning) is represented by the planning of the rehabilitation project according to the specific and individualized needs expressed by the patient having spinal cord injuries.

In Italy, the Code of Ethics (deliberazione n. 1/09 del 10.01.2009) recognizes the nurse as the health professional responsible for nursing assistance. This meaning "service to the person, family, community is obtained through specific, autonomous and complementary interventions of an intellectual nature as well as scientific, managerial, relating and educational techniques. By putting this process of nursing into action with scientific methodologies and with better organization of the work done in the Spinal Unit, each nurse will be able to assure high quality nursing.

Each of the above mentioned models has some positive aspects but also large limits when one thinks about Spinal Unit. The fundamental aspect is that the centrality of the patient be guaranteed with complete and personalized health assistance as well as the use of advanced techniques and technologies together with the presence of competent professionals, updated to the latest scientific material available and possessing compassion.

W26

Schedule for Working in Multi-professional Team

Lucia Bambagioni

Italy

Our Association has led a survey to carry out a plan about the management of Mini – Multi-professional Team Schedule in order to foster the development of patient's rehabilitation process.

Working in Multi-professional Team is not simply gathering different professionals (physician, physiotherapist, occupational therapist, nurse, social worker, psychologist, etc.) dealing with patient's program. Most importantly, the meaning of team working is to built together a complete rehabilitative program and to take care of different objectives every professional decides to suggest with the aim of obtaining the best quality of life for the patient and her/his family.

Multi-professional Team organizes meetings among practitioners with the participation of the patient and her/his family; the team decides the length of rehabilitative stay in Spinal Unit, fixing timing for activities and treatment sessions.

Multi-professional Team makes evaluations of outcomes, follows home reintegration project, inclusive of all patient's needs of assistance and devices support.

Schedule permits registration of activities and outcome attainment in every area of intervention. Every professional is responsible of his/her work activity and reporting about it.

Schedule is divided in four sections:

1. Clinical data of the patient
2. Area's objectives and outcomes (physician, nurse, physiotherapist, respiratory physiotherapist, occupational therapist, social worker, psychologist)
3. Data about family, home, job and professional situation
4. Timing of admission in Spinal Unit and discharge at home, assistive devices equipment, working environment and driving licence attainment

There's also a section regarding contacts with community health and social care services (medical doctor, social worker, school, etc.)

With this schedule Multi-professional Team in Spinal Unit work very closed and take really care of all the problems of patient and his/her family.

W27

The role of social-worker and psychologist in Spinal Unit

Gabriella Rossi

Italy

Since from acute phase in Spinal Unit, Multi-professional Team begins to take care of social and family situation of the patient.

Many important social and psychological factors are to consider during the development of the Rehabilitative Program in Spinal Unit.

Multi-professional Team organizes Social Project to support and attend patient and family to find a new life.

Social workers and psychologists help patients to cope with the new condition and to develop their own approaches to implement an health-related behaviour.

They follow the reactions of patient after complete information about his/her diagnosis and future life; they must follow the re-building of feelings and motivations of patients and their family.

Psychologists approach patient and family to re-find and re-built the identity throughout a personal and specific project.

Social workers have different tasks: they deal with bureaucratic procedures for rights recognition related to disability, reintegration in the home environment, vocational or educational issues.

The Counselor is a new practitioner with a particular role in approaching family and patient and helping them to identify their most significant needs. Another task of the counsellor is to harmonize the work inside the multi-professional team with the aim of giving the best answer to the different needs of the patient and his/her family.

"Peer consultant" is a member of the Associations of people with paraplegia and tetraplegia, he plays an important role of comparison with patients. Patients like to speak with whom got before them a similar experience and sometimes patients pay more attention to them then to health professionals.

W28

Network among health-care and social practitioners working in Spinal Unit

Alberto Nobile

Italy

Since 1995 our Association, CNOPUS, has realized many continuing education courses for health-care and social practitioners working in Spinal Unit. From this remarkable experience we had felt the need of establishing a basilar network among all the practitioners. We would present this proposal during this workshop.

The aim of our proposal is to involve every professional working in Spinal Unit into actively participation at the rehabilitation process of spinal cord injured patients.

The creation of an international Network could be a tool for knowledge, education, culture and exchange of experiences and expertise.

Above all, the network is an important media for communication, that could let us talking each other with the same language.

Throughout the use of the network we can enter in contact with many colleagues, develop co-operation, share resources and scientific expertise, realize a common methodology, spread scientific news and epidemiologic rates very quickly, share different skills, build data-bases for scientific research and elaborate guidelines in EBP.

We hope to discuss with other practitioners of International Spinal Units to determine together the realization of this international network, with many voices for managing home page and use of different languages (French, English, Spanish, German, etc).

Network is really a good opportunity for health-care and social workers to increase knowledge, experience, expertise and to improve quality of total rehabilitation in our Spinal Unit.

W29

Main objectives of Occupational Therapist in Multi-professional Team in Spinal Unit

Maru Marquez

Italy

Rehabilitation in Spinal Unit is a process who starts in acute phase and ends when patient is really able to live by her/himself in her/his own environment.

Every practitioner in Spinal Unit works with the aim of best outcomes (physical and social health, functional independence) achievement for patients giving answers for learning new skills and abilities essential in patient's new life.

They teach to the patient how take decisions for herself/himself, how cope with emerging problems and how become responsible of her/his own life.

Patient got new habits of life, new skills, new friends and "peers", entering in a process known as empowerment.

For the achievement of a good level of independent life, Occupational Therapist trains patients in several activities of daily living: personal care, transfers and wheelchair mobility, communication with high technology aids. The Occupational Therapist evaluates the patient's own environment and selects different assistive devices helpful in daily living activities.

Patients need to rebuild a new life, be aware of the new situation and conscious about

all the opportunities to be able to have a family, study and have a job, go on holiday and everything they really wish to do.

Occupational Therapist helps them to understand that, despite the disability, they are the same persons before spinal cord injury and they need to make life programs like everybody else.

Occupational Therapist is responsible of elaborating a plan for independence and together with all the others professionals in the Team, select goals for every patient with paraplegia, tetraplegia and especially for high tetraplegia patients.

W30

What do we know, and what don't we know, about blood pressure management in patients with spinal cord injury?

Andrei Krassioukov
Canada

Cardiovascular Health:

What do we know, and what don't we know, about blood pressure management in patients with spinal cord injury? Evidence-based practice

Cardiovascular complications in the early stages of complete cervical spinal cord injury (SCI) can be life-threatening, and include bradyarrhythmias, cardiac arrest, and hypotension. While many of these conditions improve in the weeks following SCI, cardiovascular control does not usually return to normal. Cervical and high-thoracic SCI can alter cardiovascular responses to exercise, impair circadian oscillations in blood pressure, and produce autonomic dysreflexia (AD), a condition characterized by episodes of extreme hypertension. The most common precipitant of AD is urinary bladder distension. The cause of AD may be a blockage or a kink in an indwelling urinary catheter, urinary tract infection, urodynamic procedures or cystoscopy, or even simple urological manipulations like routine urethral catheterization or movements of an indwelling catheter. After bladder distension, bowel distension, and stimulation of the genitals or internal reproductive organs are the most common causes of AD. Mild or noxious somatic stimuli, such as belt-tightening, pressure sores, ingrown toenails, fractures and dislocations also induce AD.

Autonomic disorders affect a significant number of individuals with SCI. Abnormal cardiovascular control results not only in a significant discomfort but results in serious medical issues in these individuals. Extremely low resting blood pressure, episodes of orthostatic hypotension or unpredictable hypertensive crises in these individuals result in an inability to perform day-to-day activities or participation in rehabilitation. It is crucial to incorporate into the clinical practice up-to-date synthesis of research evidence in SCI rehabilitation medicine (SCIRE) to aid the diagnosis of autonomic dysfunctions in these individuals for early recognition and management.

W31

Evidence based management of spasticity secondary to spinal cord injury

Andrea F. Townson
Canada

Spasticity after spinal cord injury: Evidence-based practice.

In recent years, there has been heightened interest in evidence based medicine and best practice. A brief introduction regarding evidence based medicine and its application to clinical care will provide the framework for the remainder of the workshop which will focus on clinical case presentations. SCIRE Version 2 (Spinal Cord Injury Rehabilitation Evidence) will be used to guide much of the discussion.

Spasticity, sexual health, and acute cardiovascular and blood pressure complications are all common following spinal cord injury. Over 50% of patients living with spinal cord injury experience spasticity. In up to 40% of these patients, it is a major obstacle to community and workplace integration. Given the numerous treatments available to patients with spasticity, functional treatment goals and outcome measures must be identified prior to initiating therapy.

This section of the workshop on spasticity will focus on the management of spasticity using both pharmacologic and non-pharmacologic interventions. Case studies will be used to illustrate the identification of treatment goals, the use of outcome measures and the practical aspects of initiating therapies. There will be time for interactive discussion regarding spasticity treatment and audience members' experiences.

W32

Sexual Health SCIRE Case Study

Stacy Elliott
Canada

Sexual health after spinal cord injury: A case study highlighting evidence-based practice. A 34-year-old man sustained an incomplete spinal cord injury at the C4 neurological level while surfing on his honeymoon. He was devastated as his sexual life was of great importance, and wishing to start a family was their impetus to finally marry. He was eager to return to his sexual function early within his rehabilitation, and was assessed by Sexual Health within the first month post-injury. He was disappointed to hear that semen quality changes had likely already occurred, but wished to resume sexual activity. After several trials with PDE5i, he decided to utilize intracavernosal injections (ICI) to assist with his unreliable erection (SCIRE level 1 and 2 evidence of efficacy and safety), as the use of mechanical methods (SCIRE level 4 evidence) was not of interest to him. At 9 months post injury he and his wife visited the Fertility Clinic enquiring about sperm retrieval methods, as he had not experienced ejaculation since his injury. Assessment of the couple was done and, since he was an appropriate candidate, vibrostimulation (PVS) was tried before electroejaculation (EEP) (SCIRE level 4 evidence). Due to his level of injury, symptomatic autonomic dysreflexia at ejaculation was a problem, at least initially. Over the next year several successful VS trials were done but semen quality was poor, (SCIRE level 4 evidence). However, with assistive reproductive techniques they had a healthy child 2 years later (SCIRE evidence level 4).

W33

Introduction/overview of pediatric SCI including medical complications/bowel

Lawrence Vogel

USA

An introduction to the pediatric SCI workshop course will be presented. This will be followed by an overview of pediatric SCI, including demographics, pathophysiology, unique manifestations, complications and rehabilitative needs of pediatric SCI and the natural history of SCI in children and adolescents. Unique manifestations and complications of children who were injured at 5 years of age or younger will be compared to older children and adolescents with SCI, including a discussion on spinal cord without radiologic abnormalities (SCIWORA) and delayed onset of neurologic findings. This presentation will also include a discussion on pressure ulcers, autonomic and bowel dysfunction, pain, spasticity and metabolic disturbances, such as hypercalcemia.

W34

Urological management of SCI in children and adolescents

Mario De Gennaro

Italy

Theoretically the neuro-urological approach could be the same in children with acquired spinal cord injury (SCI) and congenital lesions as spina bifida (SB): the urological goals are the same establishing satisfactory bladder emptying, maintaining safe bladder storage pressure and avoiding infections, to prevent upper urinary tract deterioration, with the final goal to reach continence. The importance of neurogenic bladder dysfunction (NBD) has been well described, renal damage remains a real risk and children require a careful evaluation and follow-up because NBD changes from the spinal shock phase to the later time. The management strategies will be not defined by urodynamics studies and urinary tract imaging only, and in our experience a multidisciplinary approach is mandatory from the Intensive Care Unit to the Neurorehabilitation Department. NBD are related to lesion site anyway the approach will be different when an head trauma will be coexisting. The children's physical limitations, patient's emotional status, as families social needs may play a critical role determining a different therapeutic strategy in the same clinical situation. Furthermore we have to consider the families psychological features following the injury especially if it was related to a parents act. In any case before any surgical reconstruction all available medical management options as well as all endoscopic or minimally invasive procedures should be exhausted. Clean intermittent catheterisation (CIC) and anticholinergic medications are still the mainstay of NBD management. When CIC may not be instituted vesicostomy button seems to be very useful. It has been suggested that sacral root stimulation during spinal shock facilitates bladder recovery, we have experienced sacral neuromodulation (SNM) in children with incomplete injury and SNM seems to be a promising therapeutic modality for NBD in selected ones.

Anyway the most important urological advancement in NBD treatment in these years remains the use of Botulinum toxin A (BontA). From 1997 we have successfully treated 72 children with BontA, 12 of them with SCI. For this reason bladder augmentation it is still a therapeutic option, often associated to a Mitrofanoff procedure but dramatically reduced. In the same bladder outlet may be well managed by fascial sling or urethral

lengthening procedures but always considering other options as bulking agents. Finally we have to remember that SCI children presented NBD as well as Bowel dysfunction.

W35

Epidemiology of pediatric SCI

Michael J. DeVivo

USA

Objective: To describe the unique aspects of the epidemiology of pediatric-onset spinal cord injury (SCI) in the United States of America (USA).

Methods: The characteristics of persons enrolled in either the Shriners Hospitals for Children SCI database or the National Spinal Cord Injury Statistical Center database from 1973 through 2008 were evaluated based on age at time of injury (0-5 years, 6-12 years, 13-15 years, 16-21 years, and 22 years and older).

Results: Males comprised a decreasing proportion of new cases of SCI, ranging from 82% among persons 16-21 years of age to only 53% among those aged 0-5 years. Among children and adolescents (under age 22 years), the proportion of motor vehicle crashes was higher than in adults (22+ years). Sports, violence, and medical or surgical complications also accounted for a significantly greater proportion of SCI in teenagers (13-21 years) than in adults. Violence is the leading cause of SCI among African American and Hispanic teenage males (13-21 years), whereas vehicular crashes are more common among African American and Hispanic men of older ages (> 22 years). Approximately one third of new cases of SCI in the youngest two age groups (0-5 years, 6-12 years) had cervical injuries compared with almost one half in the older age groups (age > 13 years). SCI was much more likely to be neurologically complete in younger persons (70% age 0-5 years vs 52% age > 16 years).

Conclusion: The pediatric-onset SCI population is heterogeneous. Each pediatric age group exhibits distinct epidemiologic characteristics, and the overall pediatric group has very different characteristics than the adult-onset SCI population

W36

Pediatric Spinal Cord Injury in Europe

Marika Augutis,

Sweden

Abel R.; Levi R.

Study design: Pediatric-onset spinal cord injury (pedSCI) has received scarce research attention due to its rarity. Knowledge of incidence and etiology of pedSCI is important in order to identify risk groups, improve prevention, planning of care, rehabilitation and research.

Objectives: To collect information about incidence and management of pedSCI in a subset of European countries.

Methods: A short semi structured questionnaire was sent to respondents working with spinal cord injury (SCI) in 19 countries in Europe.

Results: Only for Portugal and Sweden the incidence of pedSCI (fatal injuries included) is documented, i.e. 27 children/million children/year and 4.6 children/million children/year respectively. For the other countries, the estimated incidence of pedSCI (non-fatal

injuries) varied from 0.9-21.2 children/ million children/year in the ages 0-14 years. Although the incidence varies considerably, the estimated incidence of pedSCI seems to be rare throughout Europe. The management differs between the countries depending on the age of the child and the local organization of health care. Only for Portugal and Sweden the incidence of pedSCI is documented.

Conclusions: The survey confirms that pedSCI is rare. More integration of knowledge in the field of pedSCI is needed throughout Europe. The contacts initiated in the process of the survey may be used to create an international network serving as a reference for health professionals, researchers and families, thereby possibly alleviating some of the unwanted variations of care identified in this survey.

W37

Orthopaedic considerations in pediatric SCI (acute management of spine fractures, hips and spine disorders, HO, pathological fractures)

Randal R Betz
USA

The purpose of this talk is to introduce some new concepts regarding care of the child with spinal cord injury (SCI). Pediatric SCI is unique with a high percentage of high cervical spinal cord injuries with neurogenic shock in very young children. Particularly unique to children is the lap belt injury, which carries a 40% prevalence of intra-abdominal injuries, and the fracture can be easily missed on a trauma CT scan. Imaging of the pediatric spine can be problematic because of the normal variance, and spinal cord injury without radiographic abnormality (SCIWORA) remains a diagnostic challenge .

Spine deformity occurs in approximately 98% of children with SCI, and 67% will require surgery to stabilize their spine if injured prior to skeletal maturity. Hip subluxation/dislocation can occur in up to 40% of patients with SCI, especially in those injured before age 10. A subluxating or dislocating hip can cause spasticity, which may adversely affect upper extremity function. Contractures of the joints, most commonly the hips, elbows, knees, and ankles, occur in almost all patients with SCI. Contractures of the elbow particularly affect upper extremity function. At our institution, serial casting of elbow contractures has been the treatment of choice, followed by biceps-to-triceps transfer.

Spinal cord syringes are prevalent in both children and adults, occurring in approximately 50% of patients. These syringes are generally asymptomatic but can clearly affect upper extremity function, and a preoperative MRI is probably indicated in all patients considering upper extremity surgery.

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W38

Use of the International Standards for Neurological Classification of Spinal Cord Injury in Pediatrics

Mary Jane Mulcahey

USA

The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) sensory, motor and anorectal examinations are used as the standard clinical method to determine the neurological consequence following SCI. Although it has been used with children, until recently there has been no research on the utility of the examinations to guide clinicians' use of the ISNCSCI with children. This presentation reviews the outcomes of a multi-center study to establish the utility of the ISNCSCI motor, sensory and anorectal examinations in children and youth and offers guidelines on the use of the ISNCSCI in children. A prospective cross-sectional multi-center reliability study involved administration of four repeated measures of the motor, sensory and anorectal examinations by seven raters on 210 children with SCI. The motor and sensory examinations can be consistently performed with high reliability in children nine years of age and older. Many children as young as six years of age can participate in the motor and sensory examinations with high reliability. There is no utility for the motor and sensory exams in children younger than six years of age. The anorectal examination requires further studies of reliability and validity. Clinicians should refrain from designating a formal neurological, motor and sensory level and AIS designation in children under six years of age.; documentation should indicate that level and severity of injury cannot be determined by formal testing due to age.

W39

Rehabilitation of the child with a SCI (general principles, ambulation, mobility, SCI education)

Allison Graham

UK

Why should a child undergo rehabilitation in a specialist paediatric spinal centre often miles from home? Who are the important people a child needs to obtain maximum functional and quality of life gain after injury? What resources are required? Where should this happen and when? Why is it so different from adult spinal injury rehabilitation? This presentation aims to address the above and is a review of current rehabilitation practice for children and their families from early rehabilitation after onset of impairment to

adulthood. Pragmatically reviewing the best of both established adult and paediatric services to adapt to the physical, cognitive, social and environmental changing needs of the child.

This reviews the combination of the individual disciplinary assessments of the child's presenting condition to rehabilitation. It establishes a method to combine these to formulate a rehabilitation assessment and plan incorporating the goals of the child and progresses to a safe community discharge.

This explains the 11 domains involved in the child needs assessment checklist used to goal plan the child during initial and subsequent rehabilitation reviews as a child grows and develops.

W40

Innovative rehabilitative strategies (activity based rehab, body weight supported ambulation, and FES cycling, ambulation and UE function)

Randal R Betz

USA

The purpose of this talk is to discuss some of the current regeneration and injury modulation strategies for patients with spinal cord injury. A study will be illustrated from the use of preclinical data through human trials using autogenous macrophages. Loss of myelin will then be discussed, along with treatment with drug therapy and stem cell grafts. Most patients with SCI do not have a severed spinal cord, and surviving axons often lose only part of their myelin. K⁺ channels are exposed, causing the axon to "short circuit." 4 Aminopyridine (4-AP) blocks K⁺ channels and permits the axon to transmit impulses, resulting in increased neurologic function. Another experimental drug, HP-184, is both a K⁺ and Na⁺ channel blocker and has demonstrated improved locomotor scores in rats. Olfactory ensheathing glia (OEG) cells are found in the olfactory bulb at the junction of peripheral nervous system and central nervous system and have been found to support neuron growth into the CNS. They do this by producing several trophic factors, including NGF, BDNF, and NT-3.

Activity based therapy will be discussed as an independent treatment for patients with SCI and then as an adjunct to biologic regeneration strategies. Weight bearing strategies with treadmill walking will be reviewed. Cycling on bicycles with and without FES will be examined for the ability to modulate neurologic outcome and for physical well being. The role of FES functional systems and their future role in supplementing biologic repair will be discussed.

W41

Evaluation and Management of the Hand in Children with Tetraplegia

Mary Jane Mulcahey

USA

Children with tetraplegia are at risk for developing upper extremity (UE) impairments that are similar to those seen in adults with SCI. They are at greater risk for developing scapular instability, scoliosis, kyphosis and, metacarpophalangeal (MCP) tightness, all of which have adverse influence on upper limb function; prevention of secondary impairment is paramount. Treatment consists of static, dynamic and functional splints and orthoses,

serial casting, in the presence of fixed deformities, and reconstructive surgeries. The presentation will review the principles of evaluation of the upper limb in tetraplegia. Secondary musculoskeletal impairments will be discussed with respect to upper limb function. Conventional and novel approaches to non-surgical interventions for prevention and function will be reviewed and their outcomes discussed. Principles of surgical reconstruction will be presented and outcomes of tendon transfers will be reviewed. Case illustrations will be presented to solidify concepts discussed in the presentation.

W42

Discharge planning of pediatric ventilator dependent Spinal Cord Injury patients

Tiziana Redaelli; Frigerio P.; Stagni G.; Valsecchi L.

Italy

SCI impacts child growth and elicits psychosocial, educational and severe disadvantages. These sequels are particularly severe in high cervical injuries who are dependent of ventilator assistance to life. As cervical lesions occur infrequently in children, there is not enough experience how to enhance quality of life, to sustain and extend life without compromising quality, to improve or sustain physical and psychological function and to enhance growth and development.

The aim of our study is to propose a planning, which has been developed in the Spinal Unit, for the discharge of the ventilator dependent child. The protocol is based on a comprehensive, multiprofessional and interdisciplinary approach and takes in account rehabilitative, psychological and social aspects. Many actors are involved in this project, but the most essential members of the discharge team are the patient and his family that need a specific training and education leaded by the rehabilitative team of the Spinal Unit. The protocol begins when the clinical conditions of the "vent-child" are considered stable and develops through different successive steps. A patient-specific discharge plan should be developed and implemented by the discharge planning team. The team identifies all patient care issues, set a target data for discharge and plan the discharge process. Each member of this team (physician, nurse, respiratory physiotherapist, physical therapist, occupational therapist, social worker) plays a specific role in order to let the parents and care-givers to acquire the best capacity to manage the child at home and to accompany him in his most physiologic environment.

W43

Psychosocial/sexuality/transition and innovative recreation and leisure time programming for the child and adolescent with a SCI

Marika Augutis; Lawrence Vogel

Sweden, USA

Psychosocial and sexuality issues unique to children and adolescents with SCI will be reviewed from a developmental perspective, along with the critical role of the family. This will include discussion on participation, education, pre-vocational activities, sexual education and mental health issues unique to each developmental stage from infancy through adolescence. The process of transition into adulthood for adolescents with SCI will be described. This transition process encompasses independent living, higher education/vocational training, employment, socialization and health-care needs. The

ultimate goal of this process is to assist adolescents to become productive adults with satisfying lives. The second part of this session will be a description of innovative recreation and leisure time programming for the child and adolescent with a SCI that enriches the lives of those with SCI. Examples of these programs, such as camps and scuba diving, from Sweden and the United States will be presented.

POSTERS

1. "PREDICTING OUTCOMES" FROM 1 TO 77
2. "NEW TREATMENTS FOR PRESSURE ULCERS" FROM 78 TO 90
3. "SPINAL CORD LESIONS IN CHILDREN" FROM 91 TO 113
4. "URINARY INCONTINENCE" FROM 114 TO 121
5. "SPASTICITY MANAGEMENT" FROM 122 TO 137
6. "FREE PAPERS" FROM 138 TO 186

P1

Evaluation factors that interfere in the accessibility of spinal cord injured (SCI) patients into rehabilitation center the city of São Paulo, Brazil.

Julia Maria D'Andrea Greve

Medical School - University of São Paulo

Brazil

Gondim Mutti C.; Castro A.; Rúbios de Souza D.

To identify interfering factors in the accessibility of SCI paraplegic patients hospitalized in the Clinical Hospital of Medical School of the University of São Paulo from 2000 to 2004.

Methods: 39 patients were phone interviewed about their independence after SCI. A questionnaire was provided asking about personal background, rehabilitation program and functional capacity information. The patients were divided in two groups: Rehabilitation (RG) (24 patients) - comprehensive program and No-Rehabilitation (NRG) (15 patients)- short program. Mean age was $33,4 \pm 12,7$ ys; 35 were males and four females.

Results: there was no place in the rehabilitation centers for new patients, long stand by time (6 months) to start the program and transportation are the main factors for the NRG patients. Transportation is a factor because there is no SCI rehabilitation inpatient program in São Paulo. The presence of clinical problems influenced the onset time for the rehabilitation program in the RG. The single and the severe injured patients have undergone more rehabilitation. There is no difference in the FIM final score.

Conclusion: There is a lack of SCI centers: number, localization and quality. Public policies must be implemented.

P2

Influence of the level and severity of spinal cord injury on cardiovascular outcomes in humans: a meta-analysis

Patricia Mills

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Canada

Numata Y.; Krassioukov A.

Background: A variety of cardiovascular (CVS) dysfunctions are associated with spinal cord injury (SCI) that are limited to study by observational methodology, given that levels and severity of SCI in humans cannot ethically be randomized. Meta-analysis can increase statistical power of results by combining similar studies.

Objective: To examine effect of the level and the severity of SCI on heart rate (HR) and blood pressure (BP) at rest and in response to physiological stressors.

Methods: Literature Search using Medline, Embase, CINAHL, SPORTDiscus databases was conducted with a combination of key words. Manuscript selection criteria: subject's inclusion/exclusion; chronic SCI; study type; and CVS outcomes.

Data Analysis: Subjects grouped into: cervical, cervical/high thoracic ($>T6$), low thoracic/lumbar ($<T6$) and able-bodied (AB); groups sub-divided by motor complete (AIS A,B) versus incomplete (AIS C,D) injury. A pooled estimate of effect using the inverse-variance weighted method was calculated with a fixed and random effects model. Forrest

plots displayed effect estimates between groups with 95% confidence intervals.

Results: 167 manuscripts met inclusion criteria. There is strong evidence that CVS parameters (HR and BP) at rest, during exercise and other physiological stressors are affected by the level and severity of SCI. CVS dysfunction is more pronounced in those with complete rather than incomplete injuries, cervical SCI, followed by high thoracic SCI. Individuals with LTL injuries have similar CVS responses to AB.

Conclusions: While evaluating cardiovascular outcomes in individuals with SCI it is crucial to make comparison between appropriate groups and consider the level and the severity of injury.

P3

Factors that impact participation in persons with spinal cord impairments, and challenges in prediction

Joy Wee

Queen's University
Canada

In-depth interviews were conducted in persons with spinal cord lesions to explore factors impacting participation. Examples will be provided and the importance of identifying and reporting these factors will be stressed. Literature regarding factors that impact upon participation in persons with mobility impairment will be reviewed, along with some challenges in measuring participation itself. Challenges in predicting participation from known factors will also be discussed.

P4

Relationship outcomes in adults with pediatric-onset spinal cord injury

Lawrence Vogel

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USA

Zebracki K.; Chlan K.; Bland M.; Kelly E.

Purpose: To examine associations between relationship status (dating, physical intimacy, marriage) and emotional functioning in adults with pediatric-onset spinal cord injury (SCI).

Methods: Adults (N=404, 63% male, ages 24-45) who sustained a SCI prior to age 18 completed structured telephone interviews assessing demographic and medical characteristics and questionnaires on romantic relationships, emotional well-being (Short Form-12, SF-12), and life satisfaction (Satisfaction with Life Scale, SWL). Correlational analyses and logistic regressions were used to identify associations between relationship variables and emotional functioning as well as predict relationship status.

Results: Dating (44% of the sample, n=179), physical intimacy (58%, n=234), and marriage (21%, n=85) were positively associated with SWL ($r=.12-.35$, $p<.05$). Physical intimacy was positively associated with emotional well-being (SF-12; $r=.11$, $p<.05$); however, this association was not found with the other relationship variables.

Predictors of dating included having a higher ASIA motor score ($p<.05$), a complete injury ($p<.05$), living independently ($p<.001$), and being non-Caucasian ($p<.05$). Intimacy was predicted by having a higher ASIA motor score ($p<.05$) and living independently ($p<.001$). Finally, predictors of marriage included a higher ASIA motor score ($p<.05$),

female gender ($p<.05$), and being Caucasian ($p<.05$).

Conclusion: Involvement in a romantic relationship may serve as a protective factor and promote SWL. ASIA motor score is a particularly important predictor of relationship status. Identifying barriers to establishing these relationships and designing interventions to promote adaptive coping to the challenges faced by adults with pediatric-onset SCI may help improve SWL.

P5

Measuring Quality of Life in Spinal Cord Injury: Development of a Basic International Data Set

Denise G. Tate

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Denmark

Biering-Sørensen F.; Catz A.; Charlifue S.; Dijkers M.; Geyh S.; Horsewell J.; Kirchberger I.; Noreau L.; Post M.; Sinnod A.

Clinical trials of SCI require a set of outcomes available to assess the effectiveness of such trials. The ability to compare such approaches across international borders using the same items and being able to collect minimal and extended data on the quality of life (QoL) of persons with SCI is essential. Measuring QoL using the same items and collecting consistent data is particularly challenging since the concept has been defined in many ways by many people. Based on this need and challenge, the International Spinal Cord Society (ISCoS) and the American Spinal Injury Society (ASIA), appointed a working group to develop a Quality of Life Basic Data Set as part of the International Spinal Cord Injury Datasets. The current version of the QoL basic data set includes three questions on satisfaction with life as a whole, satisfaction with physical health, and satisfaction with psychological health. The selection of these items took into account the psychometric properties of measures from which items were selected, their content and purpose. Steps are under way to complete an extended QoL data set designed for research use. This presentation will provide an opportunity to discuss this process and its results and to obtain feedback from international participants who may be interested in using these data sets in the near future.

P6

Reliability of walking parameter for patients with motor incomplete spinal cord injury using gait analysis

T. Jung

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Korea

The purpose of this study is to relate locomotor function to the Lower Extremity Motor Score(LEMS) and Ambulatory Motor Index(AMI) using gait analysis and to investigate energy consumption in persons with motor incomplete spinal cord injuries(SCI). The gait analysis from forty three patients with SCI were reviewed. The temporospatial data were obtained with a Vicon 370 system. The LEMS and AMI were assessed before the gait analysis and the influence of an increase in lower limb motor scores was investigated with linear parameters of gait analysis. For the group including both tetraplegic and paraplegic patients, AMI & LEMS score were statistically significant with gait speed, step

length and double limb support. However only LEMS was statistically significant with cadence. For the paraplegic group, with AMI & LEMS score, there was statistical significance with gait speed, step length, Rt single limb support and Rt double limb support. However only LEMS was statistically significant with Lt cadence and double limb support. For the tetraplegic group, only the Lt cadence was statistically significant with AMI. In term of energy expenditure VO₂/kg and VO₂ were not statistically significant with linear parameters of gait analysis. In conclusion this study suggests that in terms of evaluating locomotor function of patients with SCI, LEMS and AMI can be used only for the paraplegic group. Also energy expenditure and gait analysis showed no statistical significance.

P7

Consumer Preference in Ranking Walking Function

Patricia Ditunno

Thomas Jefferson University

USA

Patrick M.; Ditunno J. F.

Objective: A pilot to determine consumer preference in ranking walking function utilizing the Walking Index for Spinal Cord Injury (WISCI). Also, to determine if this consumer ranking differs from professionals who ranked the WISIC according to impairment.

Design: Blinded hierarchical rank ordering

Methods: Photographs were taken depicting each defined WISCI level using the same person and a similar background in order to ensure uniformity of the pictures. The pictures were printed out on a color laser printer on a half sheet of paper with the written WISCI descriptors at the bottom of each photo. The photographs were randomly shuffled. Sixteen individuals with chronic motor incomplete spinal cord injury (11 cervical, 2 thoracic, 3 lumbar) met one-on-one with the research coordinator and were asked to put the pictures in rank order by their individual preference for walking. The responses of each participant were entered into an excel spreadsheet for analysis.

Results: Most consumers implicitly ranked the WISCI levels requiring physical assistance as a lower preference than those levels not requiring physical assistance. Secondly, consumers ranked the stability of a walker higher than crutches. These differed from the professionals who were instructed to rank subjects from most impaired to least impaired based on the theoretical construct of the WISCI scale.

Conclusions: Consumers preference for recovery of walking function differed from professionals. Minimal clinical significance for recovery of walking function may need to be investigated differentially for professionals and consumers since the differences may reflect bias or the intent of the measure.

P8

Effect of age and gender on electrical perceptual threshold (ept) in the healthy population

Phil Waite

University of NSW

Australia

Lauschke J.L.; Leong G.

Background: EPT testing is a sensitive and reproducible form of quantitative sensory assessment in people with spinal cord injury (SCI). Previously published normative templates have been derived from a single group of 30 volunteers of both genders not older than 55 years of age¹. It remains uncertain if older individuals or women with SCI can be accurately compared against the existing normogram.

Aim To determine if there are EPT differences in healthy volunteers with respect to side, age and gender.

Methods: Cutaneous stimulation with constant current electrical pulses at the 28 ASIA sensory points was performed on 22 male and 24 female healthy volunteers ranging from 21-76 years of age. The lowest stimulus intensity at which sensation was perceived was recorded as the EPT. Repeated measures ANOVA and paired t-tests were used to compare for left-right, gender-related and age-related differences in EPT values.

Results: There was no significant left-right difference in any of the dermatomes ($p=0.924$). Women had lower EPTs compared to men ($p<0.0001$). This difference was maintained across the age groups. There was no significant difference between younger and older males. However, older women had consistently higher EPT values compared to younger women in limb dermatomes.

Conclusion: There is an age-independent difference in EPT between genders. Our results suggest an increase in EPT values with age in women, but not men. This argues for the establishment of gender and age-specific normograms for comparison with SCI EPT values.

Sponsorship: NSW OSMR

Savic et al. Spinal Cord 2006; 44:560-566.

P9

Rehabilitation results in tetra- and paraplegic patients after spinal abscess

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Germany

Cakir B.; Reichel H.

Introduction: The aim of the study was to prospectively use the SCIM (Spinal Cord Independence Measurement) and general evaluation of 16 patients with spinal cord disease (SCD) caused by spinal abscess.

Methods: After decompression, stabilisation and antibiotic therapy (Levofloxacin, Rifampicin, Flucloxacillin) the SCIM-Score and the general situation was evaluated at admission, discharge and 12 months later.

Results: 5 patients were tetraplegic, 11 paraplegic, 6 females and 10 males. The average age was 68 years. 3 patients stayed complete, 13 incomplete with 4 patients AIS D. 1 patient was transferred into a nursing home, 15 patients went home to a mostly adapted

area. 5 patients were completely independent, 11 patients needed help by relatives or ambulance care. 1 year after discharge 2 patients were dead, the SCIM had improved only in 2 cases.

Conclusion: Less than a third of this patient group developed independence during the stay in the SCI /SCD centre, but most patients be discharged home. 1 year later the SCIM score revealed mostly no improvement in function in the elderly patients.

P10

Functional improvement of a spinal cord injured patient who have been operated at late period: Case Report

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GATA Dept. of PM&R

Turkey

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Objective: Trauma is the main etiological factor in spinal cord injury (SCI). The efficacy and the timing of surgical operations are still controversial. In this case we aimed to determine functional improvement of a spianl cord injured patient who has been operated at late period.

Case: 20 year old man who had C3 dislocation due to motor vehicle accident in August 2007. He had not been surgically operated when admitted to our hospital in October 2007. 4 months of rehabilitaion were performed with the patient prior to his admittance to our hospital. On examination; the C2-4 dermatomes were normoesthetic and the distal dermatomes were hypoesthetic. He had anal contraction. His motor scores were 32 and he could not ambulate independently. Stabilisation surgery was performed with a C3-4 lateral mass screw and rod. He rehabilitated for 2 months. After 2 months his motor scores was 87 and he ambulated independently.

Conclusion: As the pathophysiology of spinal cord injury becomes clear, the efficacy of surgery in this condition is understood better. The efficacy and the timing of surgical operations are still controversial. To determine the efficacy and the optimum timing of surgical operations more clinical trials are needed.

P11

Vulnerability after SCI: corroboratin quantative and qualitative evidence

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Purpose: To gain a deeper understanding of vulnerability of persons with longer-term SCI. Their available levels of resources, in the form of financial, human, infrastructure and social capital, were explored.

Method: items sourced from self-report survey (N=443), optional qualitative survey response (n= 230, 52% responses), in-depth interviews (n=4) provide 3 levels of data. Quantitative analyses were used for survey responses, content analyses were used for the qualitative responses and interviews.

Results: Financial capital – a two-tier system, those who were compensated for their injury and those who were not, exists. Many live close to the poverty line. Compensation

did not protect from stress. Most live under financial strain. Human capital – loud cry for information and support for themselves and for their family/carers were expressed. Infrastructure capital – the endorsement of equality in commercial and governmental organizations appears to be only rhetoric since reasonable solutions to common problems that have existed for sometime, to date have not been resolved. Social capital – a significant lack of reciprocity by the wider community was evident in both the quantitative and qualitative data.

Conclusion: It is noteworthy that many people with spinal cord injury reported good overall satisfaction with life and points to the remarkable resiliency of people in general. Not just because spinal cord injury had an impact on every facet of their physical lives but because there was also a parallel cost to their 'capitals' so decreasing resources that buffer against hardship.

P12

Psychosocial risk factors and outcomes: Measuring risk and progress in an Australian context

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Purpose: Psychosocial factors are known to influence functional outcomes following spinal cord injury (SCI) but are frequently overlooked and are less systematically addressed during rehabilitation. Identifying psychosocial risk factors, and actively monitoring psychosocial outcomes during rehabilitation, is a first step to ensuring appropriate management of these issues. The purpose of this study was to identify a suite of measures of psychosocial risk factors and outcomes appropriate for use in an Australian context.

Description: This paper will describe a systematic review of available measures of psychosocial risk factors and outcomes in SCI populations, and the selection of those considered appropriate for use in a clinical setting in an Australian context. Relevant databases (MEDLINE, PsychInfo etc) were searched using keywords such as depression, anxiety, mood, paraplegia and tetraplegia. Papers were selected based upon abstracts and reviewed by the authors. Information was abstracted concerning the reliability and validity data available.

Results: A broad range of relevant psychosocial risk factor and outcome domains were identified, including quality of life, mood, community participation and pain. In many of these domains, examples of measures could be identified but there were significant limitations with many due to lack of reliability and validity data, or other issues that compromised their use in this context.

Conclusions: The review concluded that there are currently no gold standard psychosocial risk factor or outcome measures available with sufficient data from Australian samples. However, tentative recommendations for the adoption of a number of specific measures were made.

P13

Life expectancy after spinal cord injury: a fifty-year study

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Purpose: To analyse acute and long-term mortality, estimate life expectancy and identify temporal patterns in survival of individuals experiencing traumatic SCI.

Methods: Data of patients with traumatic SCI admitted to a spinal unit in Sydney, Australia between January, 1955 and 2006 were collated and deaths confirmed either by telephone call or comparison with National Death Index. Cumulative survival probability was estimated using life-table techniques and mortality rates calculated from number of deaths and aggregate years of exposure. Standardised Mortality Ratios (SMRs) were estimated from the ratio of observed to expected number of deaths (from matched population mortality).

Results: From a total of 2162, 106 persons with tetraplegia (9%) and 37 persons with paraplegia (3.8%) died within first 12 months after injury, with the highest death rates occurring in those with complete and high cervical (C1-4) lesions. Among first-year survivors, the overall survival rate at 30 years post-injury for persons with tetraplegia is 77% compared to 87% for those with paraplegia. The most significant increases in mortality rates were seen in the group with tetraplegia and ASIA/Frankel A lesions, with SMRs ranging between 6.2 to 8.4 for people 50 years or younger, and SMRs reducing with advancing current attained age.

Conclusion: Survival was strongly related to neurological level and degree of impairment. Research should now focus on identifying contextual factors, either personal or environmental, that may interact with age and impairment to further reduce life expectancy after SCI.

P14

Primary Outcomes of the Stockholm Model for Traumatic Spinal Cord Injury Rehabilitation 1996-2006

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The purpose of the study is to evaluate the efficiency of the Stockholm Model.

Methods: Descriptive retrospective study. Journal survey. Number of patients 306.

In Sweden the incidence of traumatic spinal cord injuries is among the lowest in the world, 15-20/million. Since 1996 all patients with traumatic spinal cord injuries in the County of Stockholm (population 1.8 million) have been included in a 2-year comprehensive rehabilitation program managed by the Spinal Unit, Department of Neurology, Karolinska University Hospital. Immediately after surgery patients are transferred to the Spinal Unit, where they stay as long as full hospital environment is deemed necessary. Thereafter follows an in-patient rehabilitation period with partners in a non-hospital setting (Rehab Station Stockholm or Stockholms Sjukhem). Finally day-

care and long term follow-up takes place at the Spinalis Clinic.

The parameters studied are:

- 1.Changes of duration of care at different levels in the rehabilitation chain
- 2.Changes in patient demographics
- 3.Changes in types of injuries
- 4.Changes of outcome after two years of rehabilitation:
 - § Number of patients reaching expected functional goals
 - § Number of patients at work or studies
- 5.Changes in medical complications

P15

Comparison of bone mineral density (BMD) and weight bearing activity between sci patients during the first 3 years post injury

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Aim: To evaluate the degree of bone loss in SCI patients with different weight – bearing activity, regardless the level of injury in the first 3 years post-SCI.

Material-method: We examined 32 patients, 11 females, 21 males with complete SCI. We divided them into standing and non-standing groups. BMD was first measured one to three months post-injury and re-assessed before discharge and once a year during follow-up.

Results: At initial measurements, all patients had a general BMD reduction. Three years post-SCI, patients who used to stand up twice daily had higher leg BMD vs patients who were wheel chair bound.

Conclusion: It is very difficult to reach a clear conclusion because standing time was not exactly the same for all patients and the time of immobilization differed between the two groups. It is also very difficult to match exactly age, gender, height, weight and level of lesion.

P16

Predicting the risk of falling in sci subjects using a reaction time test

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Purpose: Persons with an incomplete spinal cord injury (iSCI) often regain ambulatory function, but are prone to falling. Clinical scales such as the Berg Balance Scale are unable to predict the falling risk in persons with iSCI. As the reaction time of the lower limb plays an important role for safe locomotion, we aimed to develop a lower extremity reaction time test that could be applied in iSCI subjects and might distinguish fallers from non-fallers.

Methods: This Reaction and Execution Test (RET) consists of a platform containing six buttons. The subjects move their foot from the starting position to one of the five target buttons, as soon as a corresponding LED next to the button lights up. These lights flash

up in random order and reaction time is recorded. First, 25 healthy subjects were assessed to determine normative values, reliability and differences between sit and stance. At present, iSCI subjects are being tested.

Results: In healthy subjects, task performance did not differ between sit and stance and was little but significantly slower in the left leg (mean \pm SD: 485 \pm 55 ms) compared to the right leg (471 \pm 55 ms; $P = 0.004$). First results ($n = 7$) show a moderate reliability (ICC = 0.59). Results of the persons with iSCI will be presented at the meeting.

Conclusions: The RET assesses reaction time of the lower extremities. It should provide further information about the mechanisms that underlie falling in iSCI subjects thereby leading to improved rehabilitation programs.

P17

Characteristics of sci patients discharged with home ventilation

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Aim: The National Spinal Injuries Centre (NSIC) receives patients with spinal cord injury (SCI) from around the UK. High cervical cord injury patients are ventilated at the referring centre and most of these are weaned at the NSIC. The aim of this analysis was to review the characteristics of SCI patients discharged from the NSIC with long term ventilation. Method: A review of the data of all SCI patients discharged from the NSIC with a form of ventilation between January 2004 and 2009.

Results: Over a 5 year period 21 ventilated patients were discharged from the unit. 16 were males and 5 females with an age range of 17-71 years. The injury level was mainly C2-C4 but included 3 patients with C7 lesions. 18 patients were ventilated invasively via a tracheostomy and 2 of these also had a phrenic nerve stimulator, 2 patients were face ventilated with non invasive ventilation and one with a cuirass ventilator. Most patients (14) were discharged home with a care package and the other 7 to nursing homes. At follow up 14 patients were alive and 7 had died.

Conclusions: The number of patients needing discharge with a form of ventilation is small. Most of these are high cervical cord injury patients but some are lower cervical with complications such as collapsed basal lobe of lungs. Most patients are discharged home and are still alive at follow up.

P18

Pain after spinal cord injury – time course and pattern of pain syndromes in acute SCI

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We report on a prospective multicenter study investigating the onset and duration of pain symptoms following SCI at three time points after injury (e.g. 1, 3 and 6 months). Pain syndromes were classified according to three main pain types (e.g. musculoskeletal, visceral and neuropathic pain) as outlined by the international guidelines (IASP, 2001).

Special emphasis was directed to disclose typical pattern for pain development and changes over time.

Within the framework of the European Multicentre Human SCI Study (EM-SCI), 74 acute SCI patients were surveyed with a standardized pain-report, which is a structured interview and examines various aspects of pain according to recent recommendations as provided by the International SCI pain data set (Widerstroem-Noga et al., 2008).

Preliminary results showed that only 31.8% of patients did not experience pain within 6 months after SCI. Neuropathic pain was most frequently complaint in 38.4% (21.5% at level, 16.4% below level) of patients while musculoskeletal pain was reported in 29.9%. Whereas neuropathic pain revealed an increasing incidence over time from initially - 32.4% to 41.9%, musculoskeletal pain decreased from 32.4% to 23% within 6 months. In patients not experiencing neuropathic pain within the first month after injury less than 5% developed neuropathic at a later stage. Patients with initially no pain syndromes were unlikely to suffer from pain at a later stage (62.5%).

This is a very first study investigating pain following new established guidelines to assess and follow pain in a longitudinal SCI study and revealed characteristic patterns of pain occurrence.

P19

Contact heat evoked potentials (CHEPs) in spinal cord injury (SCI)

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The evaluation of evoked potentials complements the neurological assessment after spinal cord injury (SCI) and may improve the prediction of functional outcome. Clinical electrophysiology utilizes electrical stimulation to investigate spinal conduction in large diameter fibers in the dorsal columns. A comparable examination of small diameter fibers in the spinothalamic tract with contact heat may provide additional diagnostic and prognostic information regarding anterior spinal cord functions (i.e. pain). The aim of this study was to examine the reliability of contact heat evoked potentials (CHEPs) to measure spinothalamic tract function from cervical dermatomes in uninjured controls, as well as demonstrate the feasibility of this method for patients with tetraplegia.

CHEPs and thermal perception and pain thresholds were recorded from cervical dermatomes (C4-C6 and C8) in control subjects (n=25) and reexamined in a cohort of these subjects (n=15) at 1-week follow-up. The N2 and P2 latencies of cervical CHEPs in controls increased significantly ($p<0.05$) from C4 to C8 ($401.0\pm23.0 - 465.8\pm21.7$ ms and $474.8\pm24.2 - 529.2\pm25.3$ ms, respectively). The intra-class correlation coefficients of reexamined cervical CHEPs latency demonstrated moderate (0.5) to strong (0.9) reliability in control subjects. Patterns of dermatomal sensory impairment in patients with tetraplegia (C3-C8) above, at, and below the level of cervical injury included: 1) normal thresholds and CHEP latency (e.g. above), 2) increased thresholds and delayed CHEP latencies (e.g. at and below), and 3) abolished CHEPs (e.g. below).

This segmental neurophysiological approach could be utilized to predict aberrant changes in spinothalamic tract function and to track clinical safety and efficacy of therapeutic interventions.

P20

Neurophysiological and ASIA assessment of SCI patients for predicting the outcome of ambulatory capacity.

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What outcomes can be expected after spinal cord injury (SCI) and what extent of recovery can be anticipated is one of the most important approach for evaluation of SCI patients.

In all SCI patients examined at the Spinal Unit of Florence (more than 1300), SSEP (somatosensory evoked potential), MEP (motor evoked potential), SSR (sympathetic skin response) and EMG-ENG studies were performed. These techniques also provide an early diagnosis of neurological deficits and are of prognostic value even in uncooperative patients.

In our study 102 SCI patients were examined three times: the first within 1 month; the second between the 4 and 6 months and the last after 18 months (post-injury? Or post admission?).

For evaluation of ambulatory capacity outcome we used clinical and neurophysiological examinations. Clinical investigations included A.I.S. (ASIA Impairment Scale) and Ambulatory capacity. The neurophysiological evaluation included cortical SSEP response of the posterior tibial nerve and MEP of anterior tibial muscle.

Statistical analysis of the results (SSEP, MEP and ASIA vs Ambulatory capacity) was performed using non parametric evaluation (Spearman's r and Kendall's t)

The results confirm the data of the Curt and Dietz studies that the combination of clinical and electrophysiological recordings in acute SCI patients rapresent reliable predictors about the degree of recovery in the lower limb. The electrophysiological recordings are of similar sensitivity to the ASIA scores and are related to the outcome of ambulatory capacity. Only in uncooperative and unconscious patients electrophysiological recordings are superior to the ASIA protocol

P21

Asia impairment scale conversion in traumatic spinal cord injury: is it related with the ability to walk?

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Study Design: Prospective multi-center longitudinal cohort study.

Objectives: To determine the relationship between improvements of the ASIA/ISCOs neurological standard scale (AIS) outcome measure and improvements of functional ambulatory outcome measures in traumatic SCI patients.

Setting: European Multicenter Study of Human Spinal Cord Injury(EM-SCI)

Methods: In 273 eligible traumatic SCI patients acute phase (0-15 days) and chronic phase(6 or 12 months) AIS grades, Timed Up & Go(TUG) test and 10-meter walk test(10MWT) outcome measurements were analyzed. Subanalysis of those patients who

did have AIS conversion was performed to assess its relation with functional ambulatory outcomes.

Results: Studied population consisted of 161 acute phase AIS grade A patients; 37 grade B; 43 grade C, and 32 acute phase AIS grade D patients. Forty-two patients (26%) converted from AIS grade A, 27 (73%) from grade B, 32 (75%) from grade C and 5 patients (16%) from AIS grade D. The frequencies of AIS conversions and functional ambulation recovery outcomes were significantly different ($p < 0.001$) in motor complete SCI patients. The ratio of patients with both recovery of ambulatory function and AIS conversion ($n=101$) differed significantly ($p < 0.001$) between the acute phase AIS grade scores; AIS grade A (6 out of 40 patients, 15%), B (9/27 patients, 33%), C (23/29 patients, 79%) and D (5/5 patients 100%).

Conclusion: The AIS conversion outcome measure is poorly related to the ability to walk in traumatic SCI patients. Therefore, the authors recommend use of functional ambulation recovery outcome measures in prognosticating SCI patients' recovery of walking capacity and performance.

P22

Walking in water and on land after spinal cord lesion: a two-dimensional kinematic study in subjects with incomplete injuries

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Background: Hydrotherapy is used in the rehabilitation protocols of spinal cord injury (SCI) patients. This approach often includes walking in water, although no data are available on the effects of water on the gait of SCI subjects. The aim of this study is to characterize the gait cycle of adults with incomplete SCI walking in water in relation with healthy subjects walking in the same environment. An additional aim is to compare gait differences between controls and SCI subjects in water and on land.

Methods: The spatial-temporal gait stride parameters and lower extremity joint angles range of motion (ROM) of 15 subjects with SCI and 15 healthy controls walking on land and in water were analyzed by a two-dimensional motion system.

Results: With reference to on-land parameters, the gait in water of SCI patients was characterized by speed and stance phase reduction, an increment in gait cycle time, and invariance of stride length and ROM values. Comparison with control data demonstrated that, in water, SCI and control gait parameters differed from one another less than on land. Further, the standard deviation of joint angles showed that, in water, SCI subjects presented more stable hip and knee angles, while in controls, a larger variability was observed.

Conclusions: Walking in water reduces differences in gait parameters between SCI and healthy subjects and, in subjects with SCI, affects joint angle variability with a stabilization effect. These data are of relevance for guiding gait-training protocols in water for SCI subjects.

P23

Immune Mediators Contribute to Spontaneous Neurologic Recovery Following Spinal Cord Injury

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Shortly following spinal cord injury the neurologic status of many patients improves spontaneously, ie without the benefit of restorative surgical or therapeutic intervention. Here we propose a new three-stage model of immunologic contributions to spontaneous neurologic recovery.

1. increased expression of pro-inflammatory cytokines, reactive nitrogen and oxygen species (RNS and ROS) and the heme-oxygenase (HO) system within the parenchyma close to the epicenter of lesion immediately following trauma,
2. pro-inflammatory cytokine, RNS and ROS, and carbon monoxide (a byproduct of the degradation of heme brought about by HO) induce axonal conduction failure that is reversible, or modifiable by certain endogenous agents, in axons that have been spared traumatic axonopathy or myelinopathy,
3. resolution of acute immuno-activity allows restoration of axonal conduction which in turn enables expression of latent neurologic function.

Evidence supporting this model derives from published literature including studies from our laboratory employing ex-vivo electrophysiological recordings from the axons of guinea pig spinal cord exposed to various immuno-active agents. Novel findings include demonstration of conduction blocking effects of hemoglobin (resulting from intra-parenchymal hemorrhage), and peroxynitrite and superoxide anion donors. The model assists understanding of some of the mechanisms of transient neurologic deficits and spontaneous neurologic recovery as well as providing insights for novel interventions targeted to accelerate endogenous recovery processes. Understanding these immunologic contributions to spontaneous recovery will also help more clearly dissociate the therapeutic effects of novel cell therapies, surgical interventions or pharmacologic agents.

P24

The Stockholm Spinal Cord Injury Study: The Need for Health-Enhancing Physical Activity Interventions in Persons with Chronic Paraplegia

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Purpose: A 210 minute threshold for moderate to vigorous weekly activity is widely accepted as a standard for health maintenance. This study examined whether 210 minutes of weekly activity at these intensities was undertaken by Swedish persons with chronic paraplegia. Further, the aim was to describe physical activities that were performed.

Method: Physical activity level was self-reported in 134 persons with paraplegia using a nine-item questionnaire developed and validated for this purpose. The questionnaire was

designed to measure pre-injury patterns of activity, physical activity interests, job-related physical activity, and the frequency, duration, and intensity of weekly activity.

Result: Only 27% of the study participants engaged in the recommended minimum of 210 minutes of moderate to vigorous intensity weekly physical activity. More than 50% of the sample did not participate in any sports or exercise activity at moderate intensity, and only 18% of the cohort did so at least 3 times weekly. Eighty-four percent of the participants did not undergo any vigorous activity. Approximately 60% of the sample did not undergo resistance training. Out of the 50% of study participants who were employed, only 3% had jobs that provided moderate activity, and no job provided vigorous activity.

Conclusions: Seventy-three percent of persons with chronic paraplegia failed to attain recommended targets for weekly exercise time. This finding points out the need to educate persons with paraplegia on the authoritative targets for health maintenance and to develop and enable specialized health-enhancing physical activity programs for these persons.

P25

The tuscany net: an integrated system of care for spinal lesioned persons

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The Regional Agency for Spinal Cord Injury Persons is a departmental organization located in the Careggi University Hospital, whose mission is to develop clinical, diagnostic, therapeutic, preventive and rehabilitative activities, in order to allow the complete reintegration of paraplegic and quadriplegic people in their social and working environment.

The planned connections of the net built between the hospital structure (Spinal Unit and Neuro-Urology) and the community shall coordinate the interventions starting from the very early period after the lesion, managed by the emergency service and the emergency department of all Tuscany hospitals, through the hospitalization in the intensive care units, till the period of hospitalization in the Spinal Unit, and the final reintegration into the community.

To this end, the local health agency selects a tutor in the district zone where the patient lives, who takes care of his/her logistical needs and ensures his/her access to all the services, all interventions aimed to meet the health and social needs of the patient since the day of discharge, and for the rest of his/her life. The tutor participates with the Agency operators in the scheduling of the healing and reintegration project, in order to promptly provide suitable and customized community rehabilitation paths.

P26

Depression and quality of life among patients with spinal cord injury in acute stage

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Purpose: To evaluate the incidence of depression and to assess the quality of life and stress among spinal cord injury (SCI) patients using the Beck Depression Inventory (BDI), the World Health Organization Quality of Life Questionnaire (WHOQOL) and the Stress Response Inventory (SRI).

Methods: Subjects were 60 adult SCI patients admitted to Severance hospital between 2007 and 2008. The patients were classified according to the level of injury and interviewed using the BDI, WHOQOL and SRI. The epidemiologic, clinical and psychological data were analyzed with Pearson's correlation.

Results: Among the 60 patients, 43 were male and 17 were female. 32 patients with motor complete (ASIA Impairment Scale (AIS) A and B) and 28 patients with motor incomplete (AIS C and D) spinal cord injuries were analyzed. Mean duration after injury was about eight months. Compared to the motor complete group, there was significantly less depression and higher quality of life among the motor incomplete group ($p < 0.005$). There was significantly lower quality of life and more stress for the group with more than 2 months duration of injury ($p < 0.005$).

Conclusion: Depression is a significant problem among patients with SCI and affects quality of life. Therefore there should be more emphasis on evaluation and treatment of psychological aspect of SCI during the acute stage of injury.

P27

Activity of daily life (ADL) independence and psychological distress in patients with spinal cord lesions (LCS)

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Objective: to study the correlation between clinical features of SCL patients and ADL independence and the psychological features, at admission and discharge.

Patients and methods: consecutive patients admitted between 2005 and 2008 for their first rehabilitation cycle. American Spinal Injury Association standards to assess neurological status; Barthel Index, and Spinal Cord Independence Measure to assess ADL; CBA STAI X 2 sheet 3 for anxiety, CBA-QD sheet 8 for depression; self esteem and motivation tests. Statistic: Student's T test and Pearson correlation

Results: 71 traumatic and non traumatic patients were examined (54 males and 17 females; mean age 47.5 ± 18.5 years; lesion level: 22 C, 11 L, 38 T; ASIA impairment: 25 A, 1 B, 13 C, 32 D). psychological variables were not correlated to ADL independence measures nor to age and lesion features. Male patients showed significant lower levels of depression at admission (5.5 ± 3.3 vs 7.5 ± 4 , $p < 0.05$) and higher levels of self-esteem

both at admission (46.8 ± 13 vs 35.8 ± 12.4 , $p < 0.005$) and discharge (52.9 ± 12.6 vs 42.2 ± 13.1 , $p < 0.005$) than female ones. Depression was significantly correlated with motivation level (Pearson P between $-.35$ and $-.47$, $p < 0.05$).

Conclusions: psychological distress in SCL patients does not seem to be related to clinical features or to ADL. Several other possible factors could influence the psychological status of these patients, both clinical (for example the presence of urinary and faecal incontinence and of pain) and social (having a family, the possibility to return to work).

P28

The ATLET study: Body-weight supported locomotor training improves walking function in subjects with incomplete spinal cord injuries

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Purpose of study: The ATLET study (NCT00854555) is an on-going single-blinded randomized intervention study to assess the effect of 1) manual or 2) robotic body-weight supported locomotor training in patients with stable motor incomplete spinal cord injury (SCI) on gait, overall ADL functions and perceived psychological variables as well as estimation of health care costs. This presentation gives findings from the pilot study of eight patients.

Methods: Six men and two women, seven with ASIA Impairment Scale C and one with grade D underwent on average 55 days of manual assisted body-weight supported locomotor training. Their mean age was 50 years, mean time since injury 3.7 years, and all used a wheelchair as their primary method of ambulation.

Results: All eight subjects showed improvement in their general condition. Five of eight subjects significantly improved walking function measured by 2 min walking test (mean change of $+27.60$ m ($p = 0.03$), 10 m walking test (mean change of -18.60 sek ($p = 0.04$) and stand-up-and-go test (mean change of -67.20 sek ($p = 0.02$)). Those with thoracic lesions ($N = 5$) showed greater improvement in general function than the three with cervical lesions. Those with an injury more than 1 year prior to locomotor training, showed the greatest improvement in function.

Conclusion: Body-weight supported locomotor training appears to have a positive influence on walking function in patients with incomplete SCI. This method of training could have major impact on future rehabilitation approaches. The effect of different modes of locomotor training on physical and mental functions, and on health care costs, need to be assessed.

P29

Characteristics of Spinal Cord Injury Rehabilitation in Sichuan Earthquake

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Introduction: The epidemiology of all traumatic Spinal Cord Injuries (SCI) in Iceland has been registered at the Rehabilitation Department at Landspítali, University Hospital

in Iceland since 1973. Road traffic accidents (RTA) have been the main single cause of injury and prevention strategies have mainly focused on RTA.

Purpose: To explore changes in the incidence, causes, age, gender and severity of SCI in Iceland from 1973 to 2008.

Subjects and methods: Data were collected from the SCI-register of the Rehabilitation Department on all traumatic SCI patients in Iceland from 1973. Total number of subjects was 191.

Results: The average incidence of SCI was 5.3 per year (appr. 18/million) during the whole period, increased to 7.6 per year (appr. 24/million) in 2001-2008. Men were 73%, women 27%. Mean age was 37 years. Forty four percent were from 5 to 30 years of age. Ten died within 10 days of injury. Fifty percent of the 181 survivors had AIS A,B,C classification and were wheelchair-bound. RTA was the cause of injury in 44% of all cases, whereof 21,4% occurred in 2001-2008, 31% were due to falls, 21% were due to sport/leisure activities, whereof 50% occurred in 2001-2008. Horse riding accidents was the main single cause of injury due to sport/leisure activities.

Conclusion: The results showed an increase in the incidence of SCI and a significant increase in injuries due to sport/leisure activities in 2001-2008. Prevention strategies need to focus more on sport/leisure activities with special emphasis on horse riding accidents.

P30

ICF based case studies in persons with spinal cord injury to illustrate the implementation of icf tools in multidisciplinary rehabilitation management

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Purpose: The ICF is the universal standard to describe functioning and disability. Functioning is at the starting point of rehabilitative strategies which aim to enable people with health conditions experiencing or likely to experience disability to achieve and maintain optimal functioning in interaction with the environment. However, to implement the ICF in clinical practice within a structured rehabilitation management process suitable ICF tools are needed.

The aim of the study was to develop ICF-based tools to facilitate the implementation of the ICF in the rehabilitation process and to illustrate the implementation of those ICF-based tools.

Methods: 15 case studies with persons with Spinal Cord Injury (SCI), varying in demographics, causes, severity and situations, have been performed. ICF tools have been developed for the project and used for the presentation of the rehabilitation management.

Results: An ICF Categorical Profile, an ICF Assessment Sheet, an ICF Intervention Table and an ICF Evaluation Display have been developed and integrated in the so-called Rehab-Cycle, a problem solving approach for the management of patients in rehabilitation.

Conclusion: The developed ICF tools allow the description of individual functioning states in persons with SCI, facilitates multidisciplinary rehabilitation management and the illustration of changes in the functioning states. However, challenges for further research exist. These are the classification of the 'personal factors', the assignment of

appropriate measures to ICF categories, the operationalization of the 'ICF qualifier' and the development of an ICF based electronically documentation system.

P31

Interdisciplinary Approach to Restoration of Upper Limb Function in Tetraplegia

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Synopsis: Cervical SCI accounts for approximately 50% of the 250,000 Americans living with SCI. Functional independence is a primary desire for these individuals with an overwhelming majority rating recovery of hand function higher than that of the bowel, bladder or sexual function. Studies have shown that even though restoration of upper-limb function in tetraplegia is a well described option, these techniques have been underutilized. Fewer than 355 surgeries are performed in the United States against a recommended rate of 2500. The clinical perspective of restoration of upper limb function will be reviewed from a physiatrist's point of view with emphasis on increasing awareness among providers about current options for reconstructive surgery and targeting appropriate patients. We will discuss barriers to care at both the patient and provider level with the goal of changing attitudes and improving access to a wider range of care. The surgeon's perspective will be presented including identification of surgical candidates, factors associated with good surgical outcomes, matching surgical procedures with patients and potential complications. Post-operative rehabilitation protocols will be discussed. Expected outcomes of transfer procedures will be described with measurements of strength and muscle activation. Evidence of muscle re-education following tendon transfer will be presented with emphasis on factors most affecting ability to perform functional tasks. As current measurement tools may not capture subtle changes in neurological function, future challenges include designing sensitive measurement protocols for most valid and reliable assessment and developing evidence-based criteria that guide treatment protocols for restoring upper limb function.

P32

Preliminary Experience with Body Weight Support Robotic Device in Incomplete Spinal Cord Injured Individuals

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Introduction: The use of body weight supported treadmill (BWST) robotic exoskeletal devices, the Lokomat, aim to tap into the nervous system's ability to restore itself via passively guided gait consistent with physiological patterns. We report our experience with 6 incomplete spinal cord injured (SCI) individuals.

Methods: All SCI individuals who were ASIA impairment scale of C and above who were non-functional walkers were included. Exclusion criteria included intolerance of upright posture, significant osteoporosis, and factors impeding ambulation. Subjects were put

on a daily or every other day walking program on the device, between 10-15 sessions.

Results/Outcomes: There were 4 tetraplegics and 2 paraplegics. The mean LEMS was 28.4. In terms of Lokomat training parameters, there was improvement in mean body weight support post training, (43.8kg to 11.3kg), speed of treadmill (1.8km/hr to 2.6km/hr), orthosis guidance force (98% to 55%), distance covered without fatigue (583.6m to 1352.2m) and duration of ambulation (21.4 min to 38.9min). The improvement in these parameters was dependent on performance and ability to tolerate the training. For overground walking ability, there was no change in FIM or WISCI scores in 3 subjects. There was improvement in 3 - FIM locomotor score improving from 1 to 3, 4 to 5 and WISCI 8 to 14 respectively. 2 subjects improved in the 6minute walk test.

Conclusion and Discussion: The use of the Lokomat is promising in improving walking ability in subjects with incomplete SCI. The optimal duration, intensity and degree of training has yet to be determined.

P33

Effect of body weight increase on energy expenditure in young complete spinal cord injured patients

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Introduction: Body mass increase is a common issue in the general population, however its effects on metabolism and physical performance in spinal cord injured patients has not been clearly evaluated yet. The purpose of this study is to investigate how body weight increase can affect energy expenditure in young complete spinal cord injured patients sustaining a sub-maximal effort.

Methods: A total of 4 (median age 29 years, median Body Mass Index 21) ASIA Impairment Scale A spinal cord injured paraplegic patients underwent a sub-maximal effort of 15 minutes in the wheelchair. Heart Rate (HR) and maximal oxygen consumption (VO₂max) were recorded by means of a Cosmed Fitmate Pro® device. Patients were analysed in 2 different conditions: A) sub-maximal effort with no additional weight; B) analogue testing with the addition of 10% patient's body-weight. The two conditions were tested after a resting period.

Results: HR and VO₂max values recorded during the two conditions were compared. Patients showed VO₂max values 15% higher during condition B) when compared with condition A).

Conclusions: An increase of 10% in body weight in paraplegic subjects significantly increased oxygen consumption during wheelchair propelling. Further research is warranted to understand the influence of body weight increase on wheelchair propelling efficiency.

P34

Oxygen Consumption, Satisfaction and Safety of Robotic-assisted Gait Training in Patients with Motor Complete Spinal Cord Injury

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Objective: Robotic-assisted gait training (RAGT) is reported to help restore the walking capabilities in spinal cord injury patients with motor incomplete injury (ASIA Impairment Scale (AIS)-C or D). The aim of our study is to evaluate oxygen consumption, satisfaction and safety of RAGT in patients with motor complete spinal cord injury (AIS-A or B).

Methods: 4 patients and 4 healthy adults were divided into 4 groups: 2 patients with motor complete injury (Group I-s), age, height and weight matched 2 healthy adults (Group I-h). 2 patients with motor incomplete injury (Group II-s) and matched 2 healthy adults (Group II-h). We evaluated heart rate (HR), rating of perceived exertion (RPE) and oxygen uptake (VO₂) on resting, standing and during RAGT. To evaluate satisfaction with RAGT the following parameters were surveyed by interview: discomfort of on and off; feeling of wearing; feeling of gait; satisfaction of gait training. We also evaluated the side effects such as skin problems and pain.

Results: In resting, HR, PRE and VO₂ were not different among 4 groups. HR, PRE and VO₂ in standing and during RAGT were highest in patients of group II-s and lowest in group I-s. Satisfaction with RAGT were highest in group I-s. There were no side effects in any of the 4 groups.

Conclusion: Patients with motor complete injury were very satisfied with RAGT compared with patients with motor incomplete injury or healthy subjects. It is possible that RAGT will be the effective training program for patients with motor complete injury in physical and psychological aspects.

P35

Influence of assistive technology services on the functional abilities and quality of life of people with spinal cord injuries in India

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Despite an increasing number of people with spinal cord injuries in India, there is very little concern regarding independent living and quality of life of these people who are living into community. The major purpose of this study was to investigate the influence of assistive technology services on the functional abilities and quality of life of this group. Participants were enrolled by random sampling from last 5 years of medical records from the Indian Spinal Injuries Centre (ISIC), Delhi and from the local community within 20km from ISIC. These subjects were divided into two groups of 30. Group one was experimental, and received assistive technology services regarding better mobility, seating and other needed assistive devices with training at Assistive Technology Centre at ISIC, while the other group was the control. Data were collected 3 times; at the time of AT services delivery, and at 2 and 6 months post-AT services delivery from the experimental group and from the control group over phone and email. The instruments used were Test

of ADLs and WHO Quality of Life Index, (modified). Results demonstrated that functional abilities in the experimental group were significantly different after AT services delivery and at 2 and 6 months. In the control group, scores of functional ability were much lower. There was a significant difference in QOL in the experimental group compared to the control group. All results provided evidence for developing AT services delivery system in each SCI care specialized hospital/rehabilitation centre to maintain and enhance the functional abilities and QOL of people with SCI.

P36

Effects of a robot-mediated locomotor training on emg activation in healthy and sci subjects

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In order to assure stepping repeatability, the robotic gait orthosis Lokomat was recently added to the body weight support (BWS) treadmill training, in spinal cord injured subjects (SCI) rehabilitation. This paper presents the muscular recruitment using the Lokomat system. Methods. Twelve control subjects and two SCI, ASIA Impairment Scale (AIS) D level L1 and D4, were recruited. Each subject performed both robot-assisted and unassisted treadmill exercise, at different velocities and 30% BWS, with a surface EMG recording from rectus femoris (RF), biceps femoris (BF), tibialis anterioris (TA) and medial gastrocnemius (GA), bilaterally. During Lokomat training the subject was asked to stay relaxed ("Passive") or to help the robot ("Active"). SCI underwent a 4 week of Lokomat training and were assessed before, at the end of the training and after three months. Results. Control subjects: in "Passive" there is proximal muscle poor recruitment; in "Active" both distal and proximal muscles increased activation. SCI: an improvement in the ambulatory function was observed. In "Active" "Pre-training" there is only a RF poor activation, but in "Post-training" a good recruitment in all muscles. In "Post-training" only one subject could perform "Without" mode: the muscular recruitment was similar to the control subjects and qualitatively similar to the "Active". The EMG "Follow-up" is similar to the "Post-training" one. Conclusions. In "Active" a higher recruitment than in "Passive" is present and the Lokomat therapy in SCI improves muscular recruitment and functional capacities, even three months after the training ends.

P37

Development of a new motor-driven rowing machine for the patients with spinal cord injury

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Objective: FES assisted rowing has already been reported as an effective training tool to increase cardiovascular endurance in persons with spinal cord injury (SCI), but it has the problem of rapid muscle fatigue. Some patients can't achieve the muscle power needed to move a rowing machine by FES. Therefore, we developed a new motor-driven

indoor rowing equipment.

Methods: The prototype MOTOR-ROW system is a modified standard rowing ergometer (Concept II). MOTOR-ROW consists of a reclining seat, specialized seat cushion and harness, 7-inch visual feedback monitor, thumb operated start-stop button and velocity control button. We designed a motor-driven auto moving (back and forward) seat according to the leg length of patients. 5 healthy adults were included. We compared the 3 types of test: Upper-extremity rowing only in a fixed seat (Test 1). Upper extremity rowing without using leg muscles in the auto moving seat (Test 2). Upper extremity rowing using leg muscles with the auto moving seat (Test 3). Participants underwent one 20-minute rowing session in each test at a heart rate up to 50% of their maximal heart rate. We measured mean oxygen uptake (VO₂) (ml/kg/min) and peak oxygen uptake (VO_{2peak}) (ml/kg/min) using a portable oxygen analyzer (K4, COSMED, Italy) during rowing.

Results: VO₂ of Test 3 (10.99 ± 1.29) was higher than VO₂ of Test 1 (6.66 ± 1.36) and Test 2 (8.46 ± 1.81). VO₂ of Test 3 (13.69 ± 0.91) was higher than VO₂ of Test 1 (7.48 ± 1.39) and Test 2 (9.67 ± 1.11).

Conclusions: The newly developed MOTOR-ROW may be an effective aerobic exercise tool especially for patients with weak lower extremity motor power.

P38

The individuals' perspective of functioning and disability in SCI

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Objective: The objective of this study is to explore and document the aspects of functioning, disability and health relevant to individuals with spinal cord injury (SCI) using a comprehensive ICF-based approach (WHO, 2001).

Methods: A multicenter qualitative study was conducted with individuals with SCI in the early post-acute or the chronic context undergoing rehabilitation in the participating facilities in Switzerland (Biering-Sorensen et al 2006). A focus group process based on the ICF was applied to gather information on individuals' functioning. The responses of the patients were linked to ICF categories utilizing established linking rules (Cieza et al. 2005).

Results and discussion: 9 focus groups with 48 participants were performed. As a result, according to preliminary analysis, a list of ICF categories was obtained that reflects the relevant areas of functioning in individuals with SCI in their own experience. The resulting list was stratified according to the phases of the early post acute and chronic context. Unique categories and overlaps between the two phases are shown. The resulting list of ICF categories can serve as a reference criterion for person-centeredness in clinical and research settings.

Conclusions: A broad range of individual experiences of persons with SCI is covered by the ICF. Comprehensive ICF-based information about functioning and health from the patients' perspective can help clinicians and researchers to ensure that assessments, treatments and research priorities are person-centered.

P39

SAVE (sheffield assisted ventilation) scale, a tool for describing ventilatory requirements in spinal cord injury

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Communication failure plays an important role in causing medical errors. Clinical communication is complex and prone to error, especially during transitions of patient care and emergent situations.

Incidence of spinal cord injury requiring ventilatory support is increasing. To our knowledge there is no easy and effective way of grading a spinal cord injured individual's ventilatory needs. Their ventilatory requirements affect the amount of care they need as in-patients, for inter-hospital transfer, their discharge planning and integration back into the community.

We propose an easy and effective grading system for assisted ventilation requirements in spinal cord injured patients. Sheffield Assisted Ventilation (SAVe) scale, grades the ventilatory support requirement in spinal cord injured patient into six categories depending upon the amount of time an individual spends off the ventilator and mode of ventilation.

A survey was carried out to look into different aspects of this scale. Medical staff, nursing staff, therapy staff and community liaison and managerial staff from three different regional spinal injuries centres was requested to look into the scale's simplicity, effectiveness as a communication tool, comprehensiveness and overall usefulness. On a scale of 1 to 5 with one being strongly disagree and 5 strongly agree, SAVe scored 4.64 for simplicity, 4.28 for its effectiveness as a communication tool, 3.84 for its comprehensiveness and 4.10 for its overall usefulness.

Communication patterns are highly variable and influenced by multiple factors. Standardized approaches and tools may provide potential solutions to improve the quality of communication and prevent subsequent patient harm.

P40

The capabilities of upper extremity test (CUE-T): factor structure and item-test characteristics

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Purpose: To fill the need of an objective test of upper limb function in spinal cord injury (SCI), the CUE-T, a test of arm and hand actions, was developed. This study evaluates CUE-T factor structure and item characteristics.

Participants/methods: Thirty adults with SCI, neurological levels C4-T6, were tested on one occasion. Test procedures were developed based on items in the CUE questionnaire, with a few additional items. Most items were scored based on time or number of repetitions in 30 seconds. Items were then rescored on a 0-4 scale and internal consistency was evaluated by Cronbach's alpha. Factor analysis was used to assess

dimensionality. Two-dimensional item response theory (IRT) analyses were used to evaluate item difficulty and discrimination.

Results: There were 23 males and 7 females with an average age of 44.8 years. Twenty subjects were motor complete; 13 had motor levels C4-C6, 13 between C7-C8 and 4 were T1 or below. The test consisted of 20 items, 18 unilateral and 2 bilateral. Cronbach's alpha for the CUE-T was 0.96. One factor accounted for 44% and two factors 59% of the variability in items. Hand items and lifting loaded on the one factor and arm items on the other. IRT analyses showed that push/pull items were the easiest and manipulation and thumb items the hardest. Grasp items had the highest discrimination.

Conclusion: The CUE-T has high internal consistency and most items load with the theorized factor (hand vs. arm). Reliability and responsiveness testing on a larger sample is underway.

Support: This project was supported by NIDRR, OSERS, Department of Education grant #H13N060011

P41

Traumatic spinal cord injuries during 1952-2001 in western norway

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Purpose of the study: To study the incidence and demographic characteristics of patients with traumatic spinal cord injuries (TSCI) in an unselected, geographically defined cohort of patients in the period 1952-2001.

Methods: Retrospective population-based epidemiological study. The patients were identified from the records of all hospitals in the region.

Results: A total of 336 patients (59 women and 277 men) were included. The average annual incidence rate increased from 7.7 per million in the first decade to 21.0 per million in the last decade. Falls was the most common cause of injury (45.5%), followed by motor vehicle accidents (34.2%), other injuries (11.6%) and sports injuries (8.6%). The number of injuries caused by motor vehicle accidents and falls increased, especially during the last decade. The proportion of work-related TSCI was reduced from 44% in the period 1952-1961 to 9% in the period 1992-2001. The median age at time of injury was 40.2 years; 39.2 years for men and 47.2 years for women. The level of lesion was cervical in 52.4%, thoracic in 29.5% and lumbar/sacral in 18.2%. The neurological level of lesion was clinically incomplete in 58.6% and complete in 41.4% of the cases. The proportion with cervical incomplete lesions was highest among patients older than 50 years.

Conclusions: The annual incidence of TSCI has increased in Western Norway during the last 50 years. The high proportion of older patients with cervical incomplete lesions poses a special challenge for the health system.

P42

Spinal Cord Injuries In UAE

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Retrospective study to address SCI in UAE and the 6 yrs experience of Neuro Spinal Hospital which is a premier Neuroscience center in the gulf.

P43

25 years or more following traumatic spinal cord injury: clinical conditions of individuals in Florence and Stockholm areas

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Introduction: Today SCI patients live almost a normal lifespan, therefore it is important to avoid complications to achieve a good quality of life even later on. The aim of this study is to analyse the health situation in individuals 25 years or more following traumatic SCI in Florence and Stockholm and compare their outcomes.

Methods: Data from the computerized database at the Spinal Unit of Florence and the Spinalis unit in Stockholm, were analysed. They included age at injury, factual age, neurological level, AIS, complications such as pressure sores, bone fractures, spasticity, neuropathic pain, hypertension, cardio vascular diseases and diabetes mellitus.

Results: 66 italian patients(IP) and 74 swedish patients (SP) AIS A-C were included. In both populations M/F ratio was 4:1, 60% were paraplegics and 40% tetraplegics, 75% AIS A and 25% AIS B-C. The most common complications were pressure sores (59% of IP and 57% of SP), followed by bone fractures (18% of IP and 24% of SP). Spasticity occurred in 67% of IP and in 64% of SP. Neuropathic pain was present in 32% of patients in both groups. Prevalence of hypertension was 6% and 10% respectively, diabetes mellitus in IP 6% and in SP 10% and cardiovascular diseases in 6% and 9% respectively.

Conclusion: Pressure sores, bone fractures are main complications after SCI. Only small differences were found between IP and SP. Many patients are otherwise "healthy" 25 years or more post-injury.

P44

Work Related Traumatic Spine Cord Lesions in Chile, a 20 Year Epidemiological Analysis

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Study design: Retrospective cohort study

Objective: To describe patients with work related traumatic spine lesions (TSCI) in Chile.

Setting: Hospital del Trabajador, Santiago, Chile

Method: Patients suffering work related TSCI from 1986 to 2005 were identified through the records of the Asociación Chilena de Seguridad (Chilean Security Association).

Outcomes: The medical records of 229 patients, (220 men and 9 women) were analyzed. The yearly average incidence was 10.8 per million workers. Age at TSCI onset was 37.8 \pm 12.0 years, the number of accidents in the work place were 173 (75.5%) patients, and accidents en route to or from work 56 (24.5%). The principal external causes for TSCI in the workplace were falls from height in 86 cases (49,7%) and trauma strikes to the vertebral spine in 61 cases (35,3 %). Most falls occurred in construction, and other traumas occurred in trauma blows with tree trunks and stones in forestry and mining sectors. Mortality in this series was 7.9%, and the worst prognosis was for older patients with complete tetraplegia. The Paraplegia / tetraplegia ratio was 3.2 / 1.

Conclusions: The characteristics of workplace TSCI are different from those reported for the general population. It is important therefore to develop prevention programs for specific work related TSCI.

P45

Correlations between icf, whodas-ii and sf-36 in spinal cord injury patients

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Aims of this study were to assess: quality of life (QOL) and perceived disability in spinal cord injured patients, the relations between these two variables and the relation between perceived disability and objective clinical conditions.

Two questionnaires, SF-36 and WHODAS II, were administered to 50 patients admitted in our Department between February and December 2006 to determine their QOL with reference to health status and perceived disability. These data were then compared with the ICF evaluation of functioning and disability, to provide a descriptive diagnostic framework of the subjects clinical condition. Since ICF is not a psychometric tool, we could not obtain a total score (as for SF-36 and WHODAS II), therefore we referred to its "B1" section to compare the degree of physiological functioning damage (0 to 4) with the scores gained from the other two questionnaires.

Overall our results confirmed that SF-36 and WHODAS II were reciprocally related: particularly, WHODAS II total score was strongly correlated to SF-36 ISF (Kendall's Tau - 0.47, $p < .001$) and moderately correlated to SF-36 ISM (Kendall's Tau - 0.24, $p = 0.026$). Our results showed also a strong correlation between ICF and WHODAS II scores, indicative of an association between clinical damage assessment and patient perceived disability (Kendall's Tau - 0.39 $p < 0.001$). Finally, ICF results were also correlated to SF36 ISF (Kendall's Tau - 0,45; $p < 0.001$), while they were not to SF-36 ISM.

Our data confirm that WHODAS II is a useful and sensitive instrument to evaluate perceived disability, clinical condition and QOL in disabled population.

P46

Traumatic spinal cord injuries in Estonia from 2003 to 2007

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Background: The aim of the study was to provide data on the incidence, causes and severity of traumatic spinal cord injury (TSCI) in Estonia from 2003-2007.

Patients and Methods

The medical records for all patients with TSCI in Tartu University Hospital and in North Estonia Medical Centre from 2003-2007 were retrospectively studied. The incidence of TSCI was expressed per 1 000 000 Estonian population (census 2000).

Results: A total of 191 patients with TSCI (32 women and 159 men) were registered. The mean age at onset of injury was 37.8 (SD 16.9) for men and 43.3 years (SD 19.0) for women. The annual incidence rate was 34.1 (95%CI 29.4 – 39.3) for all, 63.1 (95%CI 53.7-73.7) for men and 10.4 (95%CI 7.1-14.6) for women. Most cases were from the age group 15-24 years among men (27%) and 35-44 years among women (28%). The most frequent cause of TSCI was fall (42%). Alcohol preceded TSCI in 50% of cases. Incomplete paraplegia occurred in 28% of cases

Conclusions: Compared to other studies the incidence rate of TSCI in Estonia is high. TSCI were related to alcohol in half of the cases. Falling was the main cause of TSCI. Like in other studies incomplete paraplegia was the most frequent outcome of the TSCI.

P47

Epidemiology of Spinal Cord Injuries in Iceland 1973-2009

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Introduction: The epidemiology of all traumatic Spinal Cord Injuries (SCI) in Iceland has been registered at the Rehabilitation Department at Landspítali, University Hospital in Iceland since 1973. Road traffic accidents (RTA) have been the main single cause of injury and prevention strategies have mainly focused on RTA.

Purpose: To explore changes in the incidence, causes, age, gender and severity of SCI in Iceland from 1973 to 2008.

Subjects and methods: Data was collected from the SCI-register of the Rehabilitation Department on all traumatic SCI patients in Iceland from 1973. Total number of subjects was 191.

Results: The average incidence of SCI was 5.3 per year (appr. 18/million) during the whole period, increased to 7.6 per year (appr. 24/million) in 2001-2008. Men were 73%, women 27%. Mean age was 37 years. Forty four percent were from 5 to 30 years of age. Ten died within 10 days of injury. Fifty percent of the 181 survivors had ASIA A,B,C classification and were wheelchair-bound. RTA was the cause of injury in 44% of all the cases, whereof 21,4% occurred in 2001-2008, 31% were due to falls, 21% were due to sport/leisure activities, whereof 50% occurred in 2001-2008. Horse riding accidents was the main single cause of injury due to sport/leisure activities.

Conclusion: The results showed an increase in the incidence of SCI and a significant increase in injuries due to sport/leisure activities in 2001-2008. Prevention strategies need to focus more on sport/leisure activities with special emphasis on horse riding accidents.

P48

Comparison of incidence of spinal cord injury (SCI)

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Objectives: To understand the practical implication of incidence of SCI against casualties of China's two major earthquakes in Tangshan (1976) and Sichuan (2008).

Methods: Numbers of deaths, wounded and SCI were compared and analyzed.

Results: There were 240, 000 deaths and 530, 000 wounded in the TE whilst 100, 000 and 10, 000 respectively in the SE. In the latter case, the death/wounded ratio was significantly reversed (Chi Sq <0.001). The surviving SCI among total casualties (death/wounded) was 5, 000 to 770, 000 (0.65%) in TE, whilst 200 to 110, 000 (0.18%) in SE. The rate of surviving SCI was much lower in the SE and the difference is significant (Chi Sq <0.01). The rescue team arrived at the epi-centre in TE within 24 hours whilst did not arrive until the 8th day in SE.

Discussion: The main cause of death/wounded was the same in both earthquakes. It was being hit by falling heavy object. The huge difference in death/wounded ratio and surviving SCI/total casualties ratio between the two earthquakes could be explained by the time between the disaster and the arrival of rescue teams. TE occurred in a flat plain, whilst SE in treacherous landscape, where the only narrow roads available along the edge of mountains were all blocked. Special heavy-lifting helicopters transporting road-clearing equipment played a pivotal role in this unique landscape. Such a helicopter was not available in the first few days. Governments of countries with possible earthquakes in such a landscape should get prepared for all eventualities in the future.

P49

Traumatic spinal cord injuries in Turkey: an epidemiological study

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Objective: To investigate the epidemiological features of traumatic spinal cord injured patients in Turkey and determine the risk factors.

Material and Method: Data of 709 traumatic spinal cord injured patients who have rehabilitated in GATA Rehabilitation Center between 2000 and 2007 were searched retrospectively. Etiology, patients age, hospitalization duration and neurological levels were noted.

Results: 551 patients were men and 158 were women. Mean age of patients were $31,26 \pm 13,12$. Mean hospitalization duration were 75,56 days. The most common etiological factor is motor vehicle accidents (50,5%), the second most common factor is

falls (%24,0) and the third is gun shots (%15,5). The most common neurological level is C-5(%11,7), second most common neurological level is ? (%10,3). ASIA Impairment Scale (AIS) A (61,9%) was the most and AIS E (%0,4) was the least common AIS classification.

Conclusion: Considering that motor vehicle accidents and falls were found to be the leading causes of traumatic SCI, it was concluded that the prevention measures should be focused mainly on these in order to reduce the frequency of SCI in Turkey.

P50

Clinical profile of spinal cord injury patients in Jordan

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Introduction: Spinal cord injury (SCI) is one of the most devastating injuries that afflict young people at the height of their social and working life. It is a multi system injury which leads to significant morbidity and mortality.

Objective: This study aims to describe the pattern and the morbidity trends in individuals with acute SCI and its association with demographic characteristics .

Methods: The medical records of 195 patient with SCI who were newly admitted during 2000-2006 were enrolled in this study .

Their demographic data and causes of injury were analyzed .

The causes of morbidities surveyed were renal complications, respiratory, complications, pressure sores, spasticity, thromboembolic complications, and neurogenic pain.

Results: A total of 195 cases were reviewed . The majority were predominantly males (78%).

The male\female ratio was 3,4:1. The mean age at the time if injury was 23 years, with a range from 3-80 years.

The vast majority had traumatic injuries (87%) and the leading cause of injury was road traffic accidents. The other 13% were of non - traumatic cause .

Of all the morbidities studied, pain was the dominant cause (45%) followed by urinary tract infection (30%), pressure sores (25%), spasticity (23%), thromboembolic complications (18%) and respiratory complications (10%).

Conclusion: Spinal cord injuries in Jordan affect mainly young adult males.

Road traffic accidents are the leading cause of traumatic injuries .The most common complications are neurogenic pain, urinary tract infections and pressure sores.

P51

The situation of spinal cord injured persons in Ukraine

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Ukraine has a population of about 45 million, but lacks official statistics for incidence and prevalence of spinal cord injured patients. Our investigation shows a difference in incidence between different regions. Ukraine has no uniform standard of treatment or

rehabilitation for SCI patients. The treatment and rehabilitation the patient receives depends on the individual hospital. Usually SCI patients are admitted to a neurosurgical department for 3 weeks to 5 months. After this period only a few receive rehabilitation, and the majority are just discharged home. The situation is made even more difficult in that there is no uniform education of physical therapists, and even if students do obtain proper education comprising both physical and occupational therapy, there are no posts available. This lack of rehabilitation results in many complications such as pressure wounds, contractures and urinary system complications.

Regarding aid supplies, there are only two companies that produce wheelchairs, and only one of these makes the active type of those. Patients can wait up to two years to receive a wheelchair. Furthermore, incontinence aid is guaranteed only for SCI patients who were injured at work.

During the last few years Ukraine has begun adjusting society for wheelchair accessibility, although only in large cities. Progressively more SCI patients are rejoining the community by studying and working. This is partially a result of the project which Rekryteringsgruppen, a Swedish spinal cord organization, introduced to Ukraine in 1992.

P52

The Stockholm Thessaloniki Acute Traumatic Spinal Cord Injury Study (STATSCIS): Late mortality during the first year post-trauma.

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Purpose: To evaluate late mortality (occurring after the first week post-trauma) during the first year after acute TSCI in two European Union regions, Thessaloniki in Greece and Stockholm in Sweden.

Methods: A prospective, population-based study. Annual incident cohorts of TSCI cases (64 cases in Thessaloniki and 32 cases in Stockholm) who had survived the first week post-trauma were identified through STATSCIS. Each case was followed-up for the first year post-trauma.

Results: Annual TSCI-related crude mortality rate in Thessaloniki was 18.75% and 0% in Stockholm. Mean time of survival after trauma for the 12 mortality cases of Thessaloniki was 47 days (Range=8-228). Mortality peaked during the 3rd and 4th weeks after trauma, and was most often due to infections causing sepsis and multi-organ failure.

Conclusions: Annual TSCI-related crude mortality rate in Thessaloniki was dramatically higher than in Stockholm. The differing care systems, one centralized and structured and the other not, is postulated to be an important factor leading to such major discrepancies between these two EU regions.

P53

Etiology of spinal cord injuries in sub-saharan africa: a literature survey

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Introduction: The aim of this study is to highlight the epidemiology of spinal cord injuries (SCI) in Sub-Saharan Africa in order to improve prevention strategies.

Methods: Pubmed was searched over September and October 2008. A combination of the following MeSH-terms was used: "Africa South of the Sahara", "Spinal Cord Diseases", "Paraplegia", "and SpinalCord Injuries". Limits were set on articles published as from 1990. The World Health Organization (WHO) -database was also consulted.

Results: We obtained 225 hits of which 11 articles were relevant to the case.

In traumatic spinal cord injuries motor vehicle accidents are the most frequent cause followed by falling from an altitude and thirdly shot- and stab-wounds, being the most important cause of SCI in South Africa.

For the non-traumatic SCI we mapped the different diagnostic methods. In general, tuberculosis appeared to be the most important cause, followed by malignant illnesses. HIV serology tests were only available in the article from Ethiopia, which explains the important prevalence of myelitis in this country.

There were relatively more men involved in traumatic spinal cord injuries and the average age was higher than in the non-traumatic group.

Discussion: Although literature on the subject is often scarce and deficient, it is clear that prevention should focus on road safety, tuberculosis and HIV.

There is also a great need for implementation of uniform classification methods as proposed by the WHO and better registration in order to obtain absolute figures about the incidence of SCI and proportion of traumatic and non-traumatic spinal cord injuries.

P54

Trends in traffic accidents among spinal cord injury in Finland

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Aim: To describe trends in traffic accidents among patients with traumatic spinal cord injury (TSCI) over 30 years.

Patients and methods: Cases aged 16 years and older sustained a TSCI in 1976-2005 and were admitted to Käpylä Rehabilitation Centre, Helsinki. Data were gathered from clinical records in the rehabilitation centre.

Specific etiologies were grouped as traffic accidents, falls, diving and other. Demographic and injury severity trends were analyzed by year of injury groupings according to decades (1976-1985, 1986-1995, 1996-2005).

Results: A total of 1647 TSCI patients (1362 men and 285 women) were analyzed. Of these 650 (79.8 % male and 20.2% female) were traffic accidents. The most common etiology was car accidents (62.2%) followed by motorcycles (15.8%), bicycles (12.9%), runners (4.6%) and all others (4.4%). Crashes of automobiles and motorcycles were the

most common causes among the age groups 16 to 30 years. Injuries due to automobile and bicycle were the most common etiology for those from 31 to 45, 46 to 60 and 65 to 75 years. The percentage of car accidents decreased significantly among the age groups 16 to 30 over time. A significant increase existed in the percentage of cases because of bicycles among male and for ages over 46 years. Tetraplegia (54.3%) and incomplete injuries (56.3%) occurred more than paraplegia and complete injuries.

Conclusion: Prevention strategies should continue, but changes in etiology should also take into account in prevention efforts.

P55

Association between cervical vertebra dynamic factors and unilateral or asymmetrical symptoms in upper limbs in patients with cervical disk disease

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Introduction: In order to determine the onset mechanisms responsible for unilateral or asymmetrical neurological symptoms in upper limbs in cervical disk diseases, we performed 3 Dimension Computed Tomography (3D-CT) in the neutral and retroflexed positions. We then examined the association between cervical vertebra dynamic factors with the onset of the neurological symptoms.

Materials and Methods: We selected 12 patients with unilateral or asymmetrical neurological symptoms in their upper limbs. These represented 5 cases of mono-segmental fusion and 7 cases of bi-segmental fusion, and surgery was performed for 2 cases at C4-5 level, 10 cases at C5-6 level, and 7 cases at C6-7 level. CT was performed at a 0.5 mm slice thickness for the neutral and retroflexed positions, after which we performed volume rendering. The inclination between vertebral bodies was measured and compared (unilateral spondylolisthesis) by drawing a line perpendicular to the line which connected the transverse processes of each vertebral body on the 3D-CT frontal view. We also examined instabilities such as misalignment or gaps of facet joints in the neutral and retroflexed positions.

Results: Of a total of 19 facet joints, instabilities or unilateral spondylolisthesis of unilateral facet joints were observed in 11 in the retroflexed position.

Conclusions: We conclude that instabilities or unilateral spondylolisthesis in unilateral facet joints in the retroflexed position can influence the onset of neurological symptoms.

P56

Surgical outcomes of three cases with retro-odontoid pseudotumors

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A retro-odontoid pseudotumor is a reactive fibrocartilaginous mass formed posterior to the odontoid process. Although it is thought to develop subsequent to chronic atlantoaxial instability, its pathomechanism has not elucidated as yet.

We report surgical outcomes of 3 patients who suffered from myelopathy due to the retro-odontoid pseudotumor. All patients were women and mean age was 74.2 years. On radiographical examinations, each patient had an atlantoaxial instability and a retro-odontoid pseudotumor compressing the spinal cord at the C1 level. Decompression of the spinal cord by resection of the posterior arch of the atlas was performed for each patient. In two cases, occipitocervical fusion (O-C3) was performed additionally. In this study, we obtained mainly two results: (1) Whether the occipitocervical fusion were performed or not, neurological improvements were obtained in all patients. Mean recovery rate of the Japanese Orthopaedic Association score was 76.4%. (2) Apparent reductions of the pseudotumor were observed only in two cases with fusion. In one case without fusion, the size of the pseudotumor was not changed.

P57

Surgical treatment of the ossified posterior longitudinal ligament of the cervical spine.

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We report our recent surgical strategies for patients with ossified posterior longitudinal ligament (OPLL) of the cervical spine. From January to December 2008, we have experienced 66 surgical cases with cervical disorders at the Southern TOHOKU General Hospital, Iwanuma, Miyagi. Nine cases were diagnosed as cervical OPLL. Six cases were treated by anterior approach; keyhole corpectomy followed by fusion with a large (10-14mm-diameter) cylindrical titanium cage or corpectomy followed by reconstruction with a titanium mesh cage and an anterior plating. The rest of the cases (3cases) were treated by posterior approach; expansive laminoplasty with hydroxyapatite or titanium spacers. Anterior approach was considered suitable for the patients with one or two intervertebral disc level lesion, whereas the posterior approach, for over three intervertebral disc level lesion. Complete recovery of the symptoms was achieved in 6 (66.7%) of the 9 patients. No major neurological complication was noted during this period, and there was no radiological problem including cage subsidence, adjacent disc lesion, and malalignment during the follow up periods. Although surgical treatment of the cervical OPLL is sometimes complicated, satisfactory outcome will be expected when the surgical strategy is appropriately selected in each patient.

P58

The clinical study of repairing cauda equina fibers after lumbar fracture and dislocation

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Study Design: a retrospective study.

Objectives: To study the outcome of repair of cauda equina fibers with fibrin glue after lumbar fracture and/or dislocation.

Methods: Eight cases of L2 or L3 fracture and/or dislocation were complicated with complete cauda equina injury. Sural nerve or sensory roots of injured cauda equina was chosen to repair the motor cauda equina fibers with fibrin glue after open reduction and internal fixation (ORIF) of the injury. The functional recovery following the surgery was observed.

Results: The recovery of thigh muscles strength (Iliopsoas, Quadriceps femoris, Gluteus maximus, Adductors) was observed in fresh injured patients, but not in chronic cases. No recovery of leg muscles and sensation of the lower extremities were observed in any case.

Conclusions: The injured cauda equina motor fibers after lumbar fracture and/or dislocation could be repaired with fibrin glue and motor recovery expected.

P59

Cervical hemilaminoplasty for cervical myelopathy

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Cervical laminoplasty is one of the surgical procedures for cervical spondylotic myelopathy, cervical ossification of the posterior longitudinal ligament (OPLL) and cervical spinal cord tumor, and good operative results have been reported. In our hospital, the hemilaminoplasty have been applied for cervical lesions. In this series, the operative results of the cervical hemilaminoplasty are reported.

Thirty-seven cases operated on by hemilaminoplasty were reviewed at the average follow-up period of 16.9 months. There were 28 males and 9 females. The average age was 72.2 years old. The lesions were as follows: cervical spondylotic myelopathy 24, cervical OPLL 12 and cervical cord tumor 1. The mean operating time was 2 hours 18 minutes (1 hour 50 minutes - 2 hours 45 minutes) and the mean bleeding volume was 355ml(240ml - 1080ml). Complications were found in 6 cases; post-operative C5 root palsy in one case and axial pain in 5 cases. The average recovery rate was 57.7%. Five cases among 7 cases with gait disability regained that ability after surgery. The space of the cervical canal per 1 disc level changed from 0.85cm² to 1.825cm² post operatively on the CT examination.

It is concluded that the cervical hemilaminoplasty is a useful surgical procedure for cervical compressive lesions because of the good operative result and less severe complications.

P60

Long tract reconstruction of transected spinal cord gap using artificial collagen-filament scaffold

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Introduction: Histological examination of the traumatically injured spinal cord reveals structural damage including discontinuity of long tracts in white matter and cavitations

in gray matter. Axonal regrowth beyond the lesion is necessary in order to achieve functional recovery following spinal cord injury (SCI). We report here the development of an artificial collagen filament (CF) scaffold to treat SCI in rats with complete injury.

Purpose: The aim of this study is to examine the treatment effect of CF transplantation.

Materials and Methods: The CF scaffold was placed between the stumps and parallel to the long axis of the spinal cord. Electrophysiological examination of motor evoked potential (MEP) and histological examination were performed at intervals of a week to 8 weeks after SCI.

Results: Three days after surgery, host cells (new vessels, neuronal and glial cells) already migrated into CF. Eight weeks after implantation, matured and myelinated nerve fibers were found in the scaffold. In addition, 10-25% of rubro-spinal tracts were repaired. Electrophysiologically MEPs were recorded in CF-grafted rats but were not detectable in nongrafted rats. These results suggest that CF provide a permissive microenvironment for the elongation of spinal cord axons and support the process of spinal cord regeneration.

Conclusions: This scaffold is more suitable for clinical use in the patients with SCI rather than other scaffolds that have been reported to date. Because the simple collagen structure is biocompatible with humans, it may be an effective substrate for regeneration after SCI.

P61

The 3D-MRI/MRA/CT fusion Image of spinal disorders

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We combined 3D-CT images of bone construction with 3D-MRI/MRA of both neural architecture (cauda equina and nerve roots) and vessels using Virtual Place software (AZE, Tokyo, Japan). We have succeeded in producing images that constitute 3D-MRI/MRA/CT fusion imaging.

Positional relationships between intervertebral discs, spinal nerve tumor, bone tumor or bony spurs and nerve roots/spinal cord could also be depicted. We present herein several cases (Chordoma of C1 vertebra, Schwannoma of C2 nerve root, neurilemoma of sciatic nerve, radiculopathy of degenerative lumbar scoliosis, ankylosing spinal hyperostosis, etc) in which noteworthy findings were observed.

3D-MRI/MRA/CT fusion imaging of spinal disorders successfully depicted the relationship between bone construction (bones, bone tumor, intervertebral joints, and intervertebral discs), neural architecture (spinal cord, cauda equina and nerve roots), and vessels on a single piece of film, three-dimensionally and in color. Such unique images will be useful in elucidating the clinical condition of complex neurological conditions such as spinal nerve tumor, bone tumor, ASH, and degenerative lumbar scoliosis, as well as in diagnosis and the planning of minimally invasive surgery. This is a groundbreaking method that enables both bone and neural architecture to be viewed simultaneously, and an even greater merit of these images is that they are produced using minimally invasive scanning methods without the use of contrast media. Some issues, however, remain to be solved, including reducing the time required for image production and improving image quality. Virtual images have thus enabled the visualization of previously inaccessible anatomical

locations and depiction in detailed images.

P62

Post traumatic tethered cord : clinical and radiological features

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Objectives: To describe population, clinical and radiological data, and to discuss pathological mechanisms and preventive and therapeutical options in patients with a non cystic post-traumatic tethered cord.

Methods: systematic analysis of clinical and radiological (CT and MRI scans) data of all patients operated on for their symptomatic post-traumatic, non cystic tethered cord. For each patient, data were collected prospectively, from the initial trauma to the post-operative (cord release) period. All patients had operations on their tethered cord, with extended laminectomy, spinal canal realignment, untethering, and expansile duraplasty.

Results: 8 patients (3 tetraplegics and 5 paraplegics) presented with a post-traumatic tethered cord. ASIA impairment scales were A: 4, B: 1, C: 2, D: 1. Symptoms of the tethered cord were progressive myelopathy with motor loss in the 3 tetraplegics, and severe, refractory, at-level neuropathic pain in the 5 paraplegics. MRI showed a tethered cord in all patients. Anatomic correlation between signs and spinal canal stenosis in CT scan or tethered cord in MRI was present in 7 patients.

Surgery stopped the progression of the myelopathy in the 3 tetraplegics, and dramatically reduced the pain in all but one paraplegics. Mild recurrence of pain, consistent with re-tethering, occurred in 3 patients, and infection in 2.

Conclusion: Post-traumatic tethered cord can present with subacute motor loss (myelopathy), but also isolated at-level neuropathic pain. Meticulous decompression and realignment in the acute phase of the SCI might prevent the tethering of the cord and roots. Surgery, with untethering and duraplasty, is an effective treatment, but re-tethering is frequent and poorly controlled.

P63

Clinical characteristics of ossification of the posterior ligament

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Purpose: To describe the characteristics of clinical manifestations and associated diseases in Korean patients with ossification of the posterior ligament(OPLL).

Methods: Clinical characteristics and radiological findings of 70 patients with OPLL were analyzed. The presence of other diseases, coexisting with OPLL was also investigated.

Results: Male to female ratio was 59:11(5.36:1). The average age for males was 58 and the average age for females was 57. Most common type was segmental accounting for 42.9%(30) of the patients and the most commonly involved levels were C5,C6, and C4 in that order of frequency. Diffuse idiopathic skeletal hyperostosis was found in 22 patients, ossification of the yellow ligament in 7, and ankylosing spondylitis in 3. Diabetes

Mellitus was also noted in 14 patients.

Conclusion: Clinical characteristic of Korean OPLL patients were similar to previous reports of Japanese patients.

P64

Traumatic Central Cord Syndrome: Diagnostic criteria of Traumatic Central Cord Syndrome: A systematic review of clinical descriptors and scores

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Study design: Systematic review

Background: The currently applied traumatic central cord syndrome (TCCS) definition lacks specific quantified diagnostic criteria.

Objective: To review currently applied TCCS diagnostic criteria and quantitative data of the 'disproportionate weakness' between the upper and lower extremity described in original studies reporting on TCCS subjects.

Methods: A MEDLINE (1966 to 2008) literature search was conducted. The descriptors being applied to define the TCCS were extracted from all included articles. Original studies that reported on the difference in motor score (based on the Medical Research Council scale) between total upper extremity motor score (UEMS) and total lower extremity motor score (LEMS) in a minimum of 5 TCCS patients at the time of hospital admission, were included for analysis. The mean difference between the total UEMS and the total LEMS of the patients included in each study was calculated. Case reports were excluded.

Results: No study on TCCS patients reported inclusion and/or exclusion criteria using a quantified difference between UEMS and LEMS. Out of 30 retrieved studies, 7 different clinical descriptors were identified that have been applied as TCCS diagnostic criteria. Nine studies reporting on 312 TCCS patients studies were eligible for analysis. The mean total UEMS was 10.5 motor points lower than the mean total LEMS.

Conclusions: There is no consensus on the diagnostic criteria for the TCCS. Nevertheless, this review revealed an average of 10 motor points between the UEMS and LEMS as a possible TCCS diagnostic criterion. However, the definitive diagnostic criteria needs further validation and consensus by an expert panel.

P65

Determination of Neurological Impairment Level in Thoracic Spinal Cord Injuries using Dermatomal Somatosensory Evoked Potentials

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Objective: To determine sensory levels of injury using dermatomal somatosensory evoked potentials (SEPs) and compare with the neurological level of injury determined by ASIA standard in patients with thoracic spinal cord injury.

Method: By stimulating segmental thoracic dermatomes, cortical SEPs were studied in nine spinal cord injured patients from T2 to T12 (9 men, mean age 41.8) and 20 normal

adult men (mean age, 28.3). The SEP studies were performed bilaterally.

Results: In eight cases (44%) of the paraplegics tested, the neurological level of injury by dermatomal SEPs was same compared to the level of injury assessed by ASIA standard. In 15 cases (83%), there were no or one level difference of the level of injury between the levels by SEPs and ASIA standard.

Conclusion: This study suggests that dermatomal SEP can be a useful tool in determination of the neurological level of injury in patients with thoracic spinal cord injury.

P66

Low plasma melatonin among tetraplegic subjects modifies their hemostatic profiles

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Purpose: Melatonin regulates biological rhythms. Tetraplegics lack the circadian variation in melatonin. Previous studies have shown altered day/night profiles of several coagulation and fibrinolytic factors in tetraplegia. We asked if there is any association between the circadian variation of these factors and that of melatonin.

Methods: We studied 14 complete and stable tetraplegic men. Seventeen able-bodied healthy men served as controls. We analyzed melatonin and hemostatic factors from blood sampled frequently during a day/night observation period. Circadian variation was analyzed with ANOVA with repeated measures, taking $p < 0.05$ to indicate statistical significance.

Results: In contrast to controls, we could not detect any circadian variation for either melatonin or the endogenous coagulation inhibitor tissue factor pathway inhibitor (TFPI). Addition of exogenous melatonin (3 mg) to the tetraplegics at bed-time, partly restored the circadian variation of melatonin albeit with higher plasma levels than controls, but with no apparent effect on TFPI levels. The circadian variation of the fibrinolytic inhibitor plasminogen activator inhibitor type-1 (PAI-1) was more marked in tetraplegia compared with controls. Addition of melatonin to the former had no effect on the circadian PAI-1 profile. In both study groups, the plasma levels of von Willebrand factor did not exhibit any significant circadian variation.

Conclusion: Whereas both melatonin and several hemostatic factors display variations during a 24 h cycle, day/night variations in plasma melatonin levels were not associated to those of plasma markers of hemostasis. Possibly, specific biological clock genes independently of melatonin regulate factors involved in coagulation and fibrinolysis.

P67

REPLICATION OF THE AIR BAG EFFECT

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One objective of this study was to replicate the air bag effect of persons with spinal cord injury and their close persons compared to a reference group of close persons of people

with brain injury (BI) and a sample of the general population during the first year of rehabilitation. The former psychological longitudinal study had been conducted from 1999 to 2001, the actual psychological longitudinal study from 2006 to current. The air bag effect is a creative adjustment process, characterised by a nonspecific mobilisation of coping resources which often occurs right at the onset of SCI.

All newly acquired injuries were approached in selected Swiss, German and Austrian spinal centres. Participants were asked to complete a questionnaire booklet at 6 weeks post injury, at 12 weeks and again one year post injury. One hundred and thirty two participants completed the questionnaire pack from 13 German speaking spinal centres. The air bag effect was mainly operationalized by the sense of coherence and stress related measures. The initial powerful air bag effect and its expected course could be replicated for people with SCI. The distress of close persons of people with BI was reflected by the data. A better development had been observed for close persons of people with SCI concerning the second and third assessment compared to the former study.

The air bag effect can be considered as a matter of fact. The role of psychological support is discussed in respect of mobilising resources and buffering distress.

P68

Assessment of cardiovascular autonomic nervous system in patients with spinal cord injury

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After spinal cord injuries (SCI), there are cardiological autonomic dysfunctions. The spectrum analysis of heart rate variability (HRV) represents an index of autonomic function; previous studies described non-univocal results. The aim of the study was to perform a complete autonomic assessment in SCI patients.

Methods: The analysis of HRV, performed at rest and during tilt and the autonomic tests were performed in 10 controls and in 14 patients with chronic SCI classified into 3 groups: complete and incomplete cervical lesion and dorsal lesion < D6. The two spectral components which reflect the sympathetic (LF) and the vagal (HF) modulations and the LF/HF rate were measured.

Results: In the SCI patients, the LF/HF rate at rest was normal, only the patients with complete cervical lesion presented a prevalence of LF. In all subjects, the tilt induced no significant modification of LF/HF rate, but it was due to an increment of HF only in the patients with complete cervical lesion.

Conclusions: The data during tilt seem to reflect a dysregulation of autonomic response. In patients with complete cervical lesion, the analysis of the HRV suggests the involvement of all autonomic systems. These preliminary results seem to underline the presence of different cardiovascular dysfunctions in chronic SCI in relation to the level and severity of lesion.

P69

ALMA Project: assistance for persons with medullary lesions: unification of treatments

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Objective: The Alma project was created to unify courses of treatment on the national level through forms that are both common to all and customized for persons with medullary lesions.

Methods: After having analyzed the existing standards — Rehabilitation Guidelines dated May 30, 1998, Guidelines for Spinal Care Units (approved on April 29, 2004 by the State-Regional Conference) — the Steering Committee (see authors of the abstract) laid out the course of study/work to be performed by the multi-disciplinary groups, guaranteed project quality and its own contribution to publishing the results.

Through workshops and working to correct the DAFNI form, the following topics were identified: 1) "Emergency treatment", 2) "Individual treatment and rehabilitation", 3) "Individual social project", 4) "Follow-up organization". The criticalities inherent to each phase were used to identify the main goals for the ensuing work.

Results: The results obtained were outlined in a detailed flowchart (or workflow). In particular, the following were proposed and agreed upon: 1) a datasheet for distribution to EADs requesting admission to the Spinal Unit; 2) an organizational model to find beds and for Trauma Center-to-Spinal Unit transfers; 3) activities, roles and times for rehabilitation project clinical-support and social aspects; iv) instruments for Spinal Unit/territorial communications (involvement of general practitioners, planning goals, self-evaluation forms and psychological assessment charts); v) follow-up/evaluation of patients' expressed/unexpressed needs of vs. the territory. This treatment model will be returned to all special treatment facilities in the region for subsequent criticality check.

P70

Traumatic central cord syndrome: clinical observations,magnetic resonance imaging and functional outcomes

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Purpose of the study: to evaluate outcomes and clinical observations with traumatic SCI central cord syndrome (TCCS).

Description of Methods: Retrospective study

Setting and participants: Spinal Cord Unit,Patients (N= 21) admitted between 2006 and 2008. Patients underwent neurology examination and MRI after trauma. Data on admission and discharge were collected, including: gender, age, cause of injury, level of lesion, type of treatment, length stay of hospitalization, ASIA Impairment Scale, radiology findings including pre vertebral hyper intensity, cord compression, intra medullar high-signal intensity and instability. Additional measures included SCIM, WISCI, spasticity,

neuropathic pain on discharge.

Results summary: Average age was 50 (23-72) years. Causes included falls (57,1%), road traffic accidents (38,1%) and violence (4,8%). Length stay of hospitalization was 42 days (8-109). Level of injury: C4 (47,6%), C5 (33,3%), C6 (14,3%) and C7 (4,8%). The average ASIA Motor Score increased from 54,6 at admission to 68,7 at discharge. No significant difference of recovery was found between surgical and conservative groups as well as between levels of injury ($P > 0.05$). SCIM and WISCI were improved significantly on discharge.

Conclusion: Extension of spinal cord enema in MRI correlates with neurological status on admission. The presence of spasticity or neuropathic pain was not related to age, sex, ASIA Motor Score, SCIM and WISCI outcome. ASIA motor score, SCIM and WISCI were related with age at time of injury. The improvement of subjects under 55 years seem to be better than for those over 55 years.

P71

The evaluation of sports, smoking, alcohol consuming, and drug taking habits in sci patients.

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This study was carried out to find the sporting, smoking, alcohol consuming, medicine and drug habits of the spinal cord injured people (scip). The members of "The Society of the Spinal Cord Paralyzed People" were included into the study. The study was performed with 103 scip by simple random sampling. Informed consent was obtained from the participants. The data were statistically calculated and evaluated. Most of the patients were male (52.3 %). Scip did more exercise and performed sports more than before the SCI. The most important reason for exercise and sports appeared to be to protect health. Most of the scip tried smoking more before SCI, but drinking alcohol and consuming drugs were very low in frequency before sci.

Scip started to abuse medicine and drugs due to boredom, familial problems, social environment, affectation, psychological problems, health problems, occupation and being homeless. For similar reasons scip were smoking (52.3 %), consuming alcohol (24.7) and taking drugs (4.85) statistically significantly differently from the population.

P72

ESCIF: setting the sci agenda in europe

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An information-gathering project carried out among ESCIF member countries in 2006 – 2007 inspired the formulation of the ESCIF policy statement that was endorsed unanimously by the ESCIF Assembly of Delegates in 2008. The policy statement calls for the establishment of compatible SCI registers in all European countries; the promotion of SCI centres of excellence; the integration of peer-counselling and peer-support services

in rehabilitation; and an increased focus on proactive support for families of persons with SCI.

Four ESCIF policy working groups, comprised of representatives from different member countries, have been working on one of the above demands. The aim of this work is to investigate the current situation and practice in member countries, and to forward recommendations regarding "best practice" or benchmarking guidelines in each of the four areas – from the perspective of the consumer.

The paper will present the preliminary results and conclusions of the working groups and consider the implications of these for the treatment, rehabilitation and life-long care of persons with SCI.

We hope that the presentation will initiate a dialogue and collaboration with SCI professionals so that we can move on to the next stage - implementation of the policy throughout Europe.

P73

Care in a Model SCI Trauma Center leads to shorter acute care lengths of stay compared to non-SCI Trauma Centers

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Objective: To compare acute care lengths of stay (LOS) and medical status of patients admitted to inpatient rehabilitation from a Model Spinal Cord Injury (SCI) Trauma Center or from a non-SCI acute hospital.

Design: Retrospective database review

Participants/Methods: Between 2005-2007, 209 patients with traumatic SCI were admitted to inpatient rehabilitation at our institution. Acute care LOS was compared for patients transferred from the SCI Center (n=78) or from non-SCI Centers (n=131), and was adjusted for neurological category (motor complete/incomplete tetraplegia/paraplegia). LOS was log-transformed to normalize the distribution. The percentages of decubitus ulcers on rehabilitation admission and transfers back to acute care were also compared.

Results: Patients admitted to an SCI trauma center had significantly shorter acute care LOS (17.1 ± 12.2 days) compared to patients admitted only to the SCI rehabilitation unit (35.4 ± 42.3 days), $p < .001$. By neurological category, acute care LOS was less for all groups admitted from the SCI center, but statistically significant only for tetraplegia: motor complete (22.8 ± 15.5 vs. 53.5 ± 50.6 days, $p < .01$) and motor incomplete (13.3 ± 10.4 vs. 23.0 ± 23.4 days, $p < .05$). There was no significant difference in the incidence of readmissions to acute care from rehabilitation (27% SCI center, 32% non-SCI Center). More patients from non-SCI centers (44%) than SCI centers (24%) had decubitus ulcers (Chi-square $p < .01$).

Conclusion: Acute care in organized SCI trauma centers can significantly lower LOS compared to non-SCI trauma centers. Patients from SCI trauma centers are less likely to develop decubitus ulcers and no more likely to be sent back to an acute hospital.

P74

Inter-rater reliability of fim in the setting of a spinal unit and rehabilitation hospital

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Purpose: We examined inter-rater reliability of the Functional Independence Measure (FIM) in a sample of patients in the routine work setting of a Rehabilitation hospital.

Methods: We included a consecutive case series of patients admitted to San Raffaele of Sulmona, from March to August 2008. Five experienced physiotherapists independently evaluated each of 50 randomly selected patients and assigned specific scores on the basis of the FIM. The degrees of inter-rater reliability were measured by simple percentage of agreement and with the weighted k statistic.

Results: Our study population included 50 patients (28 men and 22 women) with spinal cord lesion (mean age 59.46 +/- SD 22.58). The agreement on total FIM score was almost perfect (k 0.87; 95% 0.79-0.95). The greatest variability occurred in the items relating to tidying oneself (k 0.70; 95% 0.54-0.85), expression (k 0.79; 95% 0.62-0.96), and interpersonal relations (k 0.73; 95% 0.54-0.92).

Conclusions : The agreement is great in the items of the FIM related to transfers and to locomotion. Regular administration of FIM may reduce the agreement in the long run, due to over-interpretation of some items. Therefore it is useful to undertake periodic refresher courses in the rehabilitation team with proven experience.

P75

Development of a spinal care bundle/management pathway

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In collaboration with the North West Midlands Critical Care Network we have developed a care bundle/management pathway for patients with an acute spinal cord injury.

It was noted through our audit process that a number of patients transferred to the Midland Centre for Spinal Injuries with preventable complications (pressure sores, constipation) was increasing, this is also reported as a problem experienced by all the 12 spinal injury centres in Great Britain and Ireland.

The overall aim was to improve the quality of early management through information, education and liaison to all acute trauma and critical care areas throughout our catchment area.

The development of the bundle was driven by a small group with representatives of all healthcare professions from acute trauma and critical care areas from the 4 Trusts from within our local critical care network

An audit produced for the last quarter of 2008 identified that the numbers of patients admitted with complications has decreased. I consider this to be significant but it must be appreciated the numbers are small.

Liaison has increased significantly, advice re: management is increasing.

Length of time from injury to referral to a specialist centre has decreased
Nursing staff have said they have felt more supported.
Essential in embedding this in practice was the taught sessions that were mandatory for senior nurses working within critical care.
Evaluation from the education days stated 100% felt their knowledge had increased and 100% stated the practical sessions would make management of the patient more effective.

P76

Isolated dorsal vertebral trauma is not predictive for myocardial injury

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Introduction: Previous studies reported the elevation of serum markers (such as protein S, CPK, CK, myoglobin) in acute vertebral body/spinal cord injury. Our aim was to determine if the presence of significant serum level of troponin in isolated dorsal vertebral trauma can be related to occulted myocardial injury.

Methods: From December 2006 to December 2008, 306 patients affected by major trauma have been admitted in our Intensive Care Unit of a III-level trauma center (Careggi Teaching Hospital, Florence, IT). In this number were included 35 patients (11.4%) with dorsal vertebral fracture associated with other thoracic injuries. Six of them (17%) presented just isolated vertebral injury without spinal cord involvement.

Results: An early elevation of serum troponin level have been found in only one of the 6 isolated dorsal spine trauma patient. The highest level of troponin was recorded at the admission (2.98 ng/ml) and during the first day (2.56 ng/ml), then the value lowered to 0 on the 4th day. All 6 patients did not have cardiac complications and were alive at 28 days.

Conclusions: In our experience, we can conclude that an elevation of troponin and its association with occulted cardiac injury in case of isolated dorsal vertebral injury is rare. Patients affected by isolated dorsal vertebral trauma may not need in early post-traumatic period an intensive or high-dependency caring.

P77

Functional electrical stimulation for walking in incomplete spinal cord injury: our experience

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Purpose of the study: In recent years there has been a constant and continuous increase in the number of patients with incomplete spinal cord injuries that arrive at the Spinal Unit. It has therefore been necessary to implement new rehabilitative strategies. Our Spinal Unit started using about 4 years ago early functional electrical stimulation (FES) for strictly rehabilitative/therapeutic aims; patients are able to achieve functionl

objectives that are maintained once stimulation is suspended.

A brief description of the methods: We use a FES system with surface electrodes ALT2. The training with FES is always complementary with rehabilitative treatments and that of traditional occupational therapy. The training takes place in supine and prone position and successively in erect position and during deambulation. The aim is to evoke an efficient muscular contraction at first passive, then to sustain a weak active movement with stimulation and to finally be able to increase the force to obtain a functional movement.

A summary of the results obtained: We have treated 28 patients with incomplete injuries ASIA B and C at first examination. Spasticity has been evaluated with the Ashworth scale. After a period of training with daily sessions for a period which varies between 4-6 months, we obtained a functional walk of 50 mt in 22 paces, a purely therapeutic walk in 4 paces, we did not arrive at a walk in 1.

A statement of the conclusions reached: We can conclude that stimulation with FES, passive and active in incomplete lesions, can achieve satisfactory results in relation to deambulation recovery.

P78

The "team strategy" in the treatment of the multiple pressure ulcers in the patients after spinal cord injury

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The authors describe their experience of 295 patients under observation in our Spinal Cord Unit after spinal cord injury, for pressure ulcers in period 1999-2007, 178 of these presented with 2 or more ulcerative lesions (up to a maximum of 6 ulcers simultaneously) for a total of 380 lesions. The complexity of the clinicians pictures needs a careful therapeutic program with the aim of developing a plan that is satisfactory, re-united to one acceptable duration of the hospitalisation with reduction of complications. Our strategy is based, foremost, on the preparation of the team in the surgical program, and the preparation and post-operative management to and return to home of the patient. All the patients have obtained complete clinical resolution and the resumption of the ADL in wheelchair with median hospitalisation of 90 days (ranges from 45 to 180 days). In four lesions surgical review of the wounds has been necessary, for marginal necroses of the edges of the wound with successive clinical resolution. The follow up of the patients averaged 48 months (range from 6 to 96 months) and whoed 12 recurrences. Our results suggest what has happened in the treatment of these complex clinical situations happens is due to the careful programming of equipment and the possibility to manage in suitable atmospheres, which are the Spinal Cord Units.

P79

Use of Digital images in the assessment and treatment of pressure ulcers in patients with Spinal injuries in community settings.

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Introduction: Telemedicine is an evolving field that combines telecommunication and information technologies to provide remote medical care, and ranges from activities as simple as telephone consultation, to technology as complex as telesurgery. The introduction of digital photography is a relatively cost effective way to document wound care and can be easily incorporated into nursing practice.

Research aims and objectives: This study examines the feasibility of using digital images for pressure ulcer assessment, and therapeutic suggestions by a nurse who is assessing the pressure ulcers.

Methodology: This study was a retrospective study reviewing patients' medical notes within out patient department over the past 12 months.

Results: The study shows that agreement among staff regarding pressure ulcer assessment was very good. The participants judged the image quality to be very good in 65% and good in 14% of the cases and felt comfortable making a diagnosis and therapeutic intervention based on pictures in 85% of cases. There are four barriers to incorporating the digital photography identified by staff involved as: cost/ maintenance of equipment, resistance to technology, and competency in taking photographs, and confidentiality / privacy issues and accuracy and reliability .

Conclusion: Research is needed to clarify the structure and process changes that are required or result from the use of digital images for assessing pressure ulcers in spinal cord injury persons. Changes in the way practitioners and patients exchange information will dictate not only system and process changes for institutions, but also changes in national health care reforms and reimbursement.

P80

Rehabilitation programme in Stockholm, Sweden after flap surgery for pressure ulcers

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Introduction: Pressure ulcer is a common complication to spinal cord injury. Offloading to heal pressure ulcers leads to isolation, inactivity and emotional depression. A flap surgery is sometimes the only option, but the complication rate and the occurrence of recurrent and new ulcers are reported as high as 30-40 %. In 2002, a treatment and rehabilitation programme was introduced in collaboration between three units in Stockholm: Department of Reconstructive Plastic Surgery Karolinska University Hospital, Rehab Station Stockholm and the Spinalis Clinic. Here the rehabilitation part of the programme is presented.

Aim: To lower the complication rate following flap surgery for pressure ulcers and to

prevent recurrent and new pressure ulcers in patients with spinal cord injury.

Methods: The patients participate in a four weeks carefully regulated step-by-step rehabilitation. During this program, the operated muscle is being stretched gradually. The patients are taught about causes of their pressure ulcers and how to prevent them. After discharge, the patients are followed-up after 1 and 6 months, and after 3 years.

Results: During 2002-2007, the postoperative complication rate was less than 10% and the occurrence of recurrent or new pressure ulcers was 16%.

Conclusions: This new rehabilitation programme, following flap surgery for pressure ulcers, seems successful in preventing recurrent or new pressure ulcers and in lowering the complication rate. Centralised rehabilitation of these patients or a wider use of this programme is recommended.

P81

Surgical treatment of pressure ulcers: the Florence Spinal Unit experience

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Purpose: to investigate the cause of injury, clinical manifestation and treatment.

Methods: retrospective study of 50 SCI subjects (13 in cervical level, 9 thoracic, 12 thoracolumbar, 4 lumbar and 12 SCIWORA).

Results: seven of the 23 cases with complete SCI became symptomatic while other 16 remained unchanged. Among the 26 incomplete patients, 14 improved and 9 did not. As for the 30 subjects who underwent operations (ACDF: 7 cervical level and 3 thoracolumbar, posterior approach: 3 cervical level, 7 thoracic, 9 thoracolumbar and 2 lumbarsacral.), 9 had neurological recovery while 22 did not. Among 19 non-operated cases, 9 improved, 10 did not. The leading cause of injury was car accidents, following by falling and sports injury ($P < 0.05$). There were no differences between complete and incomplete SCI ($P > 0.05$), or the recovery from SCI between the surgically and conservatively treated cases.

Conclusion: The causes of SCI in children are mainly traffic accident, falling and sports injury. SCI in children has characteristics in the neurological recovery. (author, this doesn't make sense?).

P82

Development of a novel automated telehealth system for people with spinal cord dysfunction

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Purpose: While people with spinal cord dysfunction (SCD) have high rates of pressure ulcers and depression, few interventions have been identified to improve vigilance in self-care. We have developed a dynamic weekly automated telephone calling system ("Care Call") to empower and motivate people with SCD to improve their skin care, seek

treatment for depression, and appropriately utilize the health care system for both physical and mental health appointments.

Methods: Over 1.5 years, an interdisciplinary team met weekly. We describe the steps of this development initiative, including: special considerations; testing the system's ability to different voice characteristics of people with SCD; examples of patient audio clips; programming and web reporting; and developing supplementary materials such as a comprehensive Resource Book for referrals; and pilot and quality control tests.

Results: We describe the system's three modules that focus on skin care, depression and wellness, and health care utilization. Care Call generates action alerts to a Nurse Health Coordinator management system. Care Call also integrates audio taped vignettes from actual patients with SCD and clinicians. The system tailors content based on previous calls for each user. A randomized clinical trial (RCT) of 240 people with SCD is currently underway.

Conclusion: Our ultimate goal is to offer the Care Call system to health care facilities for use with their own patient populations. We are monitoring the cost of the intervention during the RCT, including costs related to: the phone system; the Nurse Health Coordinator; and other materials. A larger, multi-center RCT is planned.

P83

A rare case report on squamous cell carcinoma in pressure sore

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Malignancy in a chronic pressure sore is rare among Marjolin's ulcers. Carcinomas arising in pressure sores are highly aggressive and usually fatal and therefore, they need to be treated more aggressively.

We report a case of squamous carcinoma arising in a pressure sore. A 33-year-old man, who had been paraplegic for 13 years following a motor vehicle accident, developed a sacral pressure sore with unstable healing for 10 years which necessitated repeated hospitalization for wound infection. The sore had been left open for years with epithelialization. It had increased in size in the past 6 months, then he was referred to our hospital in 2008 for non-healing infected pressure sore. Examination revealed a sacral ulcer of 20cm × 17 cm in size, undermined edges and filled with necrotic tissues. Although the patient has been prescribed broad spectrum antibiotics for the infected wound, infection spread very quickly and the surrounding skin became hyperpigmented and developed nodule-like lesions around the pressure sore within a week's time. The patient then was transferred to the Plastic Unit in a different hospital for further management. A biopsy was taken from the sacral sore which showed a well differentiated invasive squamous cell carcinoma. Metastatic work-up showed liver and lung metastases. Because of the patient's terminal condition, no further surgery was done and the patient passed away 6 weeks later.

A high index of suspicion is necessary for long standing pressure ulcers in this frequently neglected group of people to enable early diagnosis and treatment..

P84

A retrospective study of the effects of lifestyle on the development of pressure ulcers

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Introduction and objective: Spinal-cord injured patients run an extremely high lifelong risk of developing pressure ulcers. Various factors are implicated in this risk. In the present study it was determined whether changes in a patient's lifestyle contributed to the sudden onset of a pressure ulcer after a many year ulcer-free interval.

Methods: A retrospective descriptive study was performed, based on the medical records of 17 spinal-cord injured patients.

Results: Some of the patients experienced a number of recurrent problems. In three patients a decline in general health preceded the development of a pressure ulcer; in two others the ulcer occurred during a hospital admission. In five cases isolated incidents were responsible for the development of a pressure ulcer. In another two cases, the patients failed to undertake immediate action at pressure ulcer onset.

Recommendations and conclusion: In the patient records more attention should be paid to the most important variables that may contribute to the development of a pressure ulcer. Preventive measures, such as the use of specific wheelchair seat cushions or pressure-relieving mattresses, are essential in this respect. Concrete information about drug use, spasticity, contractures, lifestyle, etc. should complete the assessment. For a full appreciation of an individual patient's situation, it is important that his/her history be included in the medical record. In this way, all members of the multidisciplinary team are well-informed of the patient's habits and health.

P85

Four-year surgical treatment of severe pressure ulcers in Spinal Cord Unit

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The aim of this study is to demonstrate that difficult wound ulcers, which harm the cutaneous continuity, are advised for surgical treatment and reparative plastic intervention in spinal cord injured patients and, provided that they are well managed, might provide good results.

The study of these case histories has been carried out on 91 surgical interventions from July 2005 to March 2009 with an operative protocol achieved before the beginning of this treatment.

Patients with pressure ulcers were selected according to the level of injury; ulcers of I and II stage were chosen, by then any longer suitable for the reparation with advanced methods. A microbiologic study was performed on the suspected infected lesions. Such infections with some germ isolation were treated with specific antibiotic therapy. Proper and qualified surgical techniques have been used mainly for myocutaneous flaps and for closing tracheotomies for tissular level.

All lesions have been medicated/dressed starting from the first day with greasy gauzes based with ionic Ag and the suture were removed nearly 20 days after the intervention. Results: on 91 interventions 72 patients have healed, while for the other 18 the recovery has been achieved with the help of advanced medications (scarce compliance of patients, management mistakes after surgical operation - due to inadequately instructed personnel - and 2 cases of self-inflicting injuries).

There has been one death several days after surgical intervention due to an Acute Myocardial Infarction.

P86

Surgical treatment of pressure ulcers: our findings

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The authors of this report present their findings in regard to pressure ulcers.

Between 2004 and 2008, 60 patient with pressure sores were admitted to our hospital. 39 of these were paraplegic, 16 tetraplegic and 5 had cranial trauma.

In our patients, the most pressure ulcers occurred in the sacral region (20 patients), the others were distributed as follows: 16 ischial, 8 trochanteric, 6 foot, 10 other locations.

19 of the lesions were type III and 48 were type IV.

46 of these patients have had surgery: myo-cutaneous flap (23) fascio-cutaneous flap (13) or skin-graft. (10)

In 2 cases the patients did not have surgery due to complications from multiple bedsores and associated clinical degeneration. In other cases patients recovered with just the assistance of medication. Surgical results have been excellent and in 39/46 cases a complete recovery was observed.

In our patients surgical results are better overall and more efficient with the patient recovering more quickly.

In a small number of cases (6) lesions have reoccured and further surgery has been necessary.

The authors discuss surgical versus conservative treatment.

P87

Efficacy of Phenol Neurolysis of Obturator Nerve on Buttock Pressure

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Background and aim: Pressure ulcers are frequently seen in spinal cord injured (SCI) patients and have serious problems on general medical status and life quality of individuals. Pressure ulcer secondary to spinal cord injury is further complicated by spasticity, which contributes to both ulcer continuance and delayed healing. Hip adductor spasticity increases sitting pressure at the buttock, complicates bladder rehabilitation and hygiene. The use of phenol neurolysis of the obturator nerve improves adductor spasticity and relieves buttock pressure. In this study we aimed to assess the effect of phenol

neurolysis of the obturator nerve to relieve buttock pressure.

Material method: Five patients included in the study. 5 cc phenol (5%) was used for neurolysis of the bilateral obturator nerves. Buttock pressure of the patients was measured while they were sitting in the wheelchair with the Xsensor system before and 1 week after neurolysis. Cushions weren't used during measurement. Adductor spasticity level was measured by using the modified Aschworth scale (MAS) before and 1 day after neurolysis.

Results: Mean spasticity of adductor muscles was 2,6 before neurolysis. Although mean pressure distribution between 0 and 37 mmHg was $64,40 \pm 1,76$ (%) before neurolysis, it was $72,64 \pm 6,71$ (%) (after? This is not clear). Mean pressure distribution between 37 and 230 mmHg was $35,58 \pm 1,76$ (%) before neurolysis, however it was $27,36 \pm 6,71$ (%) (after?). These differences were statistically significant ($p < 0,05$). Mean spasticity of the same muscles was 1,4 at 1 week after neurolysis.

Conclusion: Hip adductor muscle spasticity may cause shearing forces that can increase the risk of gluteal pressure ulcers. Phenol neurolysis of the obturator nerve may be a good choice to reduce adductor muscle spasticity and relieve buttock pressure.

P88

Pressure ulcers in spinal cord injuries: a retrospective analysis

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Purpose: To investigate the clinical characteristics and pressure ulcer occurrence of patients with spinal cord injury (SCI) who were admitted to a Spinal Unit.

Methods: We evaluated a consecutive series of patients affected by SCI admitted to the Rehabilitation Hospital 'San Raffaele' of Sulmona, from May 2007 to April 2008. All patients underwent clinical assessments. Outcome measures included the Norton Scale (NS).

Results: We included 56 patients, 39 men and 17 women with a mean age of 46.1 ± 19.1 years. The most common cause of SCI was spinal trauma (61%). 19 (33.9%) of patients were affected by tetraparesis, 17 (30.3%) by paraplegia, 12 (21.4%) by paraparesis, 8 (12.5%) by other deficit. At admission to the Spinal Unit, pressure ulcer occurred in 21.4% of patients. The most common sites of development were the sacrum (25%), trochanters (25%), multiple sites (12.5%). At discharge, improvement occurred in 66.6% of patients and worsened in 16.6% of patients. Upon admission pressure ulcer risk profile evaluated with the NS was similar to that observed at discharge.

Conclusions: Management of SCI requires development and application of intensive, advanced neurorehabilitation and nursing programs for the acute phase as well as for the long-term follow-up. Accurate evaluation with the NS is very important to define the ulcer pressure risk profile for patients with SCI.

P89

Importance of undermining in wound area measurements for clinical assessment

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Purpose: To compare calculations of open wound surface area (WSA) with WSA+undermining (UM) over 8 weeks to determine whether these two measurements were clinically different.

Frequent differences would underscore the need to measure and report undermining.

Methods: We measured pelvic pressure ulcers (PrU) in each of 6 inpatients with SCI at baseline (BL), weeks 4(W4) and 8(W8). Undermining was determined by probe and surface marking. WSA and WSA+UM (cm²) were calculated using digital software.

Wounds were "closing" if they demonstrated 30% decrease at 4 weeks or 50% decrease at 8 weeks. The two measurements were compared between each time point by paired t-tests. We compared 16 assessment pairs in all (one data point was missing). False positive occurred when the decrease in WSA met the criteria for "closing" but WSA+UM did not decrease. False negative occurred when WSA+UM decreased but WSA did not.

Results: Large wound area differences were found between WSA and WSA+UM at each time point (BL: 8.8 ± 11.9 vs 32.7 ± 20.2 cm² P=0.05; W4 5.9 ± 5.2 vs 30.8 ± 23 cm² NS, W8 3.7 ± 4.4 vs 19.5 ± 18.3 cm² NS).

11 of 16 comparisons reflected a change in WSA+UM that was different from that of WSA alone. The analysis identified 4 false negatives and 7 false positives. Three of the wounds produced both false negative and false positive assessments. One of the six wounds showed agreement at all 3 points. Two wounds agreed at only one point.

Conclusion: Changes in WSA and WSA + UM measurements demonstrated differences sufficient to produce assessments of healing/non-healing trends that disagreed in 11 of 16 assessments.

P90

Use of external tissue expansion in the treatment of decubiti in spinal injuries

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Background: Management of Stage IV sacral, ischial and trochanteric decubiti after spinal injuries, especially in patients with co morbid conditions, is challenging. Gradual expansion of the defect and extensive debridement and osteotomy have fostered promising results.

Method: Numerous patient procedures were performed at bedside employing the following steps

- (1) Minimal undermining and debridement
- (2) Extensive osteotomy
- (3) Suturing of wound with deep 20 nylon sutures (left long)
- (4) Similar 20 nylon sutures untied and secured with 1/2" steri-strips

- (5) Application of external tissue expanders ("Proxiderm") approximately 2-3 cm apart and 2-3 cm from wound edges
- (6) Application of combines below and above expanders, held in place with Elastoplast
- (7) Dressing changes every 1-2 days, depending upon wound contamination.
- (8) Irrigation of wound during dressing changes, with 5% Betadine solution, 5% peroxide, 90% saline
- (9) Tying untied sutures and control expansion
- (10) Repeated expansion and control of expansion with deep 20 nylon sutures
- (11) Final step once enough relaxed and viable tissue is present
 - redebridement and rotation of muscle over exposed bone
 - multiple-layer closure

Results: 21 Patients with spinal injury developed 25 decubiti

Type of Decubitus	# of patients	# of decubiti	Rate of healing
Sacral	6	6	87%
Trochanteric	6	6	100%
Ischial	9	13	92%

Conclusion: Gradual tissue expansion over several days (after debridement and osteotomy), followed by multi-layer surgical closure is a rapid and effective method for Stage IV decubitus treatment after spinal injury.

P91

"No Obstacles": A return to school program for spinal cord injured adolescents

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Adolescents (age 17 years and younger) have unique physical and emotional needs compared to the adult population. Physical and psychosocial development occurs at a rapid pace during these years. Most are still attending school and rely on peer approval for much of their self-esteem. Many students are apprehensive about going back to school because of the stigma issues of having a disability. The "No Obstacles" program was developed to help adolescents have a smooth transition back to school and to educate others of the individual needs of each teenager.

Once the student agrees to participate in the "No Obstacles" program, an individualized presentation is prepared. This includes anatomy, physiology, medical issues, equipment, and sports and leisure. The depth to which these topics are covered is determined by the severity and location of injury and the target audience. Additional information related to the student's activity during the school day is reviewed.

In conjunction with the school, the student determines who will attend the presentation. This may include peers, faculty, administration personnel and parents. The audience has ranged from a small group of teachers up to a student assembly.

This program has helped over 200 students return to school with confidence and graduate with their class.

P92

Moon jump anyone? team approach to adolescent traumatic SCI

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The purpose of this paper is to demonstrate the effectiveness and necessity of unique programming to enhance the psychosocial, emotional and physical needs of the adolescent population that has sustained a spinal cord injury. This population relies on peer approval as their primary mode of acceptance and the development of their self-esteem. The Shepherd Center uses a unique team approach to address these issues through the use of age appropriate community reintegration outings, a designated treatment area and utilization of peer support to foster self-efficacy.

The team that consists of the doctor, physical therapist, occupational therapist, recreational therapist, case manager, speech therapist, nurse, teacher and counselor. Although each has their own specialties, the success of our program relies on a cross-disciplinary approach. The atmosphere of the gym is kept energetic and light, encourages the teens self-expression. Patients are encouraged to set the tone of the program by helping to plan late night adventures and pranks on staff. To further facilitate community reintegration, outings such amusement parks, video arcades, movies and local attractions are selected by patients. Care is taken to provide individual outings for patients with specific goals such as prom dress shopping and school visits. Annual special events provide additional peer socialization.

Providing these unique activities during their inpatient stay assists them in the physical rehabilitation as well as acclimating them back to an active lifestyle. For example, one hundred percent of teens return to school, which shows the success of our program.

P93

Goal Planning in Adolescents with Spinal Cord Injury

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The Purpose of Goal planning is to provide a useful, time efficient patient centred tool to engage the person with SCI in rehabilitation to achieve their maximal functional potential. Goal planning is administered through the Needs Assessment Checklist for which 2 forms exist. That for adults and that for children. Many domains of rehabilitatin overlap but many others require age appropriate goals andd domains including those regarding growth and development. Adolescents have additional needs specific to the changes specific to their age group as well as those due to their spinal cord injury.

The specific needs of this group are discussed and additional questions, altered emphasis for some existing questions and training needs for staff administering this with adolescent populations are addressed.

Goal planning is important in rehabilitation of those with a SCI and can be used in all age groups. Attention to the development needs of young people not just thier chronological needs allows the process to be correctly administered.

P94

Rehabilitation Follow up- can we minimise the disruption to family and school life?

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O'Shea; O'Donnell

Aim: To review the quality of service provision to children with SCI and their families following the development of a dedicated Children's centre within the National Spinal Injuries Centre at Stoke Mandeville Hospital.

Material and method: Case note review audited by ward staff to ascertain number of professionals involved in the care of each child.

Postal questionnaire sent to families involved in the unit before and after the dedicated ward existed.

Results: Case note reviewed recorded average of 26.3 health care professionals involved in care of each child. No previous figures to compare with.

Postal satisfaction questionnaire had 38% response rate. High satisfaction rates obtained for child friendly, clean safe environment and the knowledge of the clinical team caring for their child.

Negative responses obtained for poorer family accommodation and an overfilled timetable! Time away from school was not identified as a concern by parents.

Conclusion: Minimum disruption to family life has not as yet been achieved and needs to constantly be considered. Parents appreciate the dedicated facilities for children with a SCI and are prepared to travel to obtain this care.

Further developments to continually improve service are ongoing.

P95

Application of the icf (international classification of functioning, disability and health) to evaluate functioning in adolescents with spinal cord lesion and cerebral palsy in an in-patient rehabilitation program.

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Purpose: Spina bifida (SB) and cerebral palsy (CP) cause many limitations in functioning in adolescents. Transition to adulthood poses multiple challenges and should be addressed in specific rehabilitation programs in which the assessment of functioning is the starting point. The ICF is the worldwide accepted framework for the description of functioning. To facilitate its application into practice, ICF tools have been developed. This study aimed to evaluate the application of an ICF tool in a specific rehabilitation program for adolescents with SB and CP regarding its aptitude and user-friendliness.

Methods: (1) The ICF Functioning Profile was used to document functioning states, rehabilitation goals and intervention targets. ICF Qualifiers were used to rate the extent of the problem in ICF categories. Descriptive analysis was performed.

(2) User-friendliness was evaluated within a semi-structured group interview, qualitative analysis was performed.

Results: More than 50% of the adolescents (n=9) had severe impairments in emotional and movement related body functions, limitations in performing general tasks and demands, and restrictions in interpersonal interactions and recreation and leisure. Rehabilitation goals were mainly mobility and self-care. Twenty-six intervention targets could be identified.

The use of the ICF Functioning Profile increased goal-orientation and communication within the team but was time-consuming. The amount of ICF categories was experienced too few and unspecific, the ICF Qualifiers as too less sensitive to measure little changes.

Conclusions: The results of this study showed that the ICF Functioning Profile was applicable to document functioning and structure rehabilitation management. In addition, it provided im-portant information for adaptation.

P96

Intra-rater reliability of the international standards for classification of spinal cord injury (ISCSCI) motor and sensory exam on children and youths

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Objectives: To test the intra-rater reliability of the ISCSCI motor and sensory exam in children.

Methods: 34 children with a chronic spinal cord injury (over 1 year) were tested twice within a week.

Results: 14,7%(5/34) of children, either 6 to 11 year olds or adolescents (age 16 to 20), refused part of the examination.

20,7%(6/29) of children, most of them with a complete lesion (ASIA Impairment Scale A), had an identical motor and sensory examination on both occasions.

66,7%(22/33) of children, most of them with a complete lesion, had an identical motor examination on both occasions.

13,8%(4/29) of children, all aged 0 to 11 and most of them with an incomplete lesion (ASIA Impairment Scale B, C, D), showed a difference of 2 or more sensory neurological levels between both examinations.

26,5%(9/34) of children, most of them with a complete lesion, had an identical sensory light touch examination on both occasions.

36,7%(11/30) of children had an identical sensory pinprick examination on both occasions.

Conclusions: The ISCSCI motor and sensory exam is not as reliable when applied on children and youth as on adults. Children refusing part of the examination were either adolescents or children aged 6 to 11, the latter being generally more anxious about the pin prick examination. Motor examination was more reliable than sensory examination. Children with a complete injury scored more consistently on reliability. Additional studies with a larger pool of subjects are needed and other methods of examination require investigation for children to assist with diagnosis and prognostication.

P97

Post-acute rehabilitation and outcome in ischemic spinal cord in childhood: a case report

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We present the case of a child with ischemic spinal cord lesion who underwent post-acute rehabilitation. A healthy 7-year-old girl started having headaches and pain down her neck at home, followed by vomiting and inability to walk, after 3 days from a minor cervical trauma. Taken to the Emergency Room, she was intubated and ventilated for progressive breathing difficulty. She was flaccid and areflexic in all her extremities. RM-imaging revealed an irregular T2-hyperintensity in the anterior spinal cord from bulbus to D5. Arteriography revealed an abnormality of the left vertebral artery. Spinal fluid examination was unremarkable. She was treated with steroids and anticoagulants. After 68 days she was extubated and after 85 days was admitted to our Hospital for intensive inpatient rehabilitation. RM-imaging showed persistent, even if reduced, T2-hyperintensity in the anterior cord from C5 to D5. ASIA Impairment Scale was C6 C, ASIA motor score was 51/100. The outcome, six months later, was ASIA Impairment Scale C6 D, ASIA motor score was 77.5/100; she was able to ambulate with an AFO and dynamic walker. Electrophysiological studies evidenced a SSEP normality and a MEP progressive improvement. Follow up at three years from onset revealed stability of the ASIA motor score, but improvement in walking with AFO and crutches, demonstrating how the girl was able to reorganize her remaining motor abilities in the best way. According to our opinion, intensive rehabilitation has been essential for recovering the ability to walk.

P98

Orthopaedic considerations in the child and adolescent with tetraplegia secondary to spinal cord injury (SCI)

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The purpose of this paper is to review orthopaedic problems of the upper extremity in patients with tetraplegia.

Spine deformity occurs in approximately 98% of children with tetraplegia. Of those injured prior to skeletal maturity with curves $> 40^\circ$, 67% will require surgery to stabilize their spine. Maintenance of the thoracolumbar kyphosis is important for maintaining upper extremity function.

Hip subluxation/dislocation can occur in up to 40% of patients with SCI, especially in patients injured before age 10. A subluxating or dislocating hip can cause spasticity, which may adversely affect upper extremity function. A chronic subluxation or dislocation may affect upper extremity function if the patient has to lean on one arm for balance.

Contractures of the joints, most commonly the hips, elbows, knees, and ankles, occur in almost all patients with SCI. Contractures of the elbow particularly affect upper extremity function. At our institution, serial casting has been the treatment of choice followed by

biceps-to-triceps transfer.

Spinal cord syrinxes are prevalent in both children and adults, occurring in approximately 50% of patients. These syrinxes are generally asymptomatic but can clearly affect upper extremity function, and a preoperative MRI is probably indicated in all patients considering upper extremity surgery. The authors have seen an expanding syrinx cause loss of function following tendon transfers.

Decisions regarding treatment should be made in conjunction with a knowledgeable orthopaedist, physiatrist, and occupational therapist.

P99

Description of sensory preservation in children and adolescents with incomplete spinal cord injury

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Objective: To describe patterns of preserved sensation in persons with ASIA Impairment Scale (AIS) B (sensory incomplete) and AIS C/D (motor incomplete).

Design: Cross sectional, multi-center cohort study

Participants / Methods: 93 subjects (n=58 tetraplegia, n=35 paraplegia) with incomplete injuries were included for analysis. Sensation was based on the International Standards for Neurological Classification of SCI (ISNCSCI).

Results: In the 44 subjects with AIS B, some light touch (LT) was present in 35% of dermatomes below the neurological level and pin prick (PP) in 8%. In contrast, in the 49 subjects with AIS C/D, LT was present in 77% of dermatomes and PP in 27%. AIS C/D subjects with tetraplegia had more dermatomes with preserved sensation than those with paraplegia.

When reviewing areas at highest risk for pressure sores, only 4 of 22 (19%) of subjects with AIS B/tetraplegia had any preserved LT or PP sensation in the periscapular region (dermatomes T1 to T6). In the buttocks region (S3 and S4-5), sensation was preserved in less than 50%.

Conclusions: 1) Sensory sparing below the neurologic injury was found to be surprisingly sparse in patients classified as AIS B (35% LT and 8 % PP). Sparing was considerably better in patients who were AIS C/D (77 % LT and 27% PP). 2) Preserved sensation in the periscapular region was very low in subjects with tetraplegia (19%) and was also low in the buttocks, with fewer than half of those classified as AIS B with either tetraplegia or paraplegia reporting sensation.

P100

Therapeutic approach to neurogenic bladder dysfunction in congenital and acquired spinal cord lesion in children

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Purpose: Congenital or acquired spinal cord lesions (SCL) result in a serious physical

disability, reducing quality of life and restricting social activities, and the role of neurogenic bladder dysfunction (NBD) has been described. Aim of the study was to define the therapeutic acceptance rate in acquired SCL, as spinal cord injury (SCI) and congenital, as spina bifida (SB).

Methods: 25 children (16 males and 9 females, aged 0.1-16.3 years) with SCI and 29 children (13 males and 16 females, aged 0.5-17.2 years) with SB were evaluated. In all patients a complete urological evaluation was performed considering: diaries, renal ultrasound, and urodynamics. NBD were classified according to the International Children Continence Society and neurological evaluation was performed using ASIA scale. Neuro-urological therapeutic acceptance rate was evaluated considering acceptance of suggested treatment: clean intermittent catheterization (CIC) or self administered CIC, with pharmacotherapy; bowel management; treatment of urinary incontinence.

Results: 24/25 SCI and 28/29 SB presented NBD and Bowel dysfunction. Disability was related to lesion site and it is worse in SCI. Quadriplegic patients and children < 3 years of age presented lowest autonomies. Regarding the rate of therapeutic proposal acceptance: 100 %patients accepted CIC and urotherapy, 30% bowel regimen, with no difference in the 2 groups. 9 patients with SCI and 23 with SB were treated (endoscopic or surgery) for urinary incontinence, with a rate of 70% and 90% respectively.

Conclusions: A multidisciplinary approach could be useful to facilitate acceptance of a therapeutic proposal especially in SCI, SB families showed a better adaptation to disability.

P101

The importance of physiotherapeutic intervention for spina bifida neonates

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In the last few years, although technical knowledge about the management of individual clinical issues has increased, a lot can still be done to reduce the effects of medical complications, to foster better psychomotor development and to achieve the baby's maximum autonomy and social integration, despite the remaining disability.

From this point of view, the physiotherapist's input may be crucial in establishing a specific connection between scientific knowledge and the management of such a problematic child. With a multidisciplinary approach, the therapist carries out the important tasks of deformity treatment and containment as well as that of educating families on the right skills to manage the child with a serious pathology that needs particular care. A two-year study shows that parents who didn't benefit from the physiotherapist's support during Neonatal Pathology (their child didn't not present motor impairment), turned out to be, after a few medical examinations, fearful and easily worried about their children "touching" them with "too much" precaution and denying them "normal" (not excessive) care.

In conclusion, the physiotherapist's educational approach turned out to be important, especially for the parents, who benefit from the support and assistance.

Our approach was based on studies present in Medline, Embase, Cochrane Library and on congress act's publication. We also considered existing protocols on postural treatment in the Intensive Care Unit and the clinic experience of the Spina Bifida Centre in the Niguarda Cà Granda Hospital.

P102

Spinal Cord Injury in Pediatric Age

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From 2004 until now, 32 children from 2 to 12 years old have been hospitalized at the Spinal Unit of Niguarda. 18 were paraplegic, 7 quadriplegic and 7 quadriplegic who needed respiratory support. This evidence allowed us to underline what are some of the most "critical" aspects of these pathologies, in order to improve our working methods. 14 patients had post-traumatic lesions and 18 were non-traumatic patients.

Rehabilitative Aspects:

- respiratory aspects
- urologic aspects
- prevention and deformities treatment (mobilisation, orthoses, posture)
- standing
- gait re-education
- consciousness of motor schemes
- hydrotherapy

Educational Aspects:

- taking care of the patient's family
- training relatives in order to take care of the child

Occupational Aspects:

- *choice of orthotic devices:
 - mobility (wheelchair, orthoses)
 - standing, tilt table
 - personal hygiene
 - transport
- *training the child and relatives in order that they use the orthotic devices *properly home, kindergarten, school survey
- *choice of informatic devices for communication (computer..) and proper training
- *demotic.

Playing Support Activities:

- sport therapy
- pet therapy
- art laboratories
- music therapy
- hydrotherapy

School Reintroduction: use of web cams in order to participate in lessons during hospitalisation.

The data recollection was based upon scientific studies published in Medline, Embase and Cochrane Library, upon congresses printing and upon clinical experience gained working in Spinal Unit and Spina Bifida Centre Niguarda.

The hospitalisation has to be short as possible and all the activities have to aim to facilitate the child's reintroduction into social life beginning as early as possible.

P103

Spirituality in Adults Who Sustained SCI as Children or Adolescents

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Purpose: Determine the relationship of religion and spiritual coping to demographics, injury-related factors, and life satisfaction of adults with pediatric-onset SCI.

Methods: Individuals who sustained SCI prior to 18 years of age and were 24 years or older at interview. Structured telephone interview including standardized measures: FIM, CHART, Short Form-12, Satisfaction with Life Scale (SWLS), Patient Health Questionnaire-9, and the Brief COPE adapted.

Results: 298 participants, mean age of injury 14 years, mean age at interview 31 years (24-45); 62% male, 44% paraplegia. 26% felt that religion was not important and 74% identified religion as important. Importance of religion was significantly associated with younger age at injury ($p=.036$), longer duration of injury ($p=.005$), marriage ($p=.004$), higher SWLS ($p=.004$), and coping strategies: more emotional support ($p=.001$), more positive reframing ($p=.008$), more religion ($p<.001$), and less behavioral disengagement ($p=.004$). 76% used spiritual coping which was significantly associated with older age at interview ($p=.004$), longer duration of injury ($p=.008$), lower FIM motor score ($p=.015$), lower CHART occupation ($p=.029$), higher SWLS ($p=.004$), living with parents ($p=.040$), greater importance of religion ($p<.001$), and coping strategies: more active coping ($p<.001$), more emotional support ($p<.001$), more positive reframing ($p<.001$), more acceptance ($p=.048$), and less behavioral disengagement ($p=.004$). Life satisfaction was associated with marriage ($p<.001$), less pain ($p=.001$), higher ASIA motor score ($p<.001$), less medical complications ($p=.004$), complete injury ($p=.004$), less drug use ($p=.044$), and more spiritual coping ($p=.038$).

Conclusion: Importance of religion and use of religious/spiritual coping are associated with several demographic and quality of life factors.

P104

Spinal cord injury in 49 children: clinical Aspects and management

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Purpose: to investigate the cause of injury, clinical manifestation and treatment.

Methods: retrospective study of 50 SCI subjects (13 in cervical level, 9 thoracic, 12 thoracolumbar, 4 lumbar and 12 SCIWORA).

Results: seven of the 23 cases with complete SCI got Symptomatic while other 16 remained no change. Among the 26 incomplete patients, 14 improved and other 9 did not. As for 30 subjects underwent operations (ACDF: 7 cervical level and 3 thoracolumbar, posterior approach: 3 cervical level, 7 thoracic, 9 thoracolumbar and 2 lumbar-sacral.), 9 got neurological recovery while 22 did not. Among 19 non-operated cases, 9 improved, 10 did not. The leading cause of injury was car accidents, following with falling and sports injury ($P<0.05$). There were no difference between complete and incomplete SCI

($P>0.05$), so was the recovery from SCI between the surgically and conservatively treated cases.

Conclusion: The causes of SCI in children are mainly traffic accident, falling and sports injury. SCI in children has the characteristics in the neurological recovery.

P105

Progression of spinal cord atrophy by traumatic or inflammatory myelopathy in the pediatric patients: case series.

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Study design: Case series.

Objective: To present spinal cord atrophy in pediatric patients in whom spinal cord injury developed after trauma or acute transverse myelitis, and had no subsequent motor recovery.

Setting: Department of Rehabilitation Medicine, Tertiary National University Children's Hospital, Seoul, Korea.

Methods: Case series.

Results: Two pediatric patients with paraplegia due to acute transverse myelitis and one pediatric patient with paraplegia due to traumatic myelopathy were included in this case series. Their initial MRI (magnetic resonance imaging) findings showed spinal cord swelling and high signal intensity in T2-weighted images. After several months, they had no motor recovery and showed no change of neurological level, though they underwent steroid treatment and physical therapy. A follow-up MRI revealed spinal cord atrophy.

Conclusion: If a pediatric patient with traumatic or inflammatory spinal cord injury does not show motor recovery after several months, spinal cord atrophy must be considered.

P106

Staged surgical treatment in severe and rigid scoliosis

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Objectives: To evaluate the outcome of 21 cases with severe and rigid scoliosis treated with staged surgery.

Methods: 21 cases of severe rigid scoliosis with Cobb angle more than 80° underwent staged surgeries including anterior release and halo-pelvic traction as the first stage surgery and posterior instrumentation and spinal fusion as the second stage. Pedicle subtraction osteotomy(PSO) was added in the second stage according to spine rigidity. There were 8 males and 13 females with an average age of 15.3 years (4 - 23). The mean preoperative Cobb angle was 110.5° (80° - 145°) with a mean spine flexibility of 13%. Radiological parameters were analysed after a minimum follow-up of 2 years (2 ~ 7 years)

Results: The average frontal correction rate was 65.2% (39.8%-79.5%) with mean correction loss of 2.23° at the end of follow-up. In the sagittal plane, the mean correction rate was 59.2% (39.8%-71.5%). Mean distance between the midline of C7 and midsacral

line was $1.19 \text{ cm} \pm 0.51$. Two patients had neurological complications.

Conclusion: The staged operation and halo-pelvic traction offer a safe and effective way to treatment severe rigid scoliosis. Patients whose Cobb angle was more than 80° and the flexibility of the curve less than 20% should be treated in this way, and those whose flexibility of the spine was less than 10% and the Cobb angle remained more than 70° after the first stage anterior release and halo-pelvic traction should undergo pedicle subtraction osteotomy (PSO) in the second surgery.

P107

Demonstration of diffusion tensor imaging (DTI) in children with and without spinal cord injury (SCI)

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Purpose(s): (1) To establish normative DTI values of healthy pediatric spinal cord tissue and (2) To investigate the validity of DTI as a method to evaluate SCI in children as compared to concurrent clinical examinations and imaging techniques.

Methods: 5 children (normal controls; mean age: 15.2 years) and 4 children with cervical SCI (mean age: 12.6 years) underwent routine cervical MRI/DTI imaging. Children with SCI underwent neurological classification based on the International Standards for Neurological Classification of SCI (ISNCSCI). Quantifiable values of DTI obtained included Fractional Anisotropy (FA) and Diffusivity (D).

Results: DTI of normal controls had mean FA values of 0.62 (S.D. =0.14) and D values of $2.0 \times 10^{-3} \text{ mm}^2/\text{sec}$. (S.D. = 4.3×10^{-4}). In comparison, children with SCI demonstrated decreased FA values and increased D values in the injured cervical regions. Initial test-retest obtained on one child with a mid-C5 focal SCI lesion (predicted on MRI) and one normal control showed good reproducibility. Abnormal decreased FA and ADC values one level above the mid-C5 lesion were found in otherwise normal appearing tissue on MRI in this child.

Conclusions: DTI is a new MRI technique that shows promise in predicting recovery following intracranial pathology. Limited literature exists on its utility with the pediatric spinal cord. This study demonstrated DTI's feasibility in children with and without SCI. Future studies are needed to determine if DTI can serve as an adjunct to the clinical examination when attempting to classify children with SCI.

Support: Shriners Hospitals for Children Grant #8956.

P108

Neuromuscular scoliosis in children with sci as a function of age, time since injury, neurological level, motor level, and injury severity

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Purpose: To investigate the determinants of neuromuscular scoliosis as a function of current age, time since spinal cord injury (SCI), neurological level (NL), motor level (ML) and injury severity as defined by the International Standards for Neurological Classification of SCI (ISNCSCI).

Methods: 184 children with spine radiographs and ISNCSCI exams. Relationship between ISNCSCI motor score (MS) sensory score (SS) and neurological level (NL), ASIA Impairment Scale (AIS), age at and time since injury, and progression of scoliosis (Cobb angle) was evaluated using stepwise regression. Odds ratio was calculated to evaluate age at injury as a risk factor for requiring spine fusion.

Results: Age at injury ($p < 0.050$), AIS classification ($p < 0.01$), and MS ($p < 0.01$) were predictive of worse Cobb angle. Age at injury ($p < 0.031$) and years since injury ($p < 0.0001$) were predictors of progression to spine fusion. Of the subjects > 14 years of age at the time of evaluation who were injured < 12 years of age ($n = 28$), 53% required a spine fusion compared to 13% injured > 12 years ($n = 5$). Those injured < 12 years of age were 7.6 times more likely to require a spinal fusion as compared to those > 12 (95% CI = 2.29, 25.2).

Conclusions: ISNCSCI motor score, length of time since injury, and injury severity (AIS classification) were found to be determinants of neuromuscular scoliosis in children with SCI.

Support: Shriners Hospitals for Children Grant #8956.

P109

Spinal Cord Injury in Children: Picture of a rehabilitation centre in Bangladesh

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Objectives: To explore the demographic data and epidemiological features of pediatric Spinal Cord Injury (SCI) of a rehabilitation centre in Bangladesh.

Methodology: The records of 198 children with SCI, discharged from January, 2004 to December, 2008 were reviewed retrospectively following purposive comprehensive sampling. Descriptive Statistics was chosen as the data analysis procedure of the study.

Results: This study revealed pediatric SCI accounted for 10% of the entire SCI population. The boy: girl ratio was 1.75: 1. The majority of the children (54%) were between 10-15 years old. 69% of the children, the etiology was traumatic injury. The most common cause of traumatic lesion (72%) was due to a fall from height and the leading causes of non traumatic lesion were Transverse Myelitis (38%) and TB Spine (32%). Among the traumatic cord lesion 68% were paraplegics and 32% tetraplegics.

On the other hand, 77% paraplegics and 23% tetraplegics were comprised those with non traumatic lesions. The average length of stay in the rehabilitation centre was 82 days. Most of the children (52%) were diagnosed as A in ASIA impairment scale. A majority of the children (75%) were students and planned to continue their study (62%). Only 17% children received vocational training from CRP. Half of the study participants were discharged with wheelchairs and 30% of children were independent in walking without any device.

Conclusion: This study shows significant prevalence of SCI among children in comparison with many other countries. Several major differences were also noted when comparing pediatric SCI with adults in Bangladesh.

P110

Self Reported Daily Functioning In Children And Youth With Spinal Cord Injury

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The purpose of the research was to develop a new self-reported survey that examines perceived difficulty of essential daily activities. Children 8 years and older with spinal cord injuries (SCI) completed a survey that included 66 daily tasks; dimensionality of scale was analyzed by confirmatory factor analysis (CFA) and Rasch one-parameter modeling. Rasch-based estimated person scores were used to evaluate discriminate validity of type of injury tetraplegia/paraplegia) and ASIA motor levels (C1-C4; C5-T1; T2-T6; T7-L2; L3-L6). A total of 218 children with a mean age of 15.7 years (SD 3.5; range 8-21) completed the survey. CFA indicated a strong one-factor scale with nearly 80% of variance attributed to the primary factor. Rasch analyses yielded good model fit with only 6% of the items having significant mis-fit. Ceiling effects were trivial (< 1%). Child scores were significantly different between tetraplegia and paraplegia ($t=8.0$; $df=99$; $p<.001$); and across ASIA motor levels ($F=33.8$; $df=4$; $p<.001$). Post-hoc analyses indicated that functioning in groups C1-C4 and C5-T1 could be distinguished from higher levels, but there were no significant difference among levels T2-T6; T7-L2; L3-L6. This new survey appears to capture important aspects of daily routines of children and youth with SCI across a wide age range (8-21 years) and levels of injury severity. Rasch-based person scores support the discriminant validity of injury type and ASIA motor levels, especially between cervical and thoracic levels. This unidimensional set of items has potential for development into an effective short-form questionnaire or into a computer adaptive testing format.

P111

Quality of life after pediatric spinal cord injury

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Purpose: To investigate relationships between health-related quality of life (HRQOL) and demographic, injury and psychological variables in youth with spinal cord injury (SCI),

and examine agreement between child- and caregiver-report on a HRQOL measure.

Methods: Survey conducted within 3 pediatric SCI centers. Primary caregivers and youth with SCI completed HRQOL, anxiety, and depression measures; caregivers completed a demographics questionnaire; Functional Independence Measure (FIM) scores and injury information were gathered from medical records.

Results: 197 youth with SCI and their caregivers participated, 54% of youth were male, average age was 12.81 years (range, 5-18), 65% were Caucasian, 19% were Hispanic, 6% were African American, 69% had paraplegia, mean age at injury was 6.81 years. Older age at injury was associated with decreased caregiver-report emotional HRQOL ($p=.018$); and higher FIM scores were associated with increased child-report social ($p=.030$) HRQOL. Strong relationships emerged between anxiety/depression and HRQOL, with both caregiver and youth anxiety/depression associated with lower HRQOL on self and proxy reports, one exception being that caregiver anxiety was not related to child-report social HRQOL. Agreement between child self-report and caregiver proxy-report was moderate at best, with youth consistently rating their HRQOL as better than caregivers.

Conclusion: Anxiety and depression were consistently related to HRQOL. There was little agreement between caregiver proxy- and child-report ratings. Both perspectives are important and should be taken into account in pediatric SCI.

P112

Exercises with Percussion instruments for children with spina bifida

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Poor upper extremity function is often recorded in meningomyelocele patients. Slow performance with unsystematic variability is typical. Exercise is crucial to children with spina bifida (cSB) not only in terms of physical health and development but also in terms of personality and mental development. Participation in exercise as a team member gradually improves cooperation, ability to work together and a sense of respect to team members and game procedures among children. During the planning process of our study, we considered that these children should not be involved in heavy activities due to their ages and conditions. This study was designed to strengthen the upper extremities of cSB with percussion instruments and exercises. All the children involved in this program at the ages of 6-16 received physical examinations at the Turkey Spinal Cord Injured Individuals Association. The clinical neurological examination included Muscle power, The hand function test, and family evaluation tests, were done. At the end of the 8-week percussion instrument playing and upper extremity strengthening exercise program, each test which had been done at the beginning was applied again using the same methods. As a result, we consider playing percussion instruments and exercises, which can easily be implemented, to be a collateral approach in the treatments of cSB.

P113

Evaluation of ambulatory function in adults with Spina bifida

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Introduction: Spina bifida is a congenital malformation leading to paralysis and/or sensory loss in the lower limbs. Standing and walking ability is related to the cele level. Persons with low level paresis often maintain their walking, while persons with high level paresis cease walking. Few studies on adults with spina bifida exist.

Aim: To evaluate the ambulatory function according to muscle function in adults with spina bifida older than 18 years.

Material: 45 persons, 23 female and 22 male, median age 34.8 years (17.4-65.1).

Method: Functional walking ability, outdoor walking distance and use of orthoses and walking aid was documented. Joint range of motion and lower limb muscle strength was examined. TUG, 10 meters walking test and 6 minutes walking test were performed. After the 6 minutes walking test the participants estimated pain and physical exertion.

Results: The time used during walking increased significantly for the participants with less muscle function, also the distance at 6 minutes test was significantly shorter for this group. 39 participants fulfilled the six minutes walking, 17/39 experienced pain after the performed test and 31/39 reported physical exertion. Participants with poor muscle function reported shorter walking distances outdoors and less active functional walking ability than those with more muscle function.

Conclusion: All walking tests indicated that the degree of muscle function influenced walking function to the largest extent. In a future study it would be of interest to study the adults' attitude to their walking pattern and to walking aid and orthoses use.

P114

Urodynamic study in acute phase of spinal cord injuries. When to perform?

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The investigation of neurogenic bladder dysfunction in spinal cord lesions is classically performed after the acute phase of spinal cord shock. The authors postulated that urodynamic study could be essential even during that period. A retrospective study of patients admitted between 2001 and 2008 in our department (most of them in acute phase) was performed, correlating type and level of the lesion with clinical and urodynamic bladder behaviour.

We selected 43 patients with non-evolving spinal cord lesions, which were examined in the acute phase and in follow-up visits. We excluded patients with concomitant pathology known to interfere with the bladder behaviour, like diabetes mellitus.

In our study, we found that, even during the shock phase of spinal cord lesion, 1 patient had low compliance and 2 patients had detrusor hyperactivity.

Our results show that urodynamic study of neurogenic bladder dysfunction is a

fundamental tool in spinal cord lesions, even during the shock acute phase.

P115

An effectiveness of compression stockings on nocturnal polyuria in spinal cord injured patients

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Introduction and objective: Spinal cord injury (SCI) patients often show nocturnal polyuria (NP), and that can causes various complications including urinary incontinence, urinary tract infection and urinary tract deterioration, which also could compel them to carry out clean intermittent catheterization (CIC) frequently at nighttime and lead degradation in the quality of life.

In this study, we applied compression stockings to SCI patients suffering from NP only when sitting in wheelchairs during the day, and examined whether there was a decrease in their NP.

Methods: We examined 12 SCI patients showing NP (10 males and 2 females, the mean age was 40.8 ± 13.9 years old, 4 cervical injured and 8 thoracic injured, and CIC was carried out in all cases). during the day, The patients used compression stockings only during the day while sitting in their wheelchairs, and we evaluated nocturnal polyuria index (NPI) according to the frequency volume charts (three days or more for each).

Results: The mean value of NPI before using compression stockings in 12 cases was $47.4 \pm 8.9\%$, and it decreased significantly to $40.8 \pm 9.8\%$ after using compression stockings ($p=0.024$). Moreover, among 9 cases in whom we evaluated NPI more than 6 days, it was significantly improved in 4 cases (44.4%).

Conclusion: The use of compression stockings during the day appears to improve NP in SCI patients to a certain extent.

P116

Endoscopic Treatment with Bulking Agents for Complex Vesicoureteral Reflux

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Purpose: Evaluation of long term efficacy of subureteral injections of collagen and dextranomer/hyaluronic acid (Deflux)for complex VUR, predominantly neurogenic bladder(NGB).

Materials and Methods: Retrospective chart review of 23 patients (13 male, 10 female; median age 40 (20-61)) treated from 1995 to 2009. All were considered complex: 14 neurogenic bladders (4 prior reimplants), 5 adult congenital refluxes (2 prior reimplants), and 4 surgical trauma. 23 (82%) had Reflux grade III or higher, 5 (18%) had bilateral reflux. Recurrent UTIs and deteriorating kidney function were the main indications for intervention. Pre-operative cystography was compared to post-operative imaging. Followup ranged from 3 months to 11 years with additional interventions as needed.

Results: 28 ureters (23 patients) were treated, with 23 collagen injections (74%) and 8 Deflux injections (26%). Sixteen (51.6%) patients showed some improvement in reflux grade, while 7 (22%) had no change. Four (13%) patients underwent a second injection without benefit. Patients with NGB had a 21% success rate compared to non-NGB's 72% improvement. Deflux was successful in 6 of 7 (86%) injections compared to 8 of 23 (35%) of collagen injections. However, most Deflux injections were performed in non-NGB. Seven (32%) later required open surgical intervention.

Conclusion: Subureteral injections to treat complex VUR is an initial therapy option, with greater success seen in non-NGB patients. Ease of use warrants further investigation of dextranomer/hyaluronic acid in these complex patients.

P117

Spinal cord injured are well tolerating clean intermittent catheterisation (CIC) more than fifteen years after injury

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Clean intermittent catheterisation (CIC) is the most common way of bladder emptying in spinal cord injured patients. The neurogenic bladder dysfunction needs investigations of the urinary tract lifelong. In our SCI Unit urinary tract is investigated by cystometry, intravenous pyelography and estimation of glomerular filtration rate (GFR) by Chrom EDTA clearance.

Methods: A retrospective chart review of 249 patients treated in our SCI unit 1992-2002 was done. Twenty nine patients had four investigations. A phone interview of these patients was performed in order to investigate the current bladder emptying method and if the patients needed anticholinergic medication.

Results: Mean time after injury was 15 years. Three patients were excluded. In the first investigation 81% (n=21) of the patients used CIC and at fourth investigation 65% (n=17) still used CIC. Today 2009 54% (n=14) are still emptying their bladder with CIC 15 years after the injury. Of the rest 3 patients had started to use CAD, 2 went to a mixed regime and 1 had got a continent urinary diversion, 6 used another regimen than CIC through the years. 38% needed anticholinergic treatment due to urinary leakage. When comparing GFR at the first and fourth investigations we found that the patients who still performed CIC improved their GFR significantly, whereas no improvement was found in the subgroup who changed regimen or did not use CIC.

Conclusion: The patients are very satisfied with CIC as their method of bladder emptying and renal function improves in the group using CIC.

P118

Mitrofanoff procedure for the functional management of neurogenic bladder in spinal cord injury

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Mitrofanoff procedure is essentially a continent catheterizable urinary diversion that has been widely described as a beneficial option to improve independence and ease of bladder management in clients with SCI. Mitrofanoff has not gained wide popularity in the spinal cord injured population as yet in this part of the world, possibly due to socio-cultural reasons. Most SCI clients prefer to try to catheterize per urethra or get attendant help if needed. Lack of awareness on the part of the patients as well as primary clinicians on available alternative options for better independent bladder management could be amongst the other contributory causes.

In this series we describe three female clients with SCI who had agreed to undergo the Mitrofanoff procedure for reasons of impaired balance and/or hand dexterity needing easier access and positioning to carry out intermittent self catheterization. They were 8-22 years with injury levels varying from high paraplegia to lumbar level but with associated unilateral hand injuries. All three of them were at least 3 years post injury.

Here we detail out their clinical presentations, the indications, surgical procedure and functional bladder management outcomes. We also attempt to review the appropriate literature with reference to its long term outcome and compatibility for a Malones's procedure for concurrent neurogenic bowel management should the need arise later, as well as its implications on issues such as future pregnancy for our female clients.

P119

Renal insufficiency in SCI patients

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Renal disease is a significant cause of morbidity in spinal cord injured (SCI) patients. Urinary tract infections and stone disease likely significantly contribute to renal insufficiency. This presentation considers the prevalence of renal insufficiency at the Veteran Affairs Palo Alto Health Care System (VAPAHCS).

A retrospective review was conducted relating to neurogenic bladder management at the VAPAHCS. Patients with SCI & diseases were identified by ICD9 codes 336.x, 340.xx, 806.xx, 952.xx and renal disease ICD9 codes 584.x, 585.xx and 599.xx within the VA administrative databases. Renal insufficiency was defined by laboratory results with Creatinine above 2.0mg/ml.

Between the years 2006 and 2008, 2032 patients were identified with SCI or disease at the PAVAHCS. 146 patients were identified with Creatinine > 2.0 mg/ml. Of these the mean (\pm SD) was 3.4 ± 1.5 mg/ml. 241 patients were identified with chronic renal disease. 92 episodes classified as acute renal failure. 100 patients were diagnosed with unspecified

chronic kidney disease. 16 patients had renal insufficiency due to obstruction. This represents renal insufficiency or renal disease affecting approximately 8.4% of our SCI population. A full discussion of the bladder management of these patients will be presented.

Renal disease can be a significant burden on the health services systems. The aim of urological management SCI patients is prevention of renal insufficiency and failure. We conclude, that the prevalence of renal insufficiency in our SCI population based on serum creatinine is high compared to the able bodied population. Analysis of bladder management and renal function continues.

P120

Does the Injection of Intravesical Botulinum Toxin A Prevent SCI Patients with Detrusor Overactivity from Augmentation Cystoplasty

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We are presenting our experience about two SCI patients with detrusor overactivity who were scheduled to have augmentation surgery for their bladders.

Case 1: Patient was 33 year-old male who had T6 Paraplegia Asia Impairment Scale (AIS) A three years ago due to gunshot wound. Despite the use of different oral medications with maximum dosages, he could not tolerate a Foley catheter and had consistent leakage. In urodynamic assesment, his bladder capacity was 100 ml, bladder compliance was 9,8ml/cmH₂O and maximal detrusor pressure was 115 cmH₂O. As a last chance before the surgery, intravesical botulinum toxin injection was performed. Two weeks after the injection, a controlled urodynamic assesment was performed. In this assesment, patient's bladder capacity was 420 ml, bladder compliance was 22.8 ml/cmH₂O and maximal detrusor pressure was 38 cmH₂O.

Case 2: Patient was 24 year-old male who had C7 Tetraplegia AIS D five years ago due to fall. He was a community ambulator with two canes and it was bothersome for him to use a Foley catheter. His bladder capacity was 40ml, bladder compliance was 3.2 ml/cmH₂O and maximal detrusor pressure was 49 cmH₂O. In the controlled urodynamic assesment that was performed two weeks after the injection all parameters improved (bladder capacity: 360 ml, bladder compliance: 16.3 ml/cmH₂O and maximal detrusor pressure: 34 cmH₂O) and he could tolerate clean intermittent catheterisation 6 times daily.

Augmentation cystoplasty is an expensive method to improve bladder capacity. We believe that intravesical botulinum toxin injections should be tried before deciding surgical bladder augmentations.

P121

Laser Vaporization of the Urethral Strictures: Long Term Follow Up Results

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Introduction and Objective: Urethral strictures are now most frequently associated with trauma particularly in spinal injured patients whose urethra is exposed to perineal trauma and or repeated catheterizations. Current approach to the management with repeated DVIU and dilatation adds morbidity and almost follows the axiom 'once a stricture always a stricture'. This presentation is a long-term follow up of the patients managed using Laser vaporization to ablate urethral strictures.

Methods: Sixty two male patients, 26-72 years old (51 spinal cord injured and 11 others) had their strictures (1 to 4 cm long) ablated using contact Nd: YAG or HO: YAG laser. A metal guide wire was left in for orientation; an initial urethrotomy was made at the 12 o'clock position by retrograde vaporization of the scarred tissue through the length of the stricture, before it was circumferentially vaporized. Urethral catheter was removed after 24 hours. Patients were followed every 3 to 6 months.

Results: The mean operation time was 32 minutes (range 15 to 57 minutes). No significant bleeding was encountered. Patients have been followed from 2 to 9 years. (Mean 7.1 years). Repeat vaporization was required in 17% patients with 10% needing during the first year. Repeat vaporization was easy and the patients left the hospital within first 24 hour.

Conclusions: For strictures of the urethra the success rate following the circumferential laser vaporization is greater than the other reported techniques. It may be considered a minimally invasive procedure instead of with more durable results.

P122

The effect of standing - therapeutic walking and spasticity in paraplegia related bone loss

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Purpose: The purpose of this study was to investigate the effect of standing-therapeutic walking and spasticity in paraplegia related bone loss.

Methods: Peripheral quantitative computed tomography system (p QCT XCT-3000, Stratec Medizintechnik, Germany) in distal epiphyses and midshafts of the tibia was used to examine 31 paraplegic men in the chronic stage separated in group A (n=16, Thoracic (T)4-T7 neurological level of injury) and group B (n=15, T8-T12 neurological level of injury) in comparison with 30 healthy men. The distal end of the tibia was used as an anatomical marker. We calculated bone mineral density (BMD) trabecular, BMD total at 4% and BMD cortical, cortical thickness and 38%, respectively, of the tibia length proximal to this point and studied the influence of spasticity and standing - therapeutic walking on bone structures. The degree of spasticity was assessed with Ashworth scale.

Results: In group A (mean age: 33±16 yrs, duration of paralysis (DoP): 6±6 yrs) and

in group B (mean age: 39 ± 14 yrs, DoP: 5.6 ± 6 yrs) most bone parameters were statistically significantly decreased compared with controls. The degree of spasticity did not showed any preserving effect in the tibia. Paraplegics who used standing frames or long brace orthoses had statistically significantly higher bone mass (BMD trab, BMD tot) and geometric parameters (cortical thickness) independent of the functional level.

Conclusions: Standing or ambulation could possibly have a positive effect on cortical and trabecular bone in paraplegia. The degree of spasticity did not preserve bone loss.

P123

A Pilot Study On The Effect Of Alprazolam In Spasticity

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Background: "Alprazolam" (0.5mg), commonly used as anxiolytic agent, however, in few high Spinal Cord Injury patients it showed reduction in spasticity and spasm lasting for a few hours. On searching the literature we did not come across any study to authenticate this effect of alprazolam. Hence, we planned this study.

Methodology: This was a pilot follow-up study. 38 cases suffering from spasticity of any aetiology were included. 0.5 mg or 1mg of Alprazolam once daily $\frac{1}{2}$ hour before bedtime was given to every patient and repeat evaluations were done at day 15 (.5mg) and 1 month (1mg). Spasticity was assessed by Modified Ashworth Scale (MAS), Penn spasm frequency scale (PSFS), Peak torque at 30, 60, and 90°/sec using Biodex® dynamometer, ADL, and FIM motor.

Results: 34 completed the 1 month period of study, significant improvements were observe in MAS score, in PSFS at each time, in peak torque at 30 degree /sec velocity (only with 1mg), in peak torque at 60 and 90 degree/sec, in FIM score, in drinking activity (1mg) in dressing activity and in hand activity.

Conclusion: Alprazolam was a safe and effective drug for the treatment of spasticity with fewer and tolerable side effects when used up-to 1 mg of dose. It is an effective drug for the treatment of spasticity as well as spasms, that is, both the phasic and tonic part of stretch reflexes responds to this drug. Performance of ADL improved favourably with .5 and 1 mg alprazolam. Further studies are required regarding the long-term safety and efficacy and effective dose for spasticity.

P124

Brainstem Reflexes Are Enhanced Following Severe Spinal Cord Injury And Reduced By Continuous Intrathecal Baclofen

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Objective: Plastic changes in the human central nervous system can occur at multiple levels, including circuits rostral to the lesion level in spinal cord injury (SCI). GABA is the most important inhibitory neurotransmitter in the brain. We hypothesised that one of the consequences of plasticity in SCI patients could be enhancement of brainstem reflexes,

and investigated the effect of continuous intrathecal baclofen (CITB) on such enhancement.

Methods: We studied the early ipsilateral component R1, and the late component R2 of the blink reflex (BR), jaw jerk, masseter silent period (MSP), and auditory startle response (ASR) in 9 SCI patients without baclofen and in 8 with CITB. Nine healthy volunteers served as controls.

Results: The amplitude of R1 of BR was significantly smaller in patients with CITB than in the other groups. The area of R2 of BR and of the ASR recorded in the orbicularis oculi, sternocleidomastoid, and biceps brachii muscles were significantly larger in SCI patients without baclofen than in controls, while there was no difference between patients with CITB and controls. The MSP magnitude was significantly larger in patients with CITB as compared to those without baclofen.

Conclusion: The enhancement of brainstem reflexes in SCI patients may be due to plastic changes at the brainstem level after SCI. The significant reduction in response size in patients with CITB in comparison to patients without baclofen suggests that the enhancement of brainstem reflexes may be due to decreased GABAergic activity, and that CITB is effective in reducing abnormal brainstem hyperexcitability.

P125

Galvanic Vestibular Stimulation Analgesic Effect On Cervical Spinal Cord Injury

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Cold caloric vestibular stimulation has been demonstrated efficient to decrease central pain in cervical spinal cord injury. We present the case of a 57-year-old woman affected by cervical mielopathy due to compression by a neoplastic mass with sensory level C2, Frankel D. She described a very strong paroxystic nuchal central pain followed by irradiation of pain and spasms to the entire body. The purpose of the presented experience is to test the effect of galvanic vestibular stimulation on spinal cord central pain. Method. Galvanic vestibular stimulation was obtained by a train of one minute constituted by rectangular single pulses (duration 300 ms and amplitude 2 mA) separated by pauses of 1000 ms. Each train was repeated three times with a resting time of five minutes. Two cutaneous electrodes were put on the bilateral mastoid to stimulate the vestibular receptors, with an anode on the side of the cervical pain beginning. Frequency and amount of cervical pain, expressed as 0 to 10 VAS scale, were recorded every day before and after stimulation. Results. The patient enjoyed the galvanic vestibular stimulation effect: she tolerated the stimulus well reporting only a local burning sensation and light body instability without nausea and vomiting. She obtained a pain reduction: paroxysms frequency from 8-10/day before to 1-2 after treatment and intensity from 8-9 to 3-4 VAS rate. Conclusions. This experience demonstrates that galvanic vestibular stimulation, as an alternative to caloric vestibular stimulation, can be used to obtain pain relief in cervical spinal cord injury.

P126

Multidisciplinary assessment of patients with spasticity

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Objective: The effect of the advanced treatment of spasticity depends on thorough evaluation of the patient and realistic goals for treatment. Therefore we demonstrate the multidisciplinary model of evaluation of the patient.

Methods: The 31 consecutive patients, admitted to the Spasticity Management Clinic between 01.01.2007 and 31.12.2008 were assessed by the multidisciplinary team (an occupational therapist, a physiotherapist, a nurse and a neurologist). The occupational therapist assessed the functional level using Spinal Cord Independence Measure (SCIM 3). The nurse interviewed the patients and the caretakers regarding the use of aids and presence of pain using a Visual Analog Scale. The neurologist and the physiotherapist assessed spasticity using the modified Ashworth Scale and videotaping.

Results: Mean age was 50 years (range 19-82). Thirteen (42%) needed constant nursing. Twenty patients had spasticity in all extremities. The mean SCIM 3 score was 53.2. Seventeen patients had a maximal Ashworth score of 5 and 11 scored a maximum of 4. Eighteen patients (58%) reported pain. In total, 15 patients were treated with intrathecal Baclofen and 14 with Botulinum toxin. In 25 cases (81%), the functional status improved.

Conclusion: A multidisciplinary assessment contributes to evaluating the function of patients and guides the appropriate choice of a management strategy.

P127

Long term follow-up of ITB therapy satisfaction in patients with spasticity due to Spinal Cord Injury (SCI)

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Purpose: A common clinical sign after spinal cord injury is spasticity, usually characterized by recurrent spasms. We present the qualitative long term results of a case series patients receiving intrathecal baclofen (ITB) therapy and implanted with a SynchroMed pump.

Methods: 6 male patients (5 with tetraplegia and 1 with paraplegia) were implanted after 36.0 ± 19.8 mos from event. The mean follow-up visit period is 10.3 ± 1.8 years. During this last visit, for each patient both the spasm scale score and drug dosage was registered and a satisfaction questionnaire was administered.

Results: The spasm scale score decreased significantly from 3.8 to 1.2 ($p < 0.05$), and the drug dosage increased from 116.7 to 341.7 $\mu\text{g/day}$ ($p < 0.05$). Each patient replaced the pump once after 6.3 ± 0.8 years, one patient was re-implanted twice. Every patient indicated they would be implanted again and were satisfied with the therapy. Among the 3 patients who reported pain only one experienced substantial pain relief. The physician is satisfied with the global improvement of each patient. In the physician's opinion, all

the patients improved with regard to participation in the rehabilitation program and reduced/prevented contractures. For all but one patient, both the ability to perform activities of daily living and nursing activities improved. In addition, posture and use of the wheelchair improved for every patient. Adverse events occurred in 2 patients and were due to catheter dislocation.

Conclusion: These data revealed a global long term improvement and satisfaction on patient functional capacity. Also spasm scale reduction lasted in patients treated with ITB. The number of patients will be larger to extend these results.

P128

Intrathecal Baclofen In Spinal Cord Injury: A Retrospective Study On Complications In 50 Patients

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Objectives: Intrathecal baclofen therapy (ITB) is an effective means of treating intractable spasticity in spinal cord injury (SCI). The objectives are:

1. to determine the complications encountered in a series of 50 patients after implantation of an intrathecal baclofen pump.
2. to calculate the mean dose of ITB after long term follow-up (1,3 and 5 years).

Methods: A retrospective study was performed of the records of 50 patients with a SCI who underwent implantation of a programmable pump for ITB. First, all complications were reviewed. Secondly, mean doses were calculated after implantation procedure and after 1, 3 and 5 years.

Results: Thirty patients (60%) experienced a total of 49 complications. Thirty-six out of 49 complications were catheter related. A severe infection was the next most common complication. Infection (2 patients with bacterial meningitis and 4 patients with pump infection), a cerebrospinal fluid leak (3 patients) and wound dehiscence (2 patients) were seen less. Mean daily dose was 119 µg/d (48 patients) after implantation which increased to 329µg/d (41 patients), 437µg/d (30 patients) and 393µg/d (24 patients), respectively after 1, 3 and 5 years.

Conclusion: The mean dose after 5 years is higher than in patients with severe spasticity associated with multiple sclerosis or SCI, as reported by Zahavi in 2004 (290.63µg/d). Although intrathecal baclofen is increasingly being used to manage spasticity in spinal cord injury, numerous complications are reported. Mean daily dose of intrathecal baclofen administration seems to stabilize between 1 and 3 years after implantation.

P129

Evaluation Of Whole-Hand Transcutaneous Electrical Nerve Stimulation In Patients With Spastic Upper Extremities

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In our research we evaluated effects of the whole-hand transcutaneous electrical nerve

stimulation (TENS) therapy on reduction of spasticity. Two spinal cord injured patients with spastic upper extremities participated in the research and used the therapy in addition to their regular treatment. The TENS was delivered to the subject's hand by conductive glove. The therapy lasted for four weeks with five daily 20-minutes sessions each week. The effects of the whole-hand stimulation were assessed by isometric grip force tracking task, Jebsen-Taylor hand function test and modified Ashworth scale. In grip force tracking task, the subject had to track the target signal as closely as possible by adjusting his grip force which was produced either by finger flexor or extensor muscles. Both subjects completed tracking task before TENS, immediately after TENS and after 20 minutes rest. The Jebsen-Taylor hand function test and evaluation of spasticity with Ashworth scale were carried out in the beginning and in the end of each workweek before the therapy. The tracking results show, that the whole-hand stimulation did not have immediate effect on tracking capability of the patients as it was expected. However, improvement in their tracking was observed throughout the four week period, indicating better motor control. Furthermore, the Jebsen-Taylor test showed improved hand function which coincides with improved tracking capability. The reduction of spasticity, as assessed by modified Ashworth scale, was observed in the patient with more severe spasticity.

P130

Italian multicenter data collection on Intrathecal baclofen for Spinal Cord Injury (SCI): Results at 6 months follow-up

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Purpose: Intrathecal baclofen (ITB) infusion has been shown to be an effective treatment for spasticity secondary to SCI. This ongoing prospective data collection investigates the effect of ITB in this population of patients.

Methods: Since April 2007, 68 patients are included (88% males 12% females) with a mean age at event of 43.96 years. In this population, spasticity is due to traumatic spinal injury (76.5%), to familiar spastic paraplegia (2.9%), and to non traumatic spinal injury (20.6%). Each patient is assessed by Ashworth, and spasm scale. Pharmacological therapy, clinical-functional scenario are recorded at baseline and every 6 mos after implant.

Results: After bolus test, 57 pts were implanted, 8 pts had an insufficient response, 3 are still in examinations. Almost 84% of patients have a positive screening test. The mean time between event and implant is 49.73 mos. 28 pts performed the 6 mos follow-up visit. The reduction of average Ashworth scale in the lower limbs from 3.26 to 1.85 and the reduction of spasm from 3.0 to 1.89. was significantly $p < 0.001$, $p < 0.005$, respectively. Initial ITB dose of 122.5 increased up to 152.14 $\mu\text{g}/\text{die}$ at 6 mos visit. We observed 26 adverse events 17 related to baclofen and 9 to device. 5 events occurred during test period, 18 during implant period and 3 during follow-up period.

Conclusion: These preliminary data revealed a reduction in spasticity and spasms in patients treated with ITB. The impact on functional residual abilities will be investigated extensively during data collection

P131

Management of generalized and regional spasticity based on rehabilitation criteria

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Aim: The accentuation of management of generalized and regional spasticity with a combination of intrathecal baclofen pump (IBP) and botulinum toxin injections (BTI), respectively, in patients with spinal cord lesion (SCL).

Materials And Methods: A retrospective study of 23 patients (13 men) with mean age 49 years, presenting with severe spasticity due to SCL treated with IBP, from a total of 410 SCL new admissions, followed up since 2000. The mean follow-up time since implantation was 4 years and the mean daily dose of baclofen was 256 µg /day. Despite the satisfactory management of generalized spasticity post IBP implantation, 12 patients required further intervention with BTI for regional spasticity, based on the goals of rehabilitation program. The injection was performed under EMG guidance and electrostimulation. BTI was performed in: adductors for better hygiene and performance of intermittent catheterizations (IC) (3 patients), hamstrings for better positioning in a standing frame (2 patients), pectoralis major and biceps brachii for upper limb contractures (3 patients), ankle plantar flexors for clonus and contractures (5 patients), easier orthotic (walkabout) wear and enhancement of functional ambulation (3 patients).

Results: The combination of these two methods significantly facilitated all the tetraplegics caregivers, the performance of IC and hygiene, whereas ability for better sitting on wheelchair and self-transfers improved in paraplegics.

Conclusions: As long as the goals of rehabilitation are set up after IBP implantation, the combination of the two methods has satisfactory results on spasticity management and improves many aspects of patients' lives.

P132

Current Trends In Surgical Treatment Of Spasticity In Tetraplegia

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Purpose: To analyze the shift of treatment strategies over time in patients with incomplete tetraplegia after traumatic cervical spinal cord injury.

Methods: During 2005-2008, 133 individuals with tetraplegia underwent surgical reconstruction of hand function. 30 of these persons had corrections of deformities and functional surgery aiming at reducing spasticity in the hand and thereby improving the ability to open the hand for grasp function.

Results: The percentage of spasticity related surgery during the years 2005-2008 steadily increased (19%, 20%, 28%, 32%). The surgeries performed typically included lengthening of superficial flexor tendons, release of thumb adductor and release of the ulnar wing of the dorsal aponeurosis at the proximal joint level, i.e. release of interossei.

Post-operative training was always initiated day after surgery and included both training to increase range of joint motion and improving grasp ability in multiple activities of daily life. At 6 months follow-up this improved ability was essentially retained. An additional treatment effect was the overall improvement of shoulder and upper extremity range of motion.

Conclusions: Surgical intervention and immediate post-operative activity training improves the overall function and ability in patients with incomplete tetraplegia and spasticity. The current trend is that a number of patients requiring this type of corrective surgery are progressively growing.

P133

Treatment of spasticity with intrathecal Baclofen administration: long-term follow-up, review of 51 SCI patients.

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Retrospective study of patients who underwent ITB pump placement in the Departement of Neurorehabilitation of the University Hospital of Nantes.

The test procedure is analyzed: bolus or continuous injection through a temporary catheter or a subcutaneous port and the clinical response.

After implantation of the pump, clinical data during the follow-up, daily-required dose, adverse events and complications have been recorded.

51 SCI patients have been implanted during the period from 1991 to 2008. Among them, 15 patients were walking.

The most common test procedure was a tempory catheter and the mean bolus required was 50 ± 26.4 mg. The evaluation during the test included the analysis of the spasticity with the Ashworth scale but the limitations of activities were not systematically evaluated by the Functional Index Measurement (FIM). In walking patients, a video recording was always performed.

At time of implantation, the mean delay post-injury was 60.5 ± 67.8 months. The upper end of the catheter was often located in T6.

At one year post-implantation, the mean daily dose required was 381.9 ± 227.9 mg.

In 43% of the patients, a catheter complication occurred and 47% of the patients underwent at least one pump replacement. Five patients have been explanted (4 sepsis, one flaccidity due to a Charcot Spine).

ITB is a suitable procedure for management of spasticity in SCI patients. We need a better standardized evaluation, especially in walking patients, during the test procedure. The most frequent complication is the fissure of the catheter.

P134

Role Of Botulinum Toxin In Shoulder Pain

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Shoulder pain associated with spasticity is common in people with acute tetraplegia and stroke. Prevalence rates in acute tetraplegia were 51% to 85%. Spasticity of subscapularis and pectoralis muscles were the primary cause for the pain. The effects of Dysport on shoulder pain associated with spasticity of six patients were described. Four tetraplegic males and two hemiplegic females were studied. Age ranged between 59 and 82 years. Duration of paralysis ranged from one month to three years. Out of four tetraplegic patients, three were ASIA Impairment Scale (AIS) 'D' and one was 'A'. All six patients presented with pain and restricted range of motion in shoulder abduction and external rotation. All patients were injected with Dysport into subscapularis under CT guidance and pectoralis major by surface marking. No relationship has been found between the prevalence of shoulder pain and level of injury (high versus low tetraplegia). Post injection pain relief ranged from 80% to 100%. Ashworth Scale reduced between one and two grades. Shoulder abduction passive range of motion improved between 40 and 70 degrees. Functional improvement was noticed. Several techniques using surface anatomical land markings were reported with the botulinum toxin injection to localise subscapularis. We found CT localisation was the accurate technique. Radiation dosage to the patients were carefully monitored and based on ALAR principle. Benefits achieved by this technique were pain relief, improvement in range of motion and improvement in upper limb functional activities. Botulinum neurotoxin injection into subscapularis and pectoralis major relieves shoulder pain associated with spasticity and provides a therapeutic window for physical and occupational therapists to improve range of motion, prevent contractures and improve functional activities.

P135

Our Experience with Ketamine for Neuropathic Pain in Patients with Spinal Cord Injury

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Purpose: Neuropathic pain is often difficult to treat despite the use of several drugs. We report our experience with ketamine, an NMDA receptor antagonist, in the treatment of patients with neuropathic pain due to spinal cord injury.

Methods: We treated 8 patients with neuropathic pain due to spinal cord injury with ketamine. The cause of pain was central cervical cord injury (n=6) and sequelae from cervical and thoracic OPLL (n=2). All patients underwent a challenge test with a small amount of the ketamine; if the drug proved effective, treatment was continued.

Results: Of the 8 patients, 7 responded positively to ketamine and its administration was continued. The symptoms disappeared completely in 3-, were reduced in 3- and did not respond to treatment in 1 patient. None of the successfully treated patients suffered

symptom recurrence; in these patients the nature of the pain was allodynia-like. At the challenge test, improvement was 30% or less in effectively treated patients; in the unresponsive patient it was 43%.

Conclusions: Ketamine is useful to treat allodynia-like neuropathic pain due to spinal cord injury. To predict its effectiveness, information regarding the nature of the pain, the results of the challenge test, and the anticipated duration of treatment are useful.

P136

The effect of ankle-foot orthosis constructed in 5 degree of dorsiflexion on gait and energy expenditure in patients with cauda equina syndrome.

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Objective: To assess the effectiveness of an ankle-foot orthosis constructed in 50 degrees of dorsiflexion on gait impairments and energy expenditure in patients with cauda equina syndrome for whom orthoses were indicated to control knee recurvatum.

Method: Five patients who had a diagnosis of cauda equina syndrome were included in the study. Each patient underwent gait analysis and energy consumption studies with and without the ankle-foot orthosis (AFO). The AFOs were all custom-made for the individual patient and had a dorsiflexion stop at 50 degrees. The Vicon 512 Motion analysis system was used for gait analysis. Walking energy expenditure measurements were done with breath by breath method using an open-circuit indirect calorimeter (Vmax 29c, SensorMedics, USA). All tests were carried out on the same day with adequate resting periods.

Results: AFO application, as compared with the barefoot condition did not improve walking speed, cadence or energy consumption. Ankle dorsiflexion at initial contact showed a significant increase. Maximum knee extension at stance was reduced and knee recurvatum at midstance was improved with the AFO.

Conclusion: The ankle-foot orthosis constructed in 50 degrees of dorsiflexion is useful in controlling knee recurvatum in the gait of the patients with cauda equina syndrome.

P137

Adverse events during electro-acupuncture for spinal cord injury related neuropathic pain.

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Purpose: Neuropathic pain (NeP) is a common complication of spinal cord injury (SCI) that can be particularly difficult to treat. An electro-acupuncture protocol was developed specifically to treat SCI related NeP and has been used in various Canadian rehabilitation centers. Currently, there has not been a randomized control trial. Prior to such trial, it is necessary to assess the safety of electro-acupuncture, including both recording adverse events as well as monitoring systolic blood pressure (SBP) as this population can be at risk for autonomic dysreflexia.

Objective: To assess safety of electro-acupuncture in the SCI population.

Methods: In a multi-centered, randomized controlled trial, participants with SCI related chronic NeP were randomly assigned to receive 13 sessions of active or sham electro-acupuncture. SBP was monitored throughout the first five sessions. Adverse events, such as bleeding, dizziness, and nausea were recorded at every session.

Results: Five participants successfully completed a course in acupuncture, two in treatment and three in placebo. There was a total of 48 recorded sessions, 30 of which had SBP monitoring. 27(90%) had a transient increase in SBP (mean = 6.8, SD = 6.0). There was one recording of a 25mmHg increase, which suggests risk of autonomic dysreflexia. The most common adverse events were bleeding at the needle site (18.8%), dizziness (4.2%), nausea (2.0%), and prolonged pain (2.0%).

Conclusion: Electro-acupuncture appears to be safe in the SCI population with only mild adverse events. Despite being asymptomatic, there was one recording of SBP changes over 20mmHg, emphasizing the importance of SBP monitoring.

P138

Oral midodrine in management of priapism in spinal cord injured patients

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Purpose: To evaluate midodrine as an oral treatment of pharmacologically induced priapism in spinal cord injured patients.

Materials and methods: From 2004 to 2007, 354 spinal cord injured patients were treated with intracavernosal injection (ICI) of prostaglandins (PGE1) to induce erection. A prolonged erection or priapism happened in 14 cases (1,3% of ICI). High blood pressure and bradycardia (autonomic dysreflexia) were noticed in two tetraplegic patients. Except for 2 patients, oral midodrine was used as the only therapeutic approach of this event, because of its alphasstimulant properties.

Results: all patients returned to the flaccid penile state within 30 to 45 minutes after administration of midodrine. Oral midodrine was well tolerated with few side effects, without increasing the incidence of autonomic dysreflexia. At 6 months, a complete erection could be again induced with ICI in all treated patients.

Conclusions: midodrine administered orally is a simple and efficient treatment of priapism induced by ICI of PGE1. It could be the first line therapeutic approach before more aggressive procedures.

P139

Sacral Nerve Stimulation For Neurogenic Bowel Dysfunction - A Case Report

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Sacral nerve stimulation offers a minimal surgical alternative to the major surgical procedures for idiopathic faecal incontinence with success rates of approximately 80%.

The indications for sacral nerve stimulation are broadening, and pilot studies suggest the use also in incomplete spinal cord injury patients with neurogenic bowel dysfunction. For sacral nerve stimulation an electrode is implanted through one of the posterior foramina of the sacral bone. Permanent implantation is usually preceded by a three week test period using a percutaneous needle electrode – the percutaneous nerve evaluation. This test improves patient selection for permanent implantation of the electrode and pacemaker. A case report with a patient with incomplete spinal cord injury and neurogenic bowel dysfunction successfully treated with sacral nerve stimulation is presented.

P140

Bowel Dysfunction and Colon Transit Time in Spinal Cord Injured Patients

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Objective: The aims of this study were to reporting the International Bowel Function Basic Spinal Cord Injury (SCI) Data Set and to evaluate the relationship of the functional ability and colon transit time (CTT) in SCI patients.

Method: Fourteen SCI patients were participated to the International Bowel Function Basic Spinal Cord Injury (SCI) Data Set. Total and segmental CTTs were assessed using radio-opaque markers (Kolomark) and functional ability were evaluated by using the revised version of the spinal cord independence measure (R-SCIM), functional independence measure (FIM) and walking index SCI (WISCI).

Results: The mean age of the subjects was 46.8 ± 17.6 years old and the level of injury ranged from C4 to T11. Main defecation methods were normal=6(46.2%), suppositories=3(23.1%), digital evacuation=2(15.4%) and others=2(15.4%). Average time for defecation were 0-5min=5, 5-10min=4, 21-30min=2 and others=2. Frequency of defecation were 2-6/week=6, twice daily=2, once daily=2, once every week=2 and others=1. Total CTT was 53.3 ± 16.7 hours and total R-SCIM, FIM and WISCI scores were 52.3 ± 32.0 , 84.2 ± 24.4 and 6.7 ± 8.3 . The R-SCIM, FIM and WISCI scores showed significantly correlated to the total CTT.

Conclusion: In SCI patients, bowel dysfunction was mainly according to the decreased colonic motility and it can be evaluate with CTT. There were significant negative correlation between the total CTT and their functional ability.

Key Words: Colon transit time, Spinal cord injury, Spinal cord independence measure, Functional independence measure

P141

Change In Neurogenic Bowel Dysfunction (Nbd) Score After The Sequential Step-By-Step "Montecatone" Bowel Management Program

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The NBD score is validated for assessing changes in bowel function in SCI patients (Krogh, Spinal Cord 2006). We standardized a therapeutic protocol for chronic constipation in SCI

patients, which requires stimulating bowel evacuation starting from the 1st step (balanced diet with fiber supplement and scheduled defecation by bisacodyl suppository) and only if unsuccessful to progress to subsequent steps. Macrogol, prebiotics and probiotics are administered in Step#2. Regular sessions with Retrograde Transanal Colonic Irrigation by means of Peristeen® by Coloplast (Denmark) characterize Step#3. 69 SCI patients have been involved in this program following their report of constipation during 2008: 53 had post-traumatic SCI (Group A) and 16 due to other diseases (Group B). In Group A, 31/53 had ASIA Impairment Scale (AIS) score A (58.4%) versus only 5/16 in the Group B (31.2%, $p < .05$, Fisher Exact Test). Group A was younger: 43 ± 17 years (range 14-77 years) versus 53 ± 10 years (range 29-67 years) in the Group B ($p < .03$, Student's T-Test) and the time since onset was less: 69 ± 14 months in Group A versus 163 ± 179 months in Group B ($p < .008$). NBD score did not differ (15 ± 7 and 17 ± 6) at the beginning of the program, being severe (≥ 14) in the 58% and in the 81% of Group A and B respectively. NBD score decreased < 6 (very minor bowel dysfunction) with the 1st step of the protocol in 22%, while it was necessary to proceed to Step#3 for obtaining a decrease in NBD < 6 in 35% of the patients globally considered. In 12% no change in NBD was reported.

P142

Sexual Functions And Sexual Relationships Of Thai Men With Chronic Spinal Cord Injury

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Objective: To study sexual functions and sexual relationships of Thai men with chronic spinal cord injury (SCI).

Method: Thai men, older than 18 years old with duration of SCI more than a year, were interviewed. Their sexual function and sexual relationships were analyzed and reported.

Results: There were 56 SCI men: 10 complete tetraplegics, 7 incomplete tetraplegics, 25 complete paraplegics and 14 incomplete paraplegics; 35 ASIA impairment scale (AIS) -A, 9 B, 5 C and 3 D; with mean age of 37 years (SD 11.5) and average time since injury of 7.9 years (SD 7.4). Twenty seven men (48%) had a wife or a sexual partner but 35 men (63.5%) still had sexual desire. Regarding sexual function, 57% of all had sensations arising from sexual arousal but only 29% had sufficient erection for intercourse. Of those having sexual intercourse (15 men), 60% reached the orgasmic phase but only 40% had ejaculation. Spasticity, pain and urinary incontinence were reported to interfering with sexual intercourse. When comparing between groups of different severity and levels, there was no significant difference in degree of erectile dysfunction, orgasm and ejaculation. After SCI, about one-third of all had learned about coping and managing with sexual dysfunction, mainly from the SCI handbook for patients. Those receiving sex education or counseling after injury had more satisfaction in their sexual relationships than those not getting sexual counseling or education.

Conclusion: After spinal cord injury, most of Thai men had erectile dysfunction and limitation in creating and maintaining sexual relationships.

P143

Cross-cultural adaptation of a german version of the spinal cord injury pain basic data set and its implementation into clinical routine in the Swiss Paraplegic Centre

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After the publication of the spinal cord injury pain basic data set by the work-ing group consisting of specialists of the International Spinal Cord Society, ISCoS, the American Spinal Injury Association, ASIA, the American Pain Society, APS and the International Association for the Study of Pain, IASP in 2008 we decided to implement this data set into our daily work at the Swiss Paraplegic-Centre. With the permission to perform the adaptation into German language we underwent the process, following the principles of Guil-lemain et al. (1993) and Beaton et al. (2000). Two independent translations into German were compared, discussed and formed into one version. This version was re-translated into English by a native speaker, who did not know the original text. This text was compared by an independent person with the original text. Together amendments were discussed. The final German version was given to a small group of patients and tested for comprehensibility. As there were no further corrections necessary the questionnaire was put into action.

Each patient entering the clinic is asked if he or she is suffering any pain or taking any pain modulating medication. In either of these cases the questionnaire is applied. A pain nurse helps the patient to fill out the questionnaire, controls the data for completeness and enters the answers in a common data base. The results are discussed on a weekly consultation.

P144

Medical Treatment Of Neuropathic Pain In Spinal Cord Injured Patients During The Follow-Up Period: Choice Of Medication And Effectiveness

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Aim: The aim of this study was to investigate the choice of medical treatment in the management of neuropathic pain in spinal cord injured patients attending the follow-up clinic.

Material and Methods: One hundred twenty three spinal cord injured patients attending the out-patient follow-up clinic of a rehabilitation center were included in the study. The patients' clinical data were investigated. The patients identified as having neuropathic pain during the visits were interviewed by phone and responded to a visual analogue scale (VAS) at the present time. Data on medication used for pain, effectiveness of the treatment (both by the patient and physician, 1-4 scale, where 1: poor, 4: very well) were evaluated.

Results: Forty two female, 81 male patients with a mean age of 38.8 ± 13.2 years and median injury duration of 71 months (8-324 months) were included. Forty three of the

patients (35%) had neuropathic pain with a median duration of 24 months (7-144 months). The majority of the patients were using gabapentin or pregabalin (37 and 28% respectively), 2 patients were not using any medication. The VAS improved significantly with the treatment ($p:0.00$). The effectiveness was reported as well and very well as a rate of 49% by patients and 65% by the physician.

Conclusion: In this study gabapentin and pregabalin were the most common drugs of choice for pain management. The medications were found to be effective. The known efficacy and safety profile of these drugs can be the reason for preference.

P145

Neuropathic Pain And Depression In Patients With Spinal Cord Injury

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Aim: Our aim is to investigate the characteristics of spinal cord injured (SCI) patients with neuropathic pain (NP) and the relationship between pain and depression.

Material and Methods: 100 SCI patients were evaluated with respect to demographic data. ASIA impairment scale was used for neurologic classification. The Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) for NP, the Beck Depression Inventory for depression and a Visual Analog Scale (VAS) for pain intensity were used. According to the LANSS scale, 51 patients had NP. The patients were divided into two groups (group 1: patients with NP, group 2: patients without NP) and effect of depression on NP was examined between the groups.

Results: In group 1 (33 men, 18 women) mean age was 38.76 ± 13.8 years, median duration of SCI was 14 months. Forty patients had an incomplete lesion and 33 were paraplegic. Pain duration was 1-33 months. The mean VAS was 6.4 ± 2.1 . In group 2 (35 men, 14 women) the mean age was 40.8 ± 0.6 years, median duration of SCI was 25 months. 24 patients were complete, 35 had paraplegia. There were no significant differences among the groups according to age, gender, and duration of illness. The Beck depression score was found significantly higher in group 1.

Conclusion: According to the results of this study we conclude that depression is more common among SCI patients with NP. In the management of pain after SCI, psychological factors should not be underestimated.

P146

Associated Pain And Strain Injuries In Paraplegic Wheelchair Sport Persons

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Purpose: Wheelchair provides mobility for millions with physical impairments, but only a small percentage of them are involved in wheelchair sports. Previous studies have identified the prevalence of isolated joint or muscular pain or other repetitive strain injury among wheelchair users. Wheelchair sports are more prevalent in western countries. The current study examined the associated injuries in person involved in the wheelchair sports

in India.

Methods: 40 persons with paraplegia involved in wheelchair sports were included and asked to complete a questionnaire. A detailed physiotherapy evaluation was done in order to describe the type and site of impairment or pain after sports activities of 2-3 months. The Wheelchair Users Shoulder Pain Index and an overall pain score (Brief Pain Inventory) were also used to assess associated injuries.

Results: Out of all the respondents, 40% had shoulder pain due to impingement syndrome, tendinitis or rotator cuff tear/ sprain, less than 1% had elbow pain due to sprain and complaints of pain at the medial epicondyle (epicondilitis). The prevalence of pain in the wrist was due to carpal tunnel syndrome, blisters, abrasion or laceration and was between 8-9%. Some subjects mentioned other related injuries of the body on visual observation.

Conclusion: Shoulder pain is the most commonly site of associated injury in persons involved in wheelchair sports persons and are noted in those who also reported lower quality of life. The other associated injuries of possibly equal importance were mainly overlooked but are important to be considered.

P147

The Effect Of Olfactory Mucosa On Tissue Sparing And Locomotor After Spinal Cord Hemisection In Rats

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Purpose: This study was conducted to determine the possible beneficial results of transplantation of fetal olfactory mucosa (FOM) that is the source of OECs in the recovery of locomotor function and in spinal tissue sparing after spinal cord hemisection.

Method: Forty-eight adult female Sprague-Dawley rats were spinally hemisected at the L1 level and were randomized into three groups of 16 animals. One group of immunosuppressed injured animals received cyclosporine A (CsA) and FOM graft. The second group received CsA and fetal respiratory mucosa (FRM) graft, the control group of non-immunosuppressed rats received saline and gel foam. Locomotor performance was assessed weekly for 8 weeks after lesion, using the locomotive rating scale developed by Basso, Bresnahan and Beattie (BBB). After behavioral assessment the spinal cord was examined histologically for spinal tissue sparing.

Findings: From 6-8 weeks, the functional recovery of the FOM rats significantly increased in comparison to the FRM, although a significant difference in tissue sparing was not apparent. From 3-8 weeks, the functional recovery of the FOM and FRM groups as well as tissue sparing of the FOM group increased significantly compared to the control group.

Conclusion: FOM treatment may be effective in promoting functional recovery and partially preserving tissue sparing.

P148

Augmented biofeedback rehabilitation in trunk control in spinal cord injury

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The aim of this study was to evaluate the feasibility and the efficacy of a rehabilitation protocol with augmented biofeedback (both audio and visual, AVBF) in subjects with spinal cord injuries (SCI) for improving trunk postural control.

Ten subjects with SCI (lesion level range C6-T6) were evaluated and trained at the Montecatone Rehabilitation Institute. Patients were randomly assigned to a treatment group (TG, 6 patients) and to a control group (CG, 4 patients). For 15 days, the TG patients followed an experimental training with AVBF for 20 minutes daily, in addition to a conventional therapy, whereas CG patients had only conventional therapy for 120 minutes daily. An AVBF system, previously developed by Chiari, was used to provide subjects with two different designs of either AVBF of the acceleration sensed using a two-dimensional accelerometer, while patients were seated comfortably in their wheelchair. Both AVBF were generated in real-time based on this signal.

The AVBF induced a significant reduction (from the first session of AVBF use, $p=0.004$ to the last day of program, $p=0.02$) in the antero-posterior trunk sway amplitude, with respect to trials without AVBF, in the TG. In addition, trunk sway amplitude in the TG was reduced with respect to CG starting from the first session of AVBF ($p=0.007$) to the last day of therapy ($p=0.009$).

The presented results, whereas preliminary, showed the efficacy of the AVBF in comparison with conventional therapy in increasing self-control to continuously adjust trunk movements in order to re-establish a correct voluntary trunk seated posture.

P149

Cuirass Ventilation In Spinal Cord Injury Patients

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Introduction: Respiratory failure is common in high spinal cord injury (SCI) patients. This necessitates the use of long term ventilation usually via tracheostomy tube. Some patients are unable to tolerate this mode of ventilation leading to increased morbidity and mortality. The biphasic cuirass ventilator (BCV) is a method of ventilation which works using a non-invasive cuirass or shell that controls both phases of the respiratory cycle. This type of ventilation has been used principally for patients with neuromuscular disorders but has a potential role for SCI patients.

Aims of study: To assess the response, in terms of tolerability and recurrent infections, to BCV of 2 SCI patients (C4 tetraplegics) who were unable to manage ventilation via tracheostomy.

Case Reports: 2 C4 tetraplegic patients presented with recurrent infections and admissions with respiratory failure. The first patient was unable to use conventional

ventilation due to a large tracheal stoma which could not accommodate a tracheostomy tube. The second patient would not use tracheal ventilation because of psychological problems. Both patients had a trial of BCV and tolerated it extremely well, coming out of respiratory failure and reducing the number of infections they had at follow up.

Conclusions: The cuirass ventilator is an alternative to the traditional positive pressure ventilation given via tracheostomy. Its main advantages are that it is non-invasive, it helps maintain respiratory muscles and it has an oscillation mode which provides chest physiotherapy on demand. This last benefit suggests that it may have a particular advantage for SCI patients.

P150

How to convert a bicycle to a hand-cycle for people with or without paraplegia

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Purpose: This study describes the design of a hand-cycle, and how easy it is to convert a bicycle to a custom hand-cycle with a delta-style frame and fork steering and also a recumbent body position.

Methods: A 10-year-old bicycle was cut into several pieces in order to remake a new design for a hand-cycle. We designed and built a custom hand-cycle for an able-bodied person, therefore, the user's personal needs were key design drivers (198cm and 94kg).

Results: After many hours of searching the right design and many hours of making and assembling the parts of the bicycle, and during five months of evaluation and over 500km of use there were no observed failures from the design. The only things that we had to design, in order to complete the hand-cycle, were the rear axle with two wheels, the seat and the backrest. The evaluation of this design was not a professional work, but it was a fast and serious solution in order to convert an old bicycle to a hand-cycle.

Conclusion: There are many manufacturers if someone wants to buy a new hand-cycle. Even though these solutions are suitable, hand-cycles can be very expensive if someone wants to buy. About twenty hours of good and hard work is the key in order to have a hand-cycle to meet our needs at a very low cost.

P151

Fibreoptic Bronchoscopy Relevance In A Tracheostomy Decannulation Protocol For Quadriplegic Patients

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Abstract: Fibreoptic bronchoscopy is one of the steps included in protocols of tracheostomy decannulation to check vocal cord motility and tracheal and upper bronchi status. In a retrospective study 18 tracheostomized quadriplegic patients admitted in our Spinal Unit underwent fibreoptic bronchoscopy, a procedure inside a decannulation flowchart in use in our SpinalUnit:

Inclusion Criteria:

- acute traumatic quadriplegia
- admitted to Spinal Unit with a tracheostomy
- decannulated when staying in Spinal Unit between January 2006 and February 2009.

Results: Nine of eighteen patients showed clean trachea and upper bronchi; six had understomal granuloma: five were treated by endoscopic laser, one did not need treatment; two showed a severe suprastomal stenosis that needed surgical treatment.

Discussion: fibreoptic bronchoscopy is nowadays one of the steps enclosed in decannulation protocols for tracheostomized patients. Other steps include serial controls: spirometric, otolaryngologic vocal cords, swallowing ability, mental disorders, and, with a small sized capped cannula, bronchial secretions and arterial blood gas-analysis. No procedures to perform a decannulation pathway in quadriplegic patients were found in literature. Our report emphasizes the frequency in finding tracheal granulomas or stenosis in quadriplegic tracheostomized patients and the bronchoscopy relevance in decannulation protocols. Perhaps this complication is due to a prolonged insertion of the cannula, that acts as foreign body, triggering an inflammatory and hyperplastic cascade.

CONCLUSION: in a decannulation protocol, fibreoptic bronchoscopy should be early provided, to avoid losing time in restoring bronchial lumen, when other criteria show the patient is ready to remove tracheostomy.

P152

Respiratory insufficiency in acute spinal injury relieved by intermittent breathing support

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A 75 year old man fell out of his bed and woke up on the floor. He was initially unable to move his arms and legs. This improved to partial paresis. MRT showed signs of anterior ligament damage and a C4C5 central spinal stenosis with compression of the medulla. Upon arrival to the spinal unit pulseoximetry (POX) was 89% without and 95% with 1 L O₂. On day 5 the legs were weaker. On Day 13 decompression C4C5 was performed. On Day 17 POX was 87% with 1 L O₂. Pulmonary X-ray revealed an elevated right diaphragm, atelectasis in the right basal lung and increasing CRP. CRP improved after antibiotics. Forced vital capacity (FVC) was 1,9 L/sec sitting and 1,2 L/sec supine. On Day 23 transient dips to POX to 80-81% occurred (despite 3L O₂), improving if sitting, and using accessory breathing muscles. Night measurement showed dips in POX to 89% and a morning arterial pO₂ of 8,9 kPa. It was therefore decided to use bilevel positive airway pressure (BiPAP), with 10 cm inspiratory pressure. Arterial pO₂ improved from 8,9 to 12,6 kPa, but a slight decrease in blood pressure occurred. The patient used BiPAP 1 hour two times per day. 6 weeks post injury the patient managed without oxygen and the FVC was now sitting 2,6 L/sec, supine 1,6 L/sec. C3 ASIA Impairment Scale C\|D

Conclusion: Intermittent BiPAP can be an alternative for improving respiratory status in elderly patients with a cervical spinal injury.

P153

Basal metabolic rate in wheelchaired basketball players with spinal cord injury

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Objectives: The purpose of this study was to compare the basal metabolic rate (BMR) in wheelchair basketball players with spinal cord injury and nonsportsmen with spinal cord injury.

Research Method And Procedures: Twenty motor complete paraplegic men (ASIA Impairment Scale A and B) participated in this study. 10 of them were wheelchair basketball players (group 1) and the others were not (group 2). Neurological levels of the patients were matched in both groups. Measurements of BMR (VO_2) were determined by indirect calorimetry under standardized conditions.

Results: Mean age of group 1 is $29,00 \pm 6,48$ years and group 2 is $27,33 \pm 5,98$ years. Mean BMR level of group 1 is 0,223 L/dk and group 2 is 0,215 L/dk. BMR levels of wheelchair basketball players were higher than nonsportsmen with spinal cord injury, but the difference was not statistically significant.

Conclusion: We concluded that BMR levels in spinal cord injured patients who are wheelchair basketball players are higher than spinal cord injured patients who don't play basketball. Therefore the energy needs of wheelchair basketball players with spinal cord injury may increase and it is necessary to consider this information in making daily nutrition plans.

P154

Ventilator-Dependent Motor-Complete Tetraplegia Following Cervical Transforaminal Epidural Injection: A Case Report

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Study design: Case report

Summary of background data: There have been few reported cases of spinal cord infarction following cervical transforaminal epidural injections. Although rare, the consequences can be devastating.

Objectives and results: We report the case of a healthy 51-year-old man who presented with acute left C7 radiculopathy. A fluoroscopically-guided cervical transforaminal epidural injection was performed at the C6-C7 level using 40 mg of triamcinolone and 0.5 cc of saline solution. Within minutes of the injection, the patient developed motor-complete tetraplegia with respiratory insufficiency warranting intubation. The initial cervical magnetic resonance imaging revealed no spinal cord changes but a follow-up study 24 hours later demonstrated an image compatible with spinal cord ischemia from C2-C6 in the territory of the anterior spinal artery. There was no evidence of direct spinal cord trauma or epidural hematoma.

Conclusion: Ventilator-dependent motor-complete tetraplegia is a rare complication following cervical transforaminal epidural injection. The main causal mechanism is

believed to be the larger size of the triamcinolone particles versus other corticosteroids embolizing during inadvertent intravascular injection.

P155

Spinal Cord Injury And Driving Assessment

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Purpose: To correlate Spinal Cord Injury (SCI) level, age and driving ability in people with paraplegia or tetraplegia and to find out the association between driving ability and social reintegration.

Methods: 123 drivers with SCI were evaluated during the period 2000-2008. Data regarding neurologic level, age, gender, functional capacity performing activities of daily living and driving ability were recorded by the medical team of the "INIOHOS". Vocational status and involvement in sports activities were investigated by questionnaire.

Results: The injury level, age and previous driving license strongly influenced the patients' car driving ability. The highest neurologic level in which independent driving was achieved was C6. 80% of the people with SCI who had a job could drive independently and 45% of the independently driving persons have found a job. Only 40% of the independently driving persons aged less than 40 years participated in sports activities.

Conclusions: Driving ability is one of the most important factors that permit the spinal cord injured drivers to participate in work, social and sports activities and offers independence and freedom in patients who use wheelchairs. At most neurologic levels of injury, individuals with SCI have the potential to return to independent driving with the appropriate adaptive equipment.

P156

Intensity and energy expenditure of sports in elite Spinal Cord Injury Paralympic athletes

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Evaluating the physiological responses of athletes in competitive environment is important for assessing possible health benefits induced by sport. In the present study, we measured energy expenditure (EE) during sport simulation in elite spinal cord injury (SCI) Paralympic athletes participating in the following five sports: 5k wheelchair distance racing (WR, N=5), wheelchair basketball (N=7), wheelchair tennis (N=4), wheelchair fencing (N=4) and 5k nordic sit skiing (NS, N=3). These data were compared with laboratory aerobic fitness performance (oxygen consumption peak - $\dot{V}O_{2peak}$), hypothesizing that EE and intensities would be able to induce cardiovascular beneficial adaptations. Each athlete completed an incremental arm cranking exercise test to determine $\dot{V}O_{2peak}$. In

a subsequent session, sports simulation were carried out measuring $\dot{V}O_2$, carbon dioxide production and heart rate using a telemetric system. There were no significant differences in $\dot{V}O_{2peak}$ values (48.9 ± 7.62 ml kg^{-1} min $^{-1}$) and EE (11.7 ± 1.78 METS) between WR and NS athletes. These values were significantly higher than those measured in the other three sport group athletes, with no differences among them ($\dot{V}O_{2peak}$: 33.8 ± 3.09 ml kg min $^{-1}$ and EE 8.8 ± 0.97 METS). Sports intensities were also significantly higher in WR and NS athletes (85.2 ± 2.65 % $\dot{V}O_{2peak}$) than in the other athletes (79.1 ± 4.54 % $\dot{V}O_{2peak}$). In conclusion EE and exercise intensities of all these sports can be considered appropriate stimuli to increase aerobic fitness but greater aerobic energy demands and intensity levels found during NS and WR can explain the higher $\dot{V}O_{2peak}$ of these athletes.

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P157

Cardiovascular disease prevention in individuals with a spinal cord injury, attending their annual rehabilitation review appointment

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Background: Cardiovascular disease (CVD) is the second leading cause of death in individuals with a spinal cord injury (SCI). Cardiovascular disease prevention programmes aimed specifically at individuals with a SCI do not exist. Therefore, the responsibility to identify CVD risk factors, provide education and appropriate management in those with a SCI lies with members of the rehabilitation team.

Aim: To assess whether individuals with a SCI receive adequate cardiovascular disease prevention.

Methods: 31 out-patients were given a 14 question questionnaire. CVD risk factors such as smoking and weight, knowledge about CVD, health improving behaviour and CVD information received, were investigated. Routine blood results and clinical measurements taken during annual review appointments were also recorded.

Results: 74% of subjects linked CVD to abnormalities of the heart. However, 74.2% claimed never to have received any information about CVD, its risk or risk reduction. Inactivity was the most common risk factor identified, with only 38.7% of subjects engaging in adequate weekly physical activity. BMI and waist circumference were not routinely measured in any of the subjects. Blood tests for cholesterol and glucose were requested in 66.8% of subjects and blood pressure measurements in 77.4% of subjects. Conclusion: There are currently no guidelines or targets for CVD prevention in people with a SCI. Further research investigating this is required. Comprehensive cardiovascular risk assessment, education, advice and appropriate risk reduction measures should form part of routine management in all individuals with a SCI. Specific recommendations for improving services provided by the rehabilitation team have been suggested.

P158

Effect Of The Presence Of Complications At Admission On The Functional Status Of Spinal Cord Lesion Patients.

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Background: recent studies demonstrated that a significant percentage of spinal cord lesion patients are admitted to a rehabilitation ward with complications. The aim of the study is to evaluate the effect of the presence of complications at admission on the functional status of patients with spinal cord lesion.

Patients and methods: 66 patients with complications at admission were matched for age, time since lesion, level and AIS level with 66 patients without complications.

Measures: American Spinal Injury Association standards, Barthel Index, Rivermead Mobility Index, and Walking Index for Spinal Cord Injury.

Results: patients with complications at admission were more often males (M/F ratio = 52/14 in the group without complications and 41/25 in the group with complications, $p < 0.05$) and suffered more often from a traumatic lesion (NT/T ratio = 24/42 in the group with complications and 38/28 in the group without complications, $p < 0.05$). The functional status at admission and discharge and the length of rehabilitation stay of the two populations were comparable. Patients with complications at admission were discharged to other hospitals or institutionalized more often.

Conclusions: complications seem to be more frequent in male patients and in those with traumatic lesions. The presence of complications does not seem to affect patients' functional status and length of stay, but it determines a higher risk of being institutionalised.

P159

Effects Of Noninvasive Positive Pressure Ventilation By A Volume-Controlled Ventilator For Patients With High Level Tetraplegia Due To Spinal Cord Injury

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Study design: Retrospective study.

Objective: We use noninvasive positive pressure ventilation (NPPV) by a volume-controlled ventilator for patients with high level tetraplegia due to spinal cord injury (SCI). The purpose of this study is to reveal the effects of this method on their respiratory functions.

Setting: Kansai Rosai Hospital, Amagasaki, Japan

Subjects: The authors reviewed ten patients with high level tetraplegia due to SCI (C1-C4). They were converted from intermittent positive pressure ventilation via tracheotomy tube to NPPV by a volume-controlled ventilator between 2006 and 2009. Their average age was 31.0 +/- 18. All of them were male.

Methods: We measured their vital capacities (before/after conversion). After converting to NPPV, we measured maximum insufflation capacity (MIC) by NPPV and by

glossopharyngeal breathing (GPB), unassisted cough peak flow (CPF), CPF assisted by NPPV, CPF assisted by both NPPV and chest thrust. We also investigated what kind of complications they had after conversion.

Results: Mean vital capacity increased 290 +/- 211 ml to 533 +/- 316 ml. MIC by NPPV was 2408 +/- 682 ml. Six patients could do GPB, and mean volume was 1990 +/- 793 ml. Mean unassisted CPF was 59.5 liter/min, CPF assisted by NPPV was 229 +/- 74 liter/min, CPF assisted both NPPV and chest thrust was 314 +/- 81 liter/min. Three of them had complications after conversion. One patient had an episode of epilepsy, two patients had respiratory complications.

Conclusions: NPPV was significantly effective on respiratory capacity and strength of cough for these patients.

P160

Exitus In A Tetraplegic Case Depends On Hypophosphatemia

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Phosphorus is the fourth common element in the body after carbon, nitrogen and calcium. Beside the role in Phosphorus is the fourth most common element in the body after carbon, nitrogen and calcium. Besides the role in bone mineralisation it also joins the structure of DNA, RNA, ATP and membrane phospholipidis. Many clinical features such as paresthesia, seizure, irritability, muscle weakness, or respiratory failure may occur in the absence of it. The aim of this studyn was to improve our knowledge about hypophosphatemia that is an uncommon manifestation by researching hypophosphatemia in an 80 year old case who has been followed as C4 tetraplegia ASIA Impairment Scale A.

P161

The Value Of Magnetic Resonance Imaging In Early Detection Of Neurogenic Heterotopic Ossification

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a. The purpose of our study was to evaluate the signal intensity characteristics and early detection ability of magnetic resonance (MR) imaging compared with other radiologic studies such as computed tomography (CT), triphasic bone scan (TBS), simple X-ray, ultrasound (US) in work-up of neurogenic heterotopic ossification (NHO).

b. Five patients with spinal cord injury who underwent MR imaging and other radiologic studies were included.

After clinical symptoms and signs such as pain, swelling, redness, tenderness, fever appeared, radiologic studies were carried out. One musculoskeletal radiologist compared with MR imaging with the corresponding CT or radiographic images.

c. In patients with NHO proved at CT or X-ray at a late data, there were several MR signal charateristics compared with other radiologic studies.

In early stage of NHO, the following MR findings were observed: (1) iso- or hypo T1-

signal intensity compared with muscles, (2) hyper T2 signal intensity compared with muscles, (3) peripheral rim enhancement area with central non-enhancing area in post contrast enhanced T1-weighted imaging.

TBS & US were done at approximately the same time as MR imaging.

There was no evidence of ossification.

d. In early detection of NHO, MR imaging is best choice and useful to differential diagnosis with other conditions such as tumor, infection, or deep vein thrombosis; therefore it may allow early treatment to prevent the formation of osteoid and subsequent bone formation.

P162

Dysphagia And Dysphonia Among Polio Survivors

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The aims of this study were to make a better estimate of the prevalence of dysphagia and voice production disorders in individuals with the late sequelae of poliomyelitis as well as to explore factors that characterize polio survivors with these problems. 51 persons with post-polio syndrome who were rehabilitated at Käpylä Rehabilitation Centre, Helsinki, Finland, in 2003-2004 were interviewed on problems with swallowing and voice production. Pulmonary function testing and grip strength measurement were performed. A clinical assessment of oral motor and laryngeal functions was carried out for those who reported daily problems with voice production or swallowing. Fifteen persons (29.4%) reported daily problems with swallowing or voice production. In the clinical assessment the most commonly observed deficits in swallowing included decreased pharyngeal transit (n=13) and food catching in the throat (n=4). Disturbed co-ordination of breathing and voice production was seen in 12 persons. Even though those with symptoms more often needed assistive devices for ambulation and had a more frequent need of ventilatory support at the onset of polio than those without symptoms, there were no significant differences in any of the studied variables between the groups. In conclusion, one third of persons with post-polio syndrome reported problems with swallowing and voice production.

P163

A case series report of sacral insufficiency fractures in patients with spinal cord injury

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Background: Sacral insufficiency fractures (SIFs) are well reported in the literature and are most common in the elderly female patients with osteoporosis and or other bone pathology. SIFs causing neurological insult have also been reported. We report 2 unusual cases of SIFs in individuals with known spinal cord injury (SCI) for several years. These were incidentally diagnosed while investigating for complications following their SCI. What is unique in these 2 cases is that they are both males and are middle aged.

Discussion: Insufficiency fractures represent a special category of stress fractures in bones with reduced mineral content and elastic resistance and could occur with trivial or no trauma. In the cases we report, patients presented with usual complications of spinal cord insult namely chronic constipation, increased spasms and autonomic dysreflexia. However on further investigations were found to have SIFs.

Conclusion: Patients with long term spinal cord injury present with a wide variety of symptoms which can mask the underlying diagnosis. It is well known that the usual complications of SCI could be aggravated by systemic insult e.g. increased dysreflexic symptoms in patients with fractures. We would like to highlight that SIFs should be considered in the differential diagnosis whilst investigating a patient with SCI presenting with its complications. Age and sex should not go against considering the diagnosis, particularly in the SCI patients.

P164

Angiotensin-II Contributes To The Increased Leg Vascular Resistance In Spinal Cord-Injured Individuals

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While angiotensin II (AT-II) does not contribute to vascular resistance in healthy individuals, AT-II plays a pivotal role in the increased vascular resistance in individuals with an activated renin-angiotensin system (RAS). Spinal cord-injured (SCI) individuals demonstrate an increased RAS activity, supported by elevated plasma renin levels, but also report an augmented vascular resistance in the extremely inactive legs. The aim of this study was, therefore, to assess the contribution of AT-II to the increased LVR of SCI individuals. In 8 male SCI (T4-T12, AIS A) and 7 age- and gender matched control individuals we examined leg and forearm blood flow using venous occlusion plethysmography before and 4 hours after an oral dose of irbesartan (AT-II antagonist, 150 mg). Vascular resistance was calculated as the arterial-venous pressure gradient divided by blood flow and presented in arbitrary units (AU). The results indicate a significant higher LVR in SCI (39 ± 3 AU) compared to control individuals (25 ± 3 AU; $p=0.01$). AT-II blockade decreased LVR significantly in SCI individuals (32 ± 3 AU; $p=0.02$) but not in control individuals (29 ± 4 AU, $p=0.12$). In contrast, forearm vascular resistance (FVR) in SCI individuals (44 ± 4 AU) was similar to control individuals (32 ± 6 ; $p=0.12$) and did not changed after AT-II blockade in both SCI (46 ± 5 AU; $p=0.43$) and control individuals (42 ± 9 AU, $p=0.16$). In conclusion, AT-II, at least partly, contributes to the increased LVR of SCI individuals. As AT-II blockade does not alter FVR, the elevated contribution of AT-II to LVR in SCI may relate to the extreme inactivity.

P165

MRSA SEPSIS Following The Lumbar Spinal Instrumentation Surgery - 3 Cases Report -

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Rigid fixation and early postoperative management can be obtained by using spinal instrumentation surgery. However, postoperative infection is one of the most severe complications and it is also difficult to treat the lesions. Three cases associated with MRSA sepsis following lumbar spinal instrumentation surgery are reported.

These were 2 females and 1 male. Their average age at the operation was 66 years old. Their clinical diagnosis was lumbar canal stenosis with L4 degenerative spondylolisthesis. The laminectomy and lumbar posterior fusion with PLF or PLIF by using pedicle screw systems were performed in all cases. High fever about 40°C was observed in 2 – 4 days after surgery and MRSA was cultured in a blood and pus discharge from the operation wound.

Sensitive antibiotics for MRSA were injected to the three cases, and curettage of the operation site was performed. Two cases improved without removal of the instrument and one case required the extirpation of the internal instrument.

The cause of the postoperative infection was unclear. The Cell Saver system was used in the operation in all cases. MRSA was cultured in other operations using the Cell Saver system. So, the Cell Saver system may be involved with the sepsis and postoperative infection.

P166

Respiratory muscles impairment in acute cervical spinal cord injury

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Purpose of the study: investigate inspiratory and expiratory muscle function in patients with injury level at C4-C5, in supine and seated position. 33 patients with spinal cord injury at C4-C5 level, were studied (age 40±17 year; days from trauma 74±62). Data recorded in supine and seated position were: maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP), that are maximal muscular forces developed against an occluded airway.

P01 is an index of neuromuscular respiratory drive; it's pressure generated 100 ms after onset of an inspiration performed against closed airways at functional residual capacity.

Results: MIP and MEP were reduced in both positions; MEP reduction was proportionally more reduced with respect to MIP, but constant in the supine (24±12 cm H₂O) and seated position (22±12 cm H₂O); MIP was lower in the seated position (36±15), that is about 70% of normal value P01 exhibited a huge increase compared to normal in both positions (about 300% of the normal value).

In conclusion, cervical SCI subjects present reduction of MIP and MEP in both seated

and supine positions, more evident in MEP, due to muscle weakness: it may impair the ability to cough.

MIP is better in the supine position due to diaphragm muscle fibers, which operate on a more favorable portion of their length-tension curve.

On the other hand the supine position determines reduction of FRC, that implies a reduction of expiratory flow and a cyclic opening/closure of the peripheral airways developing a chronic lung inflammation

In conclusion it is better to keep these patients in a semirecumbent position to avoid the inflammatory damage of the lung parenchyma.

P167

Infections in patients with spinal pathology on admission to rehabilitation center

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Objective: The study of frequency of infections in patients with spinal pathology on admission to the rehabilitation center and the identification of the associated risk factors.

Materials & Methods: Our sample consisted of 22 patients admitted for rehabilitation from September to December 2008. The medical history, the time elapsed from the onset of disease, its severity and the patients' functional status were recorded, as well as the type and duration of infection.

Results: The mean age of the subjects was 44.8 ± 16.2 years and 68.2% were men; 68.2 % were paraplegics and 22.7% tetraplegics. 77.7 % of the patients were transferred from other units and 54.5% were operated. 13.6% had leucopenia on admission and 54.5 % anaemia. 50% developed infections: 41 % urinary tract infections (UTI), 4.5 % pulmonary infections and 4.5% ulcer-related infections. 31.8% of UTI were attributed to the presence of an indwelling catheter, whereas the most common bacteria responsible for UTIs detected was *Escherichia coli* (44.4 %). The frequency of infections in paraplegics was 60% and in tetraplegics was 40%, whereas the frequency of UTI for the paraplegics group was 46.7% and for the tetraplegics group 40%.

Conclusions: Patients with spinal pathology frequently develop infections, predominantly UTI, that hinder the rehabilitation program. It is imperative to assess and treat the risk factors detected on admission, such as indwelling catheters, that predispose individuals to infections in rehabilitation settings. Impaired functional capacity is implicated for infections, bringing up the issue of the necessity for early commencement of rehabilitation.

P168

Intracranial bleed following spinal surgery: a report of two cases

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We describe two patients who under went major spine surgery at the thoracic and lumbar levels. After surgery they developed severe headache for which a CT scan was taken and a subarachnoid hemorrhage was diagnosed. This complication was secondary to intracranial hypotension, which was caused by a leak of cerebrospinal fluid (CSF) and also contributed by large fluctuations in blood pressure during the major surgery. This disorder is the most severe manifestation of the pathophysiological mechanism occurring to a lesser degree in patients affected by mild intracranial hypotension which occurs following standard procedures like lumbar puncture.

Conclusion: Intracranial hypotension (of an orthostatic nature or not) must be considered in the differential diagnosis of every patient who complains of headaches after major spine surgery where there has been accidental durotomy or large fluctuations in blood pressure. It is important in view of the fatal outcome and the medico-legal implications involved.

P169

Appearance of the retro-odontoid pseudotumor on magnetic resonance images

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Introduction: Tumorous lesions located dorsal to the odontoid process have been nominated as retro-odontoid pseudotumors. Sze et al (1986) reported three cases related to chronic atlantoaxial instability, however, recent reports showed cases without instability. Since the pseudotumors have been treated by posterior decompression and and/or fusion, the pathology has not been elucidated. We report four cases of pseudotumors which showed different presentation on magnetic resonance images (MRI).

Summary of the cases: Case 1: 62-year-old man. Plain radiographs revealed os odontoideum without remarkable instability. On MRI, the pseudotumor showed iso-intensity on T1- weight images (WI) and low on T2WI.

Case 2: 77-year-old woman. Plain radiographs and CT showed irregularity of the joint surface of the atlantoaxial joint, but no instability. CRP and RA test were negative. Capsule-like structure was observed on MRI, it was high signal intensity on both T1WI and T2WI, and it contained homogenously iso-intensity on T1WI and low on T2WI. There was no evidence of significant synovitis.

Case 3: 75-year-old man. Plain radiographs and CT showed no instability or deformity. Signal intensities on MRI were iso on T1WI and high on T2WI.

Case 4: 83-year-old man. Plain radiographs showed no instability, and CT demonstrated slight destruction of the dens. The signal intensities were heterogenous, iso/low on T1WI and low/iso on T2WI without contrast enhancement.

Conclusion: According to the signal intensities of the pseudotumors on MRI, the main component seems to be fibrous tissue. However, cystic lesion without synovitis is one of the pathologies.

P170

Lower Limb Fractures In Chronic Spinal Cord Injury

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Aim: To establish incidence of lower limb fractures in persons with chronic spinal cord injury (SCI) and to identify possible risk factors associated with fractures.

Method: A postal questionnaire was sent to 3147 persons with chronic SCI, 1784 (56.7%) replied, 1736 (55.2%) valid replies were analysed.

Results: 411 respondents (23.3%) reported having had one or more lower limb fractures since their SCI. The total reported number of fractures was 710, giving the incidence of 1.845 fractures per hundred person-years. Proportionally, more women (28.8%) than men (21.5%) had fractures, more paraplegics (26.2%) than tetraplegics (19.7%) and more individuals with complete (28.5%) than incomplete (19.1%) injuries. A larger proportion of individuals who never stood (27.7%) and who stopped standing (34.7%) had fractures compared with those who still stood regularly (14.3%). Similar results were observed for walking and exercising. Those with fractures were older (56.5 vs. 53 years) and injured for longer (28.6 vs. 20 years), $p < 0.05$. In multivariate logistic regression, only female gender and longer time since injury were significantly associated with increased odds of having a fracture, odds ratio (OR)=1.421, 95% confidence interval (CI)=1.095-1.844 and OR=1.019, 95% CI=1.010-1.028 respectively, while regular standing was significantly associated with decreased odds of having a fracture, OR=0.456, 95% CI=0.338-0.615.

Conclusions: Female gender and longer time since injury appear to be the strongest predictors of lower limb fractures in chronic SCI, while regular standing seems to have protective effect.

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P171

A rare case report on spinal paraganglioma

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Paragangliomas are tumors that arise from the paraganglia cells of the autonomic nervous system, ultimately derived from the neural crest. Approximately 80–90% of these tumors arise in the glomus jugulare or carotid bodies. Paragangliomas arising within the spinal canal are rare, and when they occur they are usually found in the intradural, extramedullary compartment and in the lumbosacral region. Large lumbar paragangliomas are very rare.

We report a case of a 58-year-old woman who had a history of back pain and radiculopathy and was found to have a primary lumbar paraganglioma presenting with spinal cord compression.

In this case, a large vascularised paraganglioma measuring 13.0 cm × 15.0 cm was occupying the L2-L5 vertebrae bodies extending to the paravertebral space and spinal canal with distant metastases to the left 5th rib according to the CT scan result. Total debulking procedure was impossible because of the high vascularity and we proceeded with embolization. An 80% reduction in the vascular supply was noted after a 2nd embolization procedure and radiotherapy treatment was continued as the patient refused to undergo further embolization procedures.

We believe that paragangliomas should be included in the differential diagnosis of intraosseous spinal tumors. They tend to be very vascular and difficult to excise in total. Optimal treatment of the lesions can be difficult because of their hypervascular nature and the high morbidity associated with complete surgical resection. Treatment should combine preoperative embolisation, surgical resection if possible, and radiation therapy. The clinical, radiographic, and pathologic features of this case are detailed and the relevant literature is reviewed.

P172

Spinal Cord Ependymoma Presenting With Paraplegia Due To Haemorrhage Secondary To Anticoagulation Therapy For Coronary Heart Disease: A Case Report

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Introduction: Ependymomas are commonly associated with subarachnoid haemorrhage. Intraspinal haemorrhage is a dangerous complication of anticoagulation therapy (AT). Anticoagulants are frequently administered to patients with coronary heart disease.

Case presentation: A 51-year-old man developed flaccid paraplegia and lower limbs' dysesthesias one month post initiation of AT after myocardial infarction 10 years ago. MRI of the spine revealed subdural haematoma and findings consistent with a tumor from the T12 to L2 vertebra. He underwent laminectomy at T12-L1-L2 and tumor resection which histologically had characteristics of ependymoma. He also had radiation therapy.

Post-surgery, he was admitted to our rehabilitation department. On discharge, he had incomplete paraplegia T12, ASIA Impairment Scale (AIS) D, was walking with crutches, managing his bladder with intermittent catheterizations.

During the following years, his neurology gradually declined mainly affecting ambulation and pain syndrome, and he required inpatient rehabilitation twice subsequent to the first admission.

Sequential MRIs demonstrated atrophy and abnormal architecture of the spinal cord above the initial lesion, up to the T5 level, including syringomyelia, cysts and myelomalacia, and post-radiation changes. Suspicion of tumor recurrence was set post the last MRI - close monitoring was advised.

On admission in November '08, he presented with complete paraplegia T5, AIS A,

increased pain and dysesthesias, being wheelchair bound for the last 1.5 years. He has so far managed walking in the parallel bars with walkabout mechanism.

Conclusion: Acute paraplegia due to spinal ependymoma presenting with haemorrhage secondary to AT is rare. Close monitoring of neurological and functional status is mandatory for early detection of changes and adjustments of the rehabilitation goals.

P173

Management of osteoporotic lower limb fractures in chronic spinal cord injury

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Osteoporosis related fractures in the long term have been a significant cause of morbidity in patients with Spinal Cord Injury (SCI). However, treatment of these fractures has gone through 'phasic' changes between conservative and surgical management. Conservative treatment has the advantage of avoiding the risks associated with surgery. We have gone through the medical records of 15 patients who were treated either surgically or conservatively with the idea of looking for outcomes and complication rates in both methods of managing osteoporotic fractures in SCI. Restoration of pre-fracture activity levels were achieved in the majority of both sets of patients. However, the initial findings suggest that the conservative group achieved their results with significantly fewer complications. This warrants further investigation into the relative merits of surgical and conservative treatments of osteoporotic fractures in SCI. We argue that the most important outcome measure should be the restoration of functional abilities and not radiological restoration of bony architecture.

P174

Motor And Sensory Complete Paraplegia Due To Thoracic Disc Herniation

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Background: A rare case of thoracic disc herniation with associated neurological impairment, including motor, sensor and urinary disturbances, is reported. Acute symptoms were usually due to progression of disc herniation in the presence of pre-existing spinal canal stenosis. Case: A 56 year old man who had motor and sensory complete paraplegia was admitted to our hospital. In his history; he mentioned that when he woke up in the morning 3 months previously and felt sudden dorsal pain and numbness in his legs, and was not able to move his legs. T2-3 disc hernia and spinal stenosis was detected and operated with a posterior approach. His neurological level was T 2 paraplegia ASIA Impairment Scale-A. Discussion: The diagnosis and localization of the level of cord compression were mainly based on the clinical examination supported by the findings of magnetic resonance imaging and somatosensory evoked potentials. Our case demonstrates that acute paraplegia secondary to thoracal disc herniation may occur without a history of myelopathy or trauma.

P175

Management Of Swallowing In Patients On Ventilatory Support

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Purpose of the study: In the present study we report our experience in the management of swallowing in patients with mechanical ventilation in the Intensive Care Department of a Spinal Cord Unit, where patients are primarily hospitalized for recovery following traumatic spinal cord injuries, other types of injuries, or severe brain damage.

Methods: From January 2006 to June 2008, 120 patients have been treated, transferred from other institutions, ventilated with cuffed tracheostomy tube, with enteral artificial feeding.

Results: All the patients, during the first month of hospitalization, have been set in assisted respiration in tracheal open ventilation (TOV); this has allowed a progressive recovery of their swallowing and phonation. 119 patients have completed their rehabilitation program; feeding per os has been guaranteed to them. Only one case among 120 patients continued to present a severe dysphagia; it has not been possible to guarantee feeding per os. However, with ventilation in TOV, phonation has been guaranteed to the patient.

Conclusions: Our rehabilitation program foresees a suitable respiratory physiotherapy, in partnership with the progressive deflation of tracheostomy tube cuff starting from the first days of admission in the hospital. Mechanical ventilation in TOV guarantees the ventilatory function and doesn't inhibit the physiological glottic function. With our work we guarantee to our patients with swallowing disorders a quality of life above expectations, allowing mainly the recovery of swallowing and also phonation for patients who don't succeed in being weaned from a mechanical ventilator.

P176

Keeping Students Interested in Rehabilitation Nursing

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Educating student nurses to the specialty of rehabilitation nursing is becoming more difficult as nursing programs change to meet the demands of the national nursing shortage. In the geographic area of Philadelphia, enrollment in nursing curriculums has boomed in response to the shortage. Clinical rotation sites have remained limited despite this increase in students. Student nurses have high expectations of what their clinical rotation site and its patients will teach them. This poster will identify the challenges of the nursing instructor as students rotate through the Regional Spinal Cord Center of the Delaware Valley, students' misconceptions about rehabilitation nursing and identify strategies to improve the student nursing rehabilitation clinical experience.

P177

Natural history of Pott's disease - report of two Japanese writers' cases

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Japan

To clarify the natural history of tuberculous spondylitis or Pott's paraplegia, two cases treated without anti-tuberculosis drugs are reported here. The first patient Shiki Masaoka, who was known as a famous Japanese Haiku poet and died at the age of 34 in 1902, strenuously continued writing articles for newspapers until two days before his death. In these articles and in his diary, he gave a precise description of his physical deterioration. When he was twenty, he began coughing up blood due to pulmonary tuberculosis. At the age of 28 he felt severe low back pain and diagnosed as spinal caries. He underwent drainage operation for gravitation abscess and the wound remained open. After the age of 32, he became bed-ridden, suffering from paraplegia, neuropathic pain and faecal incontinence, which were probably due to the injured spinal cord. Intolerable pain during dressing changes and suicide attempts were written by him in the diary. Pott's paraplegia restricted him to the sickbed for 6 years, but he was clearly conscious and described his physical and mental status in clinical detail, which would show us the natural history of Pott's disease.

The second patient Sanjugo Naoki, who died at the age of 43 in 1934, wrote novels in the prone position in his last years of life because of low back pain. He was admitted to hospital to receive treatment for severe backache, weight loss and cough with sputum, but died of tuberculous meningitis two weeks later.

P178

Finalising an agreed taxonomy for Non-Traumatic Spinal Cord Injury

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New P.

It is well documented that damage to the neural elements in the spinal canal (spinal cord and cauda equina) resulting in resolving or permanent neurological deficit can arise from non traumatic causes ie Non-traumatic spinal cord injury (NTSCI).

It is reported that the incidence of non-traumatic spinal cord injury (NTSCI) is greater than that of traumatic spinal cord injury (TSCI). There are a wide range of aetiologies of NTSCI that are reported in the literature and these have been extended during previous work to develop an agreed formal system of classifying NTSCI.

This poster is designed to help clarify and finalise the taxonomy and, in particular, clarify any remaining difficult issues of classification such as the best option for iatrogenic components and questions relating to coding using the ICD10.

P179

Nurse case manager: the experience of Spinal Unit

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In the spinal unit, comprehensive assistance for people with spinal cord injury provides complete social recovery.

The project involves customized assistance throughout rehabilitation by the multidisciplinary team.

The nurse case manager coordinates the process involving the assistance of family, friends of the patient and structures of the patient's local community.

1st step: acceptance of the person and the family in intensive care unit:

§ To know the person and the family

§ Data collection needs of nursing

§ Availability of beds

§ Involvement of professionals needed

2nd phase: rehabilitation pathway: monitor, modify, develop the care plan, that is:

§ education training of the patient

§ education training of the care-giver

§ rehabilitation of bladder and bowel problems

§ planning of daily and weekend activities

3rd phase: discharge and entrusting to local services:

§ assessment of attainment of rehabilitation goals

§ assessment training care-giver

§ providing aids and head teachers

§ planning for the use of the pre-discharge apartments of the Spinal Unit.

P180

Injuries In Paralympic Skiing—The Paralympic Perspective

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Purpose: To compare and contrast the patterns of injury expected in elite alpine skiers at the Paralympics and Olympics.

Methods: Literature review and expert opinion

Results: During the 2006 Torino Olympic and Paralympic Games, the Paralympic alpine skiing venue had the highest rate of medical encounters compared to any other venue. Given the higher rates of medical encounters seen at disabled alpine skiing events, the medical teams working at these events need to know the type of injuries to expect and how to manage them.

The literature review only identified 4 articles focusing on disabled alpine skiers. Most of the literature on disabled athletes concentrates on summer athletes and summer sports. While there may be some lessons to be learned from the summer athletic literature, the injuries seen in alpine skiing generally involve higher forces and greater trauma than

those seen in summer sports. The literature also identified potential equipment specific injuries such as forearm injuries secondary to landing on an outrigger ski.

Conclusions: Consideration needs to be given to sport specific issues in the disabled alpine skier such as the impact of sport equipment, co-morbidities, and the functional implications of injuries for athletes with a disability.

There is a need for ongoing prospective injury surveillance studies to look at injuries in Paralympic alpine skiers. The International Paralympic Committee (IPC) has recently established a registry to help identify such patterns of injury.

P181

Bowl regime of newly injured SCI patients

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Newly traumatic spinal cord injured patients have a period of bowel atonia in the acute phase. In our SCI Unit we have always treated all newly injured patients with a conservative regime including intravenous nutrition until bowel sounds appear. Then laxatives are started and after bowel evacuation we allow the patients to eat. By this regime we try to avoid vomiting and the delayed start of defecation. In some cases the patients had been given oral nutrition before admission to the SCI Unit.

Methods: We performed a retrospective chart review of at all traumatically injured patients in 2008, n=20. Duration from injury to defecation was monitored as well as nausea, vomiting and medications given.

Results: There were 12 men and 8 women. 11 cervical and 9 thoracic injuries, 6 ASIA Impairment Scale (AIS) A and 14 AIS B-D. The mean age was 45 (18-75). Time from injury to first defecation was a mean of 8,45 days, (4-19). 7 had received oral nutrition before defecation and 13 not. 16 used sc Morphine for a long period of time. No one complained of nausea or vomited. Level or degree of injury, age or previous intake of food did not affect length of atonia.

Conclusions: Conservative treatment of bowel atonia seems to be of value in preventing nausea and vomiting. Perhaps a bigger sample is needed in order to see if level or degree of injury has any impact on length of bowel atonia.

P182

Atrial fibrillation in incomplete tetraplegic athlete and autonomic dysreflexia

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In Italy pre-participation sports screening (PSS) for paralympic athletes includes a comprehensive laboratory, instrumental and clinical evaluation. Cardiovascular evaluation of this PSS includes: family and personal anamneses, physical examination, electrocardiogram during rest, tilt-test, maximal incremental exercise test (MIET) and high-intensity up-to-exhaustion exercise test, echocardiography, Holter electrocardiogram

(H-ECG). A C6 spinal cord injured (SCI) male swimmer (ASIA: C; swimming class: S4) eligible to compete in 3 summer Paralympic Games was screened six months after Beijing 2008 Paralympic Games (March 2009) for a rare supraventricular isolated arrhythmia found during the MIET of the previous PSS. No exam showed cardiovascular abnormalities except the H-ECG where sinus rhythm (heart rate -HR- 66 b•min⁻¹) was interrupted by a long episode of parossistic atrial fibrillation (AF) of 7 hours length. AF was characterized by mean ventricular rate of 105 b•min⁻¹ (peak rate 189 b•min⁻¹) with 83 ventricular isolated ectopic beats, one morphology, 30 ventricular couplets and 13 runs of not sustained ventricular tachycardia (longest run of 5 beats with HR=168 b•min⁻¹). Based on the athlete's clinical diary, we concluded that AF started immediately after ejaculation (a potential trigger of autonomic dysreflexia -AD) and was accompanied by headache and visual changes of about 15 seconds. Although exercise tests (typical sympathetic stimuli) were not able to evoke any arrhythmia, a probable vulnerable heart experienced a disorder, cause of not sport-eligibility, induced by AD. This case arises the necessity of particular care in the PSS of T6 and higher SCI athletes and shows potential risks induced by "boosting".

P183

A case of hematoma in the cervical ligamentum flavum

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There have been some reports describing hematoma in the lumbar ligamentum flavum, but reports of cervical ligamentum flavum hematoma are very rare. We report a case of ligamentum flavum hematoma in the cervical spine causing severe myelopathy.

A 69-year old man presented with progressive myelopathy (Frankel grade: C). On the X-ray films, several anomalies of the upper cervical spine were found: occipital assimilation with the atlas, partial aplasia of the arch, and C2-C3 block vertebra. There was no intervertebral instability. Magnetic resonance images at C3-C4 level showed a mass on the left dorsal side of the dural sac. A C3-C4 laminectomy for decompression of the spinal cord and removal of the lesion was performed.

Intraoperatively a ligamentum flavum hematoma was found, and the postoperative histological examination suggested it was the result of the rupture of a hemangioma or of an arteriovenous malformation in the ligamentum flavum. After removal of the lesion, his condition immediately improved (Frankel grade: D).

Ligamentum flavum hematoma should be considered for the differential diagnosis when a patient, especially an elderly man with hypertension, presents with symptoms of compression of the spinal cord and a recent history of trivial trauma.

P184

Studies on the immunomodulatory effect of extracts of *Paronychia argentea* L, and its efficacy to protect Chlorpyrifos-induced oxidative stress in rat erythrocytes.

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Paronychia argentea Lamb is extensively used in traditional medicine to treat various diseases in Algeria. The study reported here was focused on the antioxidant and immunological effects of the whole plant extract using n-butanol, as a solvent.

The extracts were incubated with macrophages and peripheral blood lymphocytes. Cell cultures were assayed using LTT and MTT techniques. Then the in vitro immunomodulatory activities of these extract were studied. The antioxidant and free radical scavenging activities of the extract were evaluated using DPPH (1, 1-diphenyl-2 picrylhydrazyl radical) method and cytochrome c reducing assays.

Organophosphorus insecticides may induce oxidative stress leading to generation of free radicals and alteration in erythrocytes membranes. The aim of this study was examine the protective effect of butanolic extract from *Paronychia argentea* Lamb against chlorpyrifos-induced oxidative stress in rat erythrocytes.

The present findings established that CE can cause a strong induction in LPO, while treatment by plant extract reduced /or protect CE toxicity. The decrease in LPO levels revealed the antioxidant property of this extract. The plant extract completely prevented the toxic effect of CE on the above serum parameters. A significant in vitro antioxidant activity of plant extract was reported.

The phagocytic activity of macrophages and peripheral blood lymphocytes proliferation in the presence or absence of mitogen (pokeweed pwm) or (PHA) and chlorpyrifos pesticides were assayed. The present study revealed the antioxidant and immunomodulating activities, which could explain the traditional used of this plant in Algeria.

Key words: *Paronychia argentea* Lamb, Lymphocytes, proliferation erythrocytes phagocytosis oxidative stress.

P185

Osteopathic Treatment In Cauda Equina Syndrome

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Material: We have considered a female 36 aged with cauda equina syndrome arose after a lumbar disk herniation treated surgically. The patient presented the following symptoms: low back pain that was able to be divided into local and radicular pain. Lower extremity muscle weakness.

Method: The personal rehabilitation program included ten osteopathic sessions, two sessions a week. In the 1st and in the 2nd session the osteopathic therapist applied some preparation techniques to start the visceral treatment.. From the 3rd to the 5th

session the therapist continued the visceral treatment. From the 6th to the 10th session the osteopathic therapist treated the stomach, the renal area and the spine. Every day the patient made the Brief Pain Inventory scale.

Results: At the end of the osteopathic treatment the patient presented a better flexion of the trunk, a reduction of the tension of the abdominal wall and of the pelvic floor. The patient has also referred a reduction of the lumbar and sacral pain. These results were confirmed by data of Brief Pain Inventory scale.

Conclusions: Our experience has confirmed that the introduction of osteopathic sessions in the personal rehabilitation program of a patient with a spinal cord disease can be therapeutic.

P186

Comparison Between Two Accreditation Models: Joint Commission And Iso 9001: 2000 In Rehabilitation Departments And Spinal Unit In Province Of Pavia

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The accreditation is an initiative planned to answer an increasing world question of evaluation procedures based on quality standards.

Material: Examined structures:

Spinal Unit - Maugeri Foundation Pavia

Neurological Rehabilitation Department - Maugeri Foundation Pavia

Neurological Rehabilitation Department - Local health board of Pavia

In the following years: 2003, 2006, 2007.

Method: We have considered the following Efficacy Indicators:

Functional Impairment Measure (FIM): a disability scale.

Enjoinment tests filled by the patients.

The data were analysed by statistical survey ANOVA and post test di Newman-Keuls.

Results and conclusions: In both cases there were poor organizational modifications in operative Units and in the positions of the staff. More evident modification produced by quality standards concerns documentary management of papers in both cases; the detail of the procedures, before managed by methods connected to employment experience of the operator have been scheduled. The project aimed at standardizing papers and achieving a more efficient management of the information related to productive procedures (computerization for exemple). This has produced an increase in the unitary cost in terms of time of the operators involved in the applications of the standards.

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