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INTRODUCTION TO THE BRITISH ASSOCIATION OF SPINE SURGEONS

The British Association of Spine Surgeons (BASS) actively promotes the study of spinal disorders with particular attention to the surgical treatment of spinal disease and disorders.

BASS conferences are held biennially and are usually held over 3 days. They involve the presentation of the latest spinal surgery techniques, instructional sessions and free papers. The meeting attracts approximately 300 delegates.

Previous BASS conferences:

- 2013 Norwich
- 2011 Edinburgh
- 2009 Sheffield
- 2007 Middlesbrough
- 2005 Aberdeen
- 2004 Ipswich
- 2003 London (RSM)
- 2002 Stoke-on-Trent
- 2001 Reading

If you would like to receive more information about BASS please visit the website www.spinesurgeons.ac.uk.

BASS Executive Members

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<thead>
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<th>Name</th>
<th>Position</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr Adrian Casey</td>
<td>President</td>
<td>2013</td>
<td>2015</td>
</tr>
<tr>
<td>Mr Am Rai</td>
<td>President-Elect</td>
<td>2014</td>
<td>2015</td>
</tr>
<tr>
<td>Mr Stuart Blagg</td>
<td>Secretary</td>
<td>2014</td>
<td>2016</td>
</tr>
<tr>
<td>Mr Nick Birch</td>
<td>Treasurer</td>
<td>2014</td>
<td>2016</td>
</tr>
<tr>
<td>Mr Lee Breakwell</td>
<td>Audit and Registry</td>
<td>2012</td>
<td>2015</td>
</tr>
<tr>
<td>Mr Iqroop Chopra</td>
<td>Education</td>
<td>2014</td>
<td>2016</td>
</tr>
<tr>
<td>Mr Mark Thomas</td>
<td>Membership</td>
<td>2014</td>
<td>2016</td>
</tr>
<tr>
<td>Mr Harshad Dabke</td>
<td>Professional Practice</td>
<td>2014</td>
<td>2016</td>
</tr>
<tr>
<td>Mr Colin Nnadi</td>
<td>Research</td>
<td>2014</td>
<td>2016</td>
</tr>
<tr>
<td>Mr Andrew Young</td>
<td>Trainees’ Representative</td>
<td>2014</td>
<td>2016</td>
</tr>
<tr>
<td>Mr Mike Hutton</td>
<td>Webmaster</td>
<td>2012</td>
<td>2015</td>
</tr>
<tr>
<td>Mr Otto von Arx</td>
<td>Meetings - Local Organiser</td>
<td>2013</td>
<td>2015</td>
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Dear Colleagues

It gives us great pleasure to welcome you to BASS 2015 being held in the Assembly Rooms, Bath.

Whilst most of the delegates are from the United Kingdom, we especially welcome everyone from overseas who will provide a great deal of interest and diversity to this event.

We hope you agree that this programme has something of interest for everyone. We are extremely grateful to our national and international speakers for giving up their time and for sharing their experiences with us all.

Our thanks also go to Tom Deller, Corporate Hospitality Manager and his team at the Assembly Rooms and the Pump Room, Julie Archer and her team at Archer Yates Associates and Julia Bloomfield, UKSSB Executive Assistant, who have all faced the challenge of helping us to bring this conference together.

Our thanks, as always, go to the trade for their continued support of our speciality, most of whom are longstanding friends of the spinal community. Please take time to visit their stands and talk to the representatives in order to learn about their latest developments. Please also participate in “speed-dating” on Wednesday evening which should prove not only educational, but extremely good fun.

On Thursday evening, the Conference Dinner is being held in The Pump Room. The Pump Room is one of the most elegant and atmospheric venues in Bath and it makes a memorable setting for dinner. It partners perfectly with the Roman Baths, where pre-dinner drinks will be enjoyed. You will get to walk where Romans walked around the steaming pool filled with hot spa water, the magnificent centrepiece of the Roman Baths bathing complex.

The Great Bath is a massive pool, lined with 45 sheets of lead and filled with hot spa water. It once stood in an enormous barrel-vaulted hall that rose to a height of 40 metres. For many Roman visitors, this may have been the largest building they had ever entered in their life. The bath is 1.6 metres deep, which was ideal for bathing and it has steps leading down on all sides. Niches around the baths would have held benches for bathers and possibly small tables for drinks or snacks. A large flat slab of stone is set across the point where hot water flows into the bath. It is known today as the diving stone.

Thank you once again for attending and we hope that you will have an enjoyable time both academically and socially. We are certainly looking forward to catching up with old friends, making new ones and learning much from you, the delegates and from the programme.

We sincerely hope that you enjoy the conference and look forward to meeting up again at the next spinal event.

Once again, thank you for coming and for supporting Bath 2015.

Otto von Arx
Local Organiser

Maurice Paterson
Local Organiser
Welcome message from Adrian Casey
President – British Association of Spine Surgeons

Dear Colleagues

A very warm welcome to Bath for the British Association of Spine Surgeons meeting for 2015.

The whole event carries great promise with a very high class quality of surgical presentations from the UK and abroad.

We are grateful to our international speakers Professors Rob Dunn (Cape Town) and Michael Fehlings (Toronto) sharing their knowledge and expertise on complex spine issues. Frank Feigenbaum (Texas) will be talking about the controversial area of operating on patients with symptomatic Tarlov cysts.

From Europe we have an equally strong field with Brice Ilharreborde (Paris) on sagittal balance and the very experienced Stefano Boriani (Bologna) on metastatic tumours and Peter Fritzell from Gothenburg, Sweden.

The UK offers Professor Douglas Wardlaw (Aberdeen), David Jaffray (Robert Jones and Agnes Hunt Hospital, Oswestry) and Marco Sinisi (Royal National Orthopaedic Hospital, Stanmore) for the invited keynote lectures. Joost van Middendorp, previously from Stoke Mandeville, kindly visits us from Rotterdam.

The academic programme with submitted papers and original research is particularly strong this year and nicely complemented by the social programme in this beautiful historical city.

The past few years have brought several political dilemmas to the spinal surgery community, including issues with medical malpractice, indemnity, reimbursement and revalidation. It is important we act in an informed and unified manner to optimise patient quality of care and our delivery to our patients. We need to lead the way in quality and professional issues (through the offices of BASS and the creation of FBASS) and not be dragged in different directions by individual health insurance providers, lawyers and NHS Clinical Commissioners.

The AGM is scheduled for Thursday, 19th March at 17.40 in the Assembly Rooms and, hopefully, all BASS members will be able to attend and voice their views on the future directions of our society, including voting on the creation of the category of Fellow British Association of Spinal Surgeons (FBASS). There are controversial issues with our engagement with private medical providers which need to be discussed. Portfolio updates will be delivered by the BASS Executive, including the British Spine Registry, education and professional standards. There will be formal elections for those Executive members who have reached the end of their tenure.

We will also be welcoming Am Rai from Norwich as my successor as President of our society.

I wish to give a heartfelt thank you for those who voted for me and to all those who have served in the BASS Executive.

Adrian Casey
BASS President
Organising Committee

Otto von Arx  
Consultant Spinal Surgeon  
Royal United Hospital, Bath

Maurice Paterson  
Consultant Spinal Surgeon  
Royal United Hospital, Bath

Administrative Staff

Julie Archer  
Event Management  
Archer Yates Associates Ltd  
Oxford

Julia Bloomfield  
Executive Assistant  
United Kingdom Spine Societies Board, RCS London

The Bath 2015 team is dedicated to ensuring that the conference and exhibition run smoothly and that your attendance at the event is both educational and enjoyable.

If you have any problems or require any assistance, we would be delighted to help you. Please visit us at the registration area.

The organisers cannot accept responsibility for any information in this guide that may be incorrect or accept any responsibility for programme changes.

Please note that the distribution of promotional material, except by exhibitors on their stands, is strictly prohibited.

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www.bass2015conference.premiummedicalprotection.com

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International Faculty

**Stefano Boriani – Italy**


**Stefano Boriani – Italy**

**Michael Fehlings – Canada**

Vice Chair Research for the Department of Surgery at the University of Toronto and Head of the Spinal Program at Toronto Western Hospital, University Health Network. He is a Professor of Neurosurgery at the University of Toronto, holds the Gerry and Tootsie Halbert Chair in Neural Repair and Regeneration, is a Scientist at the McEwen Centre for Regenerative Medicine and a McLaughlin Scholar in Molecular Medicine. In the fall of 2008, he was appointed the inaugural Director of the University of Toronto Neuroscience Program (which he held until June 2012) and Co-Director of the newly formed University of Toronto Spine Program. In addition, he is the Associate Scientific Director of the NeuroDevNet Network Centre of Excellence which is focused on finding improvement treatments for children with neurodevelopmental disorders.

**Robert Dunn – South Africa**

Following his under and postgraduate studies at the University of Cape Town, Robert embarked on an 18 month spine fellowship in London. He worked under Mike Edgar at the Middlesex and Queen Square Hospitals and Tim Morley, Ben Taylor and Jan Lehovsky at the RNOH, Stanmore. On return to Cape Town he took up a consultant post at Groote Schuur Hospital where he established a spine service to deal with the overwhelming burden of spine trauma, infection and deformity in both the paediatric and adult population. He has published both locally and internationally on their trauma and infection work and participates in AOSpine, IGASS, SA Spine Society. He is currently President of the College of Orthopaedic Surgeons. In 2012 he was appointed as HOD to the Pieter Moll and Nuffield chair of Orthopaedic Surgery but still leads the spine service.

**Robert Dunn – South Africa**

**Frank Feigenbaum – USA**

Board certified neurosurgeon practicing in Dallas, Texas, Kansas City, Missouri and Nicosia, Cyprus. He has extensive experience in treating symptomatic Tarlov cysts and other spinal meningeal cysts. He has has developed and refined surgical techniques for the treatment for multiple types of symptomatic spinal meningeal cysts and collected outcomes data following surgery. He also specializes in minimally invasive spine surgery with extensive experience in both developing minimally invasive technology and teaching minimally invasive spine surgery techniques. He is fully bilingual in English and Spanish and received his medical and surgical training at Georgetown University Medical Center in Washington, DC. He is Board Certified by the American Association of Neurological Surgeons and is a Fellow in the American College of Surgeons. In addition, he serves on the Medical Advisory Board of the Tarlov Cyst Disease Foundation and is Medical Director of the Tarlov Cyst Institute at Pine Creek Medical Center. He is the author of numerous journal articles and book chapters on spinal meningeal cysts, as well as other surgical disorders.
Peter Fritzell – Sweden
Graduated from medical school at Gothenburg University in 1976 and defended his thesis “Lumbar fusion vs. nonsurgical treatment in patients with CLBP” in 2002. Since 2006 he is an assistant professor at Uppsala University and is working as an orthopaedic spine surgeon in Ryhov Hospital in Jönköping parallel as a teacher/researcher in “Futurum, the academy for Quality and Safety in health care” in Jönköping, Sweden. He is currently engaged in several research projects dealing with treatment of CLBP (chronic low back pain), for example, cost-effectiveness in the surgical treatment of spinal stenosis and total disc replacement in patients with CLBP. For 15 years he is the manager of the Swedish national spine register, Swespine, owned by the Swedish Society of Spinal Surgeons: 4s and focused on presenting PROMs (patient reported outcome measures) after spinal procedures. The ultimate aim is to securing and improving outcome of health care. He and other members of the Swespine register steering group is since many years, together with 4s and Stockholm County and Health economists, engaged in the development of a "Value-based reimbursement model" based on register data. Since October 2013 this model has been used in Stockholm County.

Richard Williams – Australia
Associate Professor orthopaedic spinal surgeon based in Queensland at the Princess Alexandra and Brisbane Private Hospitals. He is a past director of the Australian Orthopaedic Association and current executive member of the Spine Society of Australasia. He is a member of the Post Fellowship Education and Training Committee within the Royal Australian College of Surgeons and, as Director of the Brisbane Spine Reference Centre, supervises an international fellowship training program in spinal surgery. He has written numerous peer-reviewed publications and is a member of the International Knowledge Forum in spinal tumour surgery.

Joost van Middendorp – The Netherlands
Having graduated in medicine in 2007, he was offered a position as a PhD student in clinical spinal trauma research at the Radboud University Medical Centre Nijmegen, The Netherlands. After 3 years of work, he was awarded a PhD degree, cum laude, for his thesis on the prognosis and classification of spinal column and spinal cord injuries. After a post-doctoral fellowship in Brisbane, Australia, he moved to Oxford in March 2012 and became the research director of Stoke Mandeville Spinal Research, based in the National Spinal Injuries Centre at Stoke Mandeville Hospital and was also a senior research fellow of Harris Manchester College, University of Oxford. Since January 2015 he has been working as a medical adviser for Pfizer in The Netherlands.
National Faculty

David Jaffray

Consultant Spinal Surgeon, Robert Jones and Agnes Hunt Orthopaedic Hospital, Oswestry, Shropshire. He has worked in Oswestry for over a quarter of a century as a Consultant in Spinal Disorders.

Marco Sinisi

In 2004 he was appointed Consultant at the Royal National Orthopaedic Hospital (RNOH) in Stanmore working on the Peripheral Nerve Injury (PNI) Unit. He is a Neurosurgeon by training, having graduated from the University of Milan in 1997 and then completed his training in Neurosurgery in the Institute of Neurosurgery of Milan. In 2002, he was appointed to a permanent consultancy at the Carlo Besta Neurological Institute of Milan, a centre of excellence among neurosurgical centers in Italy, where he was the lead surgeon for the development of the treatment of surgical disorders of peripheral nerves.

Douglas Wardlaw

Professor Wardlaw was educated at the University of Edinburgh. He became a Fellow of the Royal College of Surgeons Edinburgh in November 1974 and received his certificate of Higher Surgical Training in Orthopaedics, in June 1979. He went on to write a thesis entitled “The Clinical and Biomechanical Function of Femoral Fracture Bracing” for which he was awarded ChM (Master of Surgery), Edinburgh 1981. In 1981 he received a spinal fellowship with Professor Ian MacNab, Wellesley Hospital, Toronto, Canada and became Consultant Orthopaedic Surgeon to Grampian University Hospitals NHS Trust and Honorary Senior Lecturer, University of Aberdeen. He specialised in surgery for low back pain, spinal tumours and trauma, and had a wide experience in the treatment of spinal disorders by chemonucleolysis, disc enucleation, decompression, spinal fusion and reconstruction. After his retirement in December 2009, he continued as Honorary Consultant Orthopaedic Surgeon to Grampian University Hospitals NHS Trust until December 2011 whilst completing research. He became an Honorary Professor, Robert Gordon University, Aberdeen in July 2007. He continues to be a member of nine national and international societies. He has carried out research in the fields of Functional Bracing, Casting Materials, Gait Analysis and Low Back Pain Disorders, particularly Chemonucleolysis, Spinal Imaging, Spinal Stenosis, Kyphoplasty, Spinal Stabilisation and Fusion. He has authored 7 book chapters, most recently 3 chapters on functional bracing in the centenary edition of John Charnley’s “Closed Treatment of Common Fractures”. He has presented or been a co-author in more than 500 presentations and posters at scientific meetings and has 70 papers published in Peer reviewed journals. He continues to have research and development interests in spine and functional bracing.
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<td>11.30-13.30</td>
<td>Teaching Day programme</td>
<td>BRLSI</td>
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<td>13.30-14.00</td>
<td>Lunch</td>
<td>BRLSI</td>
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<td>14.00-16.00</td>
<td>Teaching Day programme</td>
<td>BRLSI</td>
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<td>16.00-16.30</td>
<td>Tea/Coffee</td>
<td>BRLSI</td>
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<tr>
<td>16.30-17.30</td>
<td>Teaching Day programme</td>
<td>BRLSI</td>
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<td>10.00-21.00</td>
<td>Exhibition set up</td>
<td>Bath Assembly Rooms</td>
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<tr>
<td>16.30-18.00</td>
<td>BASS Executive</td>
<td>Bath Assembly Rooms</td>
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<tr>
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<td>Faculty Dinner</td>
<td>Casanis French Bistro Restaurant (invitation only)</td>
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<th>Location</th>
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<td>Registration</td>
<td>Bath Assembly Rooms</td>
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<td>10.30-10.45</td>
<td>Welcome</td>
<td>Maurice Paterson</td>
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<td>Richard Williams</td>
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<td>Keynote Speaker</td>
<td>Frank Feigenbaum</td>
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<td>14.15-15.15</td>
<td>Plenary Session 2</td>
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<td>15.15-15.45</td>
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<td>Douglas Wardlaw</td>
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<td>Keynote Speaker</td>
<td>David Jaffay</td>
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<td>Keynote Speaker</td>
<td>Peter Fritzell</td>
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<td>19.00-20.15</td>
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## Programme and Key

### Thursday, 19th March 2015

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<th>Location</th>
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<td>08.30-09.00</td>
<td>Registration</td>
<td>Bath Assembly Rooms</td>
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<td>09.00-10.25</td>
<td>Plenary Session 4</td>
<td>Spinal Tumour</td>
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<tr>
<td>10.25-11.20</td>
<td>Keynote Speaker</td>
<td>Stefano Boriani</td>
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<tr>
<td>11.20-11.50</td>
<td>Tea/Coffee and Exhibition</td>
<td>Octagon and Tea Rooms</td>
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<tr>
<td>11.50-13.00</td>
<td>Plenary Session 5</td>
<td>Adult Spinal Deformity</td>
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<tr>
<td>13.00-13.55</td>
<td>Keynote Speaker</td>
<td>Brice Ilharreborde</td>
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<tr>
<td>13.55-14.15</td>
<td>Colin Howie</td>
<td>BOA President</td>
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<tr>
<td>14.15-15.15</td>
<td>Lunch and Exhibition</td>
<td>Octagon and Tea Rooms</td>
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<td></td>
<td>Symposium</td>
<td>Alphatec Spine</td>
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<td>15.15-16.25</td>
<td>Plenary Session 6</td>
<td>Spinal Infection</td>
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<td>16.25-17.05</td>
<td>Keynote Speaker</td>
<td>Robert Dunn</td>
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<tr>
<td>17.05-17.35</td>
<td>Tea/Coffee and Exhibition</td>
<td>Octagon and Tea Rooms</td>
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<tr>
<td>17.35-17.55</td>
<td>Audit and Registry</td>
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<tr>
<td>17.55-18.30</td>
<td>Annual General Meeting</td>
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<tr>
<td>19.00-23.00</td>
<td>Drinks Reception followed by Conference Dinner</td>
<td>The Pump Room</td>
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### Friday, 20th March 2015

<table>
<thead>
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<th>Time</th>
<th>Activity</th>
<th>Location</th>
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<td>08.30-09.00</td>
<td>Registration</td>
<td>Bath Assembly Rooms</td>
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<tr>
<td>09.00-10.05</td>
<td>Plenary Session 7</td>
<td>Spinal Injuries and Trauma</td>
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<tr>
<td>10.05-11.05</td>
<td>Keynote Speaker</td>
<td>Marco Sinisi</td>
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<tr>
<td>11.05-11.35</td>
<td>Technical Tips: Pearls and Pitfalls</td>
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<td>11.35-12.05</td>
<td>Tea/Coffee and Exhibition</td>
<td>Octagon and Tea Rooms</td>
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<tr>
<td>12.05-12.40</td>
<td>Keynote Speaker</td>
<td>Joost van Middendorp</td>
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<tr>
<td>12.40-13.25</td>
<td>Keynote Speaker</td>
<td>Michael Fehlings</td>
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<tr>
<td>13.25-13.55</td>
<td>Debate</td>
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<tr>
<td>13.55-14.10</td>
<td>Prizes and Awards</td>
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<td>14.10-14.15</td>
<td>Conference Close</td>
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<td>14.15</td>
<td>Lunch and Depart</td>
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BASS 2015 Teaching Day

Bath Royal Literary and Scientific Institution (BRSLI)
(please see www.brlsi.org for further information)

- The pre-conference teaching day is popular with both residents and consultants.
- The faculty includes eminent past and present spinal surgeons from around the country.
- The target audience is senior Orthopaedic and Neurosurgical residents, spinal fellows and junior consultants.
- The format includes didactic lectures, debates and orations on concurrent spinal practice.

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker(s)</th>
</tr>
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<tbody>
<tr>
<td>11.00 - 11.30</td>
<td>REGISTRATION</td>
<td>BRSLI (see <a href="http://www.brlsi.org">www.brlsi.org</a>)</td>
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<td>Chairs</td>
<td>Adrian Casey and Am Rai</td>
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<td>11.30 - 12.30</td>
<td>Role of surgery for back pain in view of results of the SPORT studies</td>
<td>Mike Hutton, Stuart Blagg</td>
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<td>12.30 - 13.00</td>
<td>Cauda Equina Syndrome and BASS guidelines</td>
<td>Harshad Dabke</td>
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<td>13.00 - 13.30</td>
<td>How I do a micro-discectomy</td>
<td>Maurice Paterson</td>
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<td>13.30 - 14.00</td>
<td>LUNCH</td>
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<td>14.00 - 14.45</td>
<td>Surgical Decision making with seniority</td>
<td>Bob Crawford, Rodney Laing</td>
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<td>14.45 - 15.30</td>
<td>The Big Picture</td>
<td>Alan Crockard</td>
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<td></td>
<td>Introduction</td>
<td>Adrian Casey</td>
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<td>15.30 - 16.00</td>
<td>Spinal metastasis - when is anterior support required?</td>
<td>Nas Quraishi</td>
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<td>16.00 - 16.30</td>
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<td>16.30 - 17.00</td>
<td>SI joint dysfunction - fact or fiction?</td>
<td>Sashin Ahuja</td>
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<td>17.00 - 17.30</td>
<td>Spondylolisthesis - when and how to treat</td>
<td>Vinay Jasani</td>
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Wednesday 18th March 2015

08.30  REGISTRATION  Bath Assembly Rooms

TEA/COFFEE

10.30  Welcome  Maurice Paterson

10.45  PLENARY SESSION 1 – CERVICAL SPINE

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<tbody>
<tr>
<td>10.55</td>
<td>Complications of anterior cervical disc fusion (ACDF) for brachialgia</td>
<td>Tim Pigott</td>
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<tr>
<td>11.00</td>
<td>Is anterior plating of the cervical spine associated with increased incidence of adjacent segment disease compared with anterior cage fusion alone?</td>
<td>Yizhou Wan</td>
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<tr>
<td>11.05</td>
<td>Referral of upper cervical spine injuries to a major trauma centre: review of management, clinical and radiological outcomes</td>
<td>Theofano Tikka</td>
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<td>11.10</td>
<td>Morphometric analysis of joint arthropathy at the occipito-cervical junction on hybrid bone SPECT/CT</td>
<td>Vittorio Russo</td>
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<td>11.15</td>
<td>Predicting mortality in octogenarians and nonagenarians following cervical spine surgery</td>
<td>Mark McGowan</td>
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<td>11.20</td>
<td>Association of APOE 4 with poor outcome following decompressive surgery for cervical spondylotic myelopathy</td>
<td>Jesus Lafuente</td>
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<td>11.25</td>
<td>Nuence disc arthroplasty for cervical radiculomyelopathy improves quality of life: a three year follow-up</td>
<td>Isobel Turner</td>
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<td>11.30</td>
<td>Anatomical effect of rotation on atlantoaxial joint: a pilot MRI study</td>
<td>Narendra Rath</td>
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11.35  QUESTIONS

11.45  Introduction  Otto von Arx

11.50  KEYNOTE SPEAKER  Richard Williams

‘Odontoid fractures in the elderly’

12.20  QUESTIONS

1230 – 1330  LUNCH AND EXHIBITION

13.30  Introduction  Adrian Casey

13.35  KEYNOTE SPEAKER  Frank Feigenbaum

‘Management of Tarlov cysts’

14.05  QUESTIONS

14.15  PLENARY SESSION 2 – BACK PAIN LUMBAR DEGENERATIVE

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<thead>
<tr>
<th>Time</th>
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<tr>
<td>14.20</td>
<td>Radiological outcomes of Peek vs Titanium transforaminal lumbar interbody cages</td>
<td>Kiran Lingutla</td>
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<td>14.25</td>
<td>Does duration of symptoms at presentation influence subjective outcome in patients treated with microdiscectomy and lateral recess decompression?</td>
<td>Marina Pitsika</td>
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<td>14.30</td>
<td>Oswestry Disability Index (ODI) and Visual Analogue Score (VAS) in pre-operative patients with radicular leg pain</td>
<td>Lisa Grandidge</td>
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<td>14.35</td>
<td>Sacroiliac joint fusion for low back pain: a systematic review and meta-analysis</td>
<td>Kiran Lingutla</td>
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<td>14.40</td>
<td>Cauda Equina Syndrome – The Prelude to an Evidence-Based Scoring System</td>
<td>Ravi Badge</td>
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<tr>
<td>14.45</td>
<td>Is decompression alone a feasible option for lumbar stenosis patients with degenerative</td>
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<td></td>
<td>spondylolisthesis? Abdulkader Hamad</td>
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<tr>
<td>14.50</td>
<td>Lumbar spinal stenosis with stable low grade spondylolisthesis – treatment alone with minimally</td>
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<td>invasive decompression – 2 year comparative outcomes. B Roy Chaudhary</td>
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<tr>
<td>14.55</td>
<td>Results of LLIF with Avenue L cage in lumbar degenerative disease Charlie Bouthors</td>
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<td>15.00</td>
<td>Can we predict recurrence following microdiscectomy? Fabian Wong</td>
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<tr>
<td>15.05</td>
<td>QUESTIONS</td>
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<td>15.15</td>
<td>TEA/COFFEE</td>
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<tr>
<td>15.45</td>
<td>Introduction</td>
<td>Philip Sell</td>
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<td>15.50</td>
<td><strong>KEYNOTE SPEAKER</strong></td>
<td>Douglas Wardlaw</td>
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<td></td>
<td>‘Evidence based vs practice based VTE prophylaxis in spinal surgery: Is there controversy?’</td>
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<td>16.10</td>
<td>QUESTIONS</td>
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<tr>
<td>16.20</td>
<td><strong>PLENARY SESSION 3 – BASIC SCIENCE/SPINAL SURGERY</strong></td>
<td>Douglas Wardlaw/Ian Nelson</td>
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<td>Moderators</td>
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<tr>
<td>16.25</td>
<td>Quality improvement project the effect of an enhanced recovery programme on length of stay and patient experience following elective spinal surgery at Musgrove Park Hospital Alex Goubran</td>
<td><em>(scroll down for more sessions)</em></td>
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<td>16.30</td>
<td>British Spine Registry (BSR) PROMS compliance and results after primary lumbar microdiscectomy Lisa Grandidge</td>
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<td>16.35</td>
<td>Functional outcome following surgery for giant thoracic disc herniation – retrospective cohort study Meriem Amarouche</td>
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<td>16.40</td>
<td>The rootogram to success? Suribabu Gudipati</td>
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<tr>
<td>16.45</td>
<td>OSRAS (Orthopaedic Spinal Rapid Access Service) a new model for spinal on call service</td>
<td>Mukta Vadhva</td>
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<tr>
<td>16.50</td>
<td>Is there a relationship between prescribed medications and symptoms of cauda equina syndrome in patients with evidence of degenerative change in the lumbar spine? Jill Billington</td>
<td><em>(scroll down for more sessions)</em></td>
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<tr>
<td>16.55</td>
<td>Influence of paraspinal muscle activity on lumbar inter-vertebral flexion rotation range Alister Du Rose</td>
<td><em>(scroll down for more sessions)</em></td>
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<tr>
<td>17.00</td>
<td>SPECT/CT fusion imaging as a preoperative planning tool for patients undergoing revision adult spinal deformity surgery Joseph Butler</td>
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<tr>
<td>17.05</td>
<td>Developing a nurse-led nerve root block service Gill Rhind</td>
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<td>17.10</td>
<td>QUESTIONS</td>
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<td>17.20</td>
<td><strong>BASS FELLOWS</strong></td>
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<td>17.35</td>
<td>Introduction</td>
<td>Maurice Paterson</td>
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<td>17.40</td>
<td><strong>KEYNOTE SPEAKER</strong></td>
<td>David Jaffray</td>
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<tr>
<td></td>
<td>‘My career evolution in managing back pain?’</td>
<td><em>(scroll down for more sessions)</em></td>
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<tr>
<td>18.10</td>
<td>Introduction</td>
<td>Nick Birch</td>
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<td>18.15</td>
<td><strong>KEYNOTE SPEAKER</strong></td>
<td>Peter Fritzell</td>
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<td>Managing back pain in a surgical perspective – have we changed practice in line with EBM since 2000?</td>
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<td>18.45</td>
<td>QUESTIONS</td>
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<tr>
<td>19.00</td>
<td><strong>RECEPTION AND INDUSTRY SPEED DATING</strong></td>
<td>Bath Assembly Rooms</td>
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<tr>
<td>08.30</td>
<td>REGISTRATION</td>
<td>Bath Assembly Rooms</td>
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<td>TEA/COFFEE</td>
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<tr>
<td>09.00</td>
<td>PLENARY SESSION 4 – SPINAL TUMOUR</td>
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<td>Moderators</td>
<td>Stefano Boriani/Jeremy Reynolds</td>
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<tr>
<td>09.05</td>
<td>Management of vertebral compression fractures (VCFS) in multiple myeloma (MM) patients with balloon kyphoplasty (BKP) Anand Patel</td>
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<tr>
<td>09.10</td>
<td>The Oswestry Risk Index – internal validation study Abdulkader Hamad</td>
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<td>09.15</td>
<td>Minimally invasive spine stabilisation for spinal metastatic lesions - case series &amp; review of complications Abdulkader Hamad</td>
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<tr>
<td>09.20</td>
<td>Surgical treatment of sacral chordoma: prognostic variables for local recurrence and overall survival Nasir Quraishi</td>
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<td>09.25</td>
<td>A low cost spinal dural closure simulation for tomorrow’s spinal surgeons Deborah Ferguson</td>
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<td>09.30</td>
<td>Anterior cervical transsternal approach for thoracic outlet neoplasms; a 15 year experience in two tertiary centres George Prezerakos</td>
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<td>09.35</td>
<td>Pathologic sternal involvement as a risk factor for severe sagittal plane deformity in multiple myeloma with concomitant thoracic fractures Joseph Butler</td>
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<td>09.40</td>
<td>Surgical management of myeloma in the cervical spine Adam Benton</td>
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<td>09.45</td>
<td>Sustained improvement in quality of life after surgery for spinal metastases: cohort study of 922 patients David Choi</td>
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<td>09.50</td>
<td>Minimally Invasive Direct Lateral Corpectomy (MIDLaC) of the thoraco-lumbar spine for metastatic spinal cord compression Terence Tan</td>
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<td>09.55</td>
<td>Spinal osteoid osteoma: a multicentre retrospective cohort study comparison of results with appendicular osteoid osteoma Nasir Quraishi</td>
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<td>10.00</td>
<td>Systematic review of en bloc resection in the management of Ewing’s Sarcoma of the mobile spine with respect to local control and disease free survival Nasir Quraishi</td>
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<td>10.05</td>
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<td>10.20</td>
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<td>Alistair Stirling</td>
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<td>KEYNOTE SPEAKER</td>
<td>Stefano Boriani</td>
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<td>'Spinal tumour management and solitary spinal metastases'</td>
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<td>11.20 - 11.50</td>
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<td>11.50</td>
<td>PLENARY SESSION 5 – ADULT SPINAL DEFORMITY</td>
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<td>Moderators</td>
<td>Brice Ilharreborde/Ian Harding</td>
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<tr>
<td>11.55</td>
<td>Early changes in sagittal spinopelvic parameters after Scheuermann’s kyphosis correction Eyal Behrbalk</td>
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<tr>
<td>12.00</td>
<td>Clinical and radiologic outcome from 360-degree lumbar spondylodesis using porous tantalum cages in complex spinal reconstruction for degenerative lumbar spine deformity Joseph Butler</td>
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<tr>
<td>12.05</td>
<td>Correlation between spinopelvic parameters and clinical outcomes after 2-stage sagittal malalignment correction in a prospective adult spinal deformity cohort Joseph Butler</td>
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<tr>
<td>12.10</td>
<td>The role of lumbosacral transitional vertebrae in the pathogenesis of degenerative lumbar scoliosis: an in vitro study Alex Torrie</td>
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<tr>
<td>12.15</td>
<td>Optimising lumbar lordosis during PLIF surgery Priyan Landham</td>
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12.20  Can spino-pelvic parameters predict hardware failure in Scheuermann’s kyphosis patients? Eyal Behrbalk
12.25  Clinical outcomes using a novel extensile lateral psosas-preserving single incision surgical approach for anterior lumbar interbody fusion from L1 to S1 Sean Molloy
12.30  Post-operative neurological observations: are you getting what you think you ordered? Donald Buchanan
12.35  The impact of a structured rehabilitation program as part of an integrated multidisciplinary treatment algorithm to enhance recovery in adult spinal deformity patients Gemma Bruce
12.40  QUESTIONS

12.55  Introduction Otto von Arx
13.00  KEYNOTE SPEAKER Brice Ilharreborde
13.00  ‘Challenges and techniques of lumbopelvic fixation in spinal surgery’
13.40  QUESTIONS
13.55  ‘Horizon Scanning’ Colin Howie (BOA President)
14.15 – 15.15 LUNCH AND EXHIBITION

SYMPOSIUM Alphatec Spine
‘Opportunities and Challenges in the Treatment of Spinal Deformities’
Associate Professor Richard Williams (Princess Alexandra hospital, Brisbane), Mr John Howes (University Hospital of Wales, Cardiff), Mr Masood Shafafy (Queens Medical Centre, Nottingham)

15.15  PLENARY SESSION 6 – SPINAL INFECTION
Moderators Robert Dunn/Bill Harcourt
15.20  A new treatment regimen for Potts disease with para-spinal abscesses and sinuses Kalpesh Vaghela
15.25  Surgical percutaneous biopsy of discitis and vertebral osteomyelitis is significantly better than CT guided biopsy in identifying the causative organism Hanny Anwar
15.30  SAPHO syndrome: clinical presentation, imaging and management and its relevance to spinal surgical practice Anne Duits
15.35  Surgical site infection (SSI) and airflow in spinal surgery – time for a national review? Anna Watts
15.40  Challenges in managing extensively drug resistant spinal tuberculosis (XDR-TB): the journey from complete lower limb motor paraplegia to independent mobilisation Jane Vanhoutte
15.45  The role of myelography in the MRI era See Yung Phang
15.50  Routine imaging after spinal instrumentation: is it necessary? Donald Buchanan
15.55  The role of SPECT/CT fusion imaging in the preoperative evaluation of patients undergoing fusion surgery for symptomatic degenerative lumbar spondylosis Joseph Butler
16.00  The role of oblique spinous process abutment in the pathogenesis of degenerative lumbar scoliosis: an in vitro study Alex Torrie
16.05  QUESTIONS

16.20  Introduction Maurice Paterson
16.25  KEYNOTE SPEAKER Robert Dunn
16.45  ‘Spinal infection and the management of spinal TB’
16.55  QUESTIONS
17.05 – 17.35 TEA/COFFEE
17.35  AUDIT AND REGISTRY Lee Breakwell
17.55 – 18.30 BASS ANNUAL GENERAL MEETING
19.00 – 23.00 DRINKS RECEPTION FOLLOWED BY CONFERENCE DINNER The Pump Room
### Full Programme - Friday 20th March

**08.30**  
**REGISTRATION**  
Bath Assembly Rooms

**09.00**

**PLENARY SESSION 7 – SPINAL INJURIES AND TRAUMA**

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<td>09.05</td>
<td>In vivo MRI tracking of mesenchymal precursor cells labelled with iron oxide fluorescent nanoparticles (IODEX) in an ovine model of disc degeneration</td>
<td>Johanne Summers</td>
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<tr>
<td>09.10</td>
<td>Diffusion-weighted MRI assessment of adjacent disc degeneration after thoracolumbar vertebral fractures</td>
<td>David Noriega</td>
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<td>09.15</td>
<td>The burden of back pain on a district general hospital</td>
<td>Claire Spolton-Dean</td>
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<td>09.20</td>
<td>Risk factors for long term neurological deficit following intraoperative monitoring alerts: do interventions change the outcome?</td>
<td>Hanny Anwar</td>
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<tr>
<td>09.25</td>
<td>A prospective multicentric observational study on the use of intervertebral implants for traumatic vertebral compression fracture treatment – 12 months follow up</td>
<td>David Noriega</td>
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<td>09.30</td>
<td>Is radiation a limit for cone beam tomography-based image guided spinal surgery?</td>
<td>David Noriega</td>
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<td>09.35</td>
<td>Audit on the effectiveness of a new orthopaedic spinal on-call rota</td>
<td>Mohamed Farook</td>
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<td>09.40</td>
<td>Comparing SPECT CT scan with other radiological modalities in diagnosing adult spinal pathologies</td>
<td>Julian Leong</td>
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<tr>
<td>09.45</td>
<td>The British experience of pedicle screw Insertion using the O-Arm® imaging system and StealthStation® navigation system</td>
<td>Anand Patel</td>
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</table>

**10.05**  
Introduction  
Adrian Casey

**10.10**

**KEYNOTE SPEAKER**  
Marco Sinisi

*‘Early and late surgical reconstructive possibilities in neurological disorders of the upper and lower extremities’*

**10.50**  
INTRODUCTIONS

**11.00**

**QUESTIONS**

**11.05**

**TECHNICAL TIPS – PEARLS AND PITFALLS**  
Surgeons from the South West Spine Group

**11.35**

**TEA/COFFEE**

**12.05**

**INTRODUCTION**  
Sashin Ahuja

**12.10**

**KEYNOTE SPEAKER**  
Joost van Middendorp

*‘The effects of the timing of spinal surgery after traumatic spinal cord injury’*

**12.40**

**INTRODUCTION**  
Iqroop Chopra

**12.45**

**KEYNOTE SPEAKER**  
Michael Fehlings

*‘Spinal Cord Injury management and prospects on the horizon’*

**13.25**

**DEBATE AND QUESTIONS**

**13.55**

Prizes and Awards

**14.10**

**CONFERENCE CLOSE**

**14.15**

LUNCH AND DEPART

Main Author: Senthil Selvanathan
Co Authors: Chris Beagrie, Simon Thomson, Rob Corns, Chris Derham, Gerry Towns, Jake Timothy, Deb Pal
Affiliation: Department of Neurosurgery, Leeds General Infirmary

Background Context: Previous studies comparing anterior cervical discectomy (ACDF) and posterior cervical foraminotomy (PCF) were flawed by utilisation of non-validated outcomes measures.

Purpose: The authors compared the effectiveness of both interventions using validated outcome measures. It will be the first study in the literature to have performed this.


Patient Sample: All patients who had ACDF and PCF for cervical brachialgia. Patients with myelopathy and large central disc were excluded.

Outcome Measures: Neck Disability Index (NDI), Visual analogue scores (VAS) for neck and arm pain.

Methods: The outcomes of both interventions were compared. Wilcoxon test and student t-test were utilised.

Results: A total of 150 ACDFs and 51 PCFs were performed. There were no differences in the pre-operative NDI, VAS neck and arm scores (p>0.05). Both ACDF and PCF delivered statistically significant improvement in NDI and VAS neck and arm scores.

Degree of improvement of NDI, VAS neck and VAS arm were similar between both groups (p>0.05) with a trend favouring the PCF group. In the ACDF group, two (1.3%) patients needed repeat ACDF due to adjacent segment disease. One (0.7%) needed further decompression via a foraminotomy. Four (2.7%) and seven (4.7%) patients had hoarse voice and dysphagia respectively. In the PCF group one (2.0%) patient needed ACDF due to persistent brachialgia.

Conclusions: PCF can be an invaluable alternative to ACDF in treating patients with brachialgia without a significant increased risk for ACDF revision surgery at the index level. The authors are currently setting up a prospective clinical trial to address this question.
Plenary Session 1 - Cervical Spine

Is anterior plating of the cervical spine associated with increased incidence of adjacent segment disease compared with anterior cage fusion alone?

Main Author: Yizhou Wan
Co Authors: Senthil Selvanas, Debasish Pal
Affiliation: Department of Neurosurgery, Leeds General Infirmary, Great George Street, Leeds LS1 3EX

Background Context: Using a cage-plate construct (ACDF-CPC) may cause higher mechanical stresses at neighbouring discs, leading to Adjacent Segment Disease (ASD).

Purpose: To determine if ACDF-CPC is associated with higher rate of revision surgery for ASD compared to using Anterior Cervical Discectomy and Fusion (ACDF-CA).

Study Design/Setting: Single centre retrospective study.

Patient Sample: Adult patients operated on from January 2008 to December 2011 for degenerative spine disease.

Outcome Measures: Functional outcomes were assessed using Visual Analogue Scale and the Neck Disability Index.

Methods: 574 patients (mean age 55.6, range 26–89) were divided into 2 groups: group A (n= 321) underwent ACDF-CA; group B (n = 253) underwent ACDF-CPC. Minimum follow-up period was two years. 32 male and 8 female adult patients (mean age = 54.7, range 37-80) received revision surgery for ASD.

Results: 18 patients developed ASD (5.6%) in group A, 20 patients developed ASD in group B (6.2%). There was no statistically significant difference in rates between the groups (Chi-square test p = .272). There was a statistically significant difference with regard to sex (Fisher exact test p = .008), but not plating (Fisher exact test p = .176).

The use of a plate was not statistically significant associated with differences in pain scores.

Conclusions: Supplementary plating is not associated with a higher rate of ASD development in our study. This supports the hypothesis that adjacent level degeneration may be more attributable to the natural history of the spondylosis rather than alterations in the biomechanical environment.

Referral of upper cervical spine injuries to a major trauma centre: review of management, clinical and radiological outcomes

Main Author: Theofano Tikka
Co Authors: F Colombo, S Kuruvath
Affiliation: Queen Elizabeth Hospital, Birmingham

Background Context: Patients with cervical spine injuries are a high-risk group, with the highest reported early mortality rate in spinal trauma.

Purpose: To study referral patterns, aetiology profile of all patients referred to our Major Trauma Centre with an upper cervical spine injury, their management strategies, clinical and radiological outcome at 12 months.

Study Design/Setting: A retrospective cohort study

Patient Sample: All patients referred with an upper cervical spine injury to our institution over a 1 year period.

Outcome Measures: Clinical and radiological outcome a year following the injury was analysed.

Methods: Data was gathered from case notes, clinical and radiological information systems.

Results: A total of 109 patients were referred, 70% of which were from other hospitals. Majority were females (56%), the mean age being 71 years (range 16-94). Co-morbidity was noted in half of the patients. Falls accounted for 70.6%, and Road traffic accidents constituted 22% as the cause. At presentation 83.5% of the patients had no neurology, 36% had complaints of pain. An isolated injury was noted in 65% of patients. C1 fracture was seen in 21 patients; C2 fracture in 66 patients, and occipital condyle fracture in 2 patients. Only 18% of patients required admission. HALO cervical vest immobilisation was undertaken in 8 patients (7%), and hard collars were used in 84% of cases. The mean duration for HALO vest immobilisation and those managed with hard cervical collars were 14 weeks (range 4 - 24) and 13.5 weeks (1 – 60) respectively. Complication was seen in 3 patients, with dislodged Halo and pressure sores. None of the patients during the study period required surgical intervention. No further follow up was advised in 27 patients (25%), after the initial referral. 20 patients were lost to follow up. Clinical outcome at 12 months revealed 66% of patients were symptom free. Decreased range of movements was noted in 21%; pain in 8%, discomfort in 6%, and 1 patient had paraesthesia. 17 patients died during the study period, 9 (15%) of which were directly related to the spinal injury. Half of the deaths were within three months of the injury. Radiology outcome at 12 months showed 28% with solid bony fusion.
Conclusions: The majority of upper cervical spine injuries occur in the elderly population, all of which were treated non-operatively in our study group. Good clinical outcome was achieved in 66% of our patients at 12 months. 15% of patients died as a direct result of the spinal injury. Complete or partial radiological union was achieved in 62% of patients.

Morphometric analysis of joint arthropathy at the occipito–cervical junction on hybrid bone SPECT/CT

Main Author: Vittorio M Russo
Co Authors: Anneli Duits, Ranju Dhawan, Adrian T H Casey
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Background Context: Osteoarthritic degeneration at the Occipito-Cervical Junction (OCJ) is an under-recognised source of sub-occipital and neck pain, limited range of motion and cervicogenic headaches. Correlation of radiographic findings with clinical symptoms is still difficult. Limited evidence currently exists to support the use of Bone SPECT/CT (Single-Photon Emission Computed-Tomography) in patients with neck pain.

Purpose: To describe scintigraphic patterns at the OCJ on bone SPECT/CT in patients with sub-occipital/neck pain and cervicogenic headache

Study Design/Setting: Retrospective case series.
Patient Sample: Patients with sub-occipital/neck pain/ cervicogenic headache from a single centre.

Outcome Measures: Osteoblastic activity on Bone SPECT/CT, visual analogue pain score (VAS), neck disability index (NDI).

Methods: Patients with >3 months of sub-occipital/neck pain/ cervicogenic headache and abnormal SPECT/CT findings at the OCJ were included. Patients with known/suspected malignancy, trauma, infectious processes and previous surgery at the OCJ were excluded. NDI, VAS and treatment were recorded for each patient. Patterns of osteoblastic activity at the OCJ on Bone SPECT/CT were described and correlated with arthritic changes on conventional scans.

Results: 18 patients were included (10 females, mean age 68). Mean NDI was 44. Mean VAS was 7.5. On Bone SPECT/CT 14 patients had high osteoblastic activity at the atlanto-axial joint (AAJ); 2 patients at the atlanto-dental joint (ADJ), 1 at the occipito-atlantal joint (OAJ) and 1 at both OAJ and ADJ.

Conclusions: The ability of hybrid bone SPECT/CT to precisely localise osteoblastic activity at the OCJ may provide significant improvement in the diagnosis and treatment of patients with sub-occipital/neck pain and joint arthropathy at the OCJ.

Predicting mortality in octogenarians and nonagenarians following cervical spine surgery

Main Author: Zdenek Klezl
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Background Context: There is limited literature on cervical spine surgery in octogenarians and nonagenarians, most of which relates to trauma. More data is required on mortality, complications and functional outcome following both elective and trauma cervical spine surgery.

Purpose: To assess whether the Charlson comorbidity index is helpful in predicting perioperative or 6 month mortality following cervical spine surgery and to assess social drift.

Study Design/Setting: Cross sectional analysis.
Patient Sample: 74 patients aged 80 to 100 years old who underwent cervical spine surgery between 2006 to 2013 at our institution.

Outcome Measures: Mortality and Residential status.

Methods: Potential relationships between Charlson comorbidity index and mortality. Social drift was assessed by applying the Fisher’s Exact Test.

Results: There were 7 perioperative deaths and a total of 17 deaths at 6 months. No correlation was found between Charlson comorbidity index and perioperative nor 6 month mortality. Social drift was statistically significant in our study (p=0.007, Fisher’s exact test). A statistically significant relationship was found between postoperative complications of aspiration pneumonia (relative risk 7.34, 95% CI 2.40–7.84) as well as hospital acquired pneumonia (HAP) (relative risk 4.25, 95% CI 2.20–8.19) and a 6-month mortality.

Conclusions: Our study has found no correlation between Charlson score and 6 month mortality. There is a statistically significant social drift present in this elderly cohort at 6 months post-operatively. The postoperative complications of hospital acquired pneumonia and aspiration pneumonia carry an increased risk of 6 month mortality.
Plenary Session 1 - Cervical Spine

Association of APOE ε4 with poor outcome following decompressive surgery for cervical spondylotic myelopathy

Main Author: Jesus Lafuente
Co Authors: A T H Casey, H A Crockard
Affiliation: NHNN

Purpose: Possession of apolipoprotein E ε4 allele (APOE ε4) has been associated with poor outcome after different forms of acute brain injury. Here we investigate whether patients with APOEε4 have a poor prognosis following surgery for cervical spondylotic myelopathy (CSM).

Study Design/Setting: Retrospective

Patient Sample: A cohort of 81 patients with CSM undergoing decompressive surgery who were entered prospectively into a relational database to measure their outcome following surgery.

Outcome Measures: Clinical outcome was assessed by Nurick’s grades, Ranawat neurological classification, European Myelopathy Score (EMS), Japanese Orthopedic Association for cervical myelopathy (JOA), and walking test.

Methods: A cohort of 81 patients with CSM undergoing decompressive surgery who were entered prospectively into a relational database to measure their outcome following surgery. APOE genotyping was performed on a blood sample using a standard PCR-based method.

Clinical outcome was assessed by Nurick’s grades, Ranawat neurological classification, European Myelopathy Score (EMS), Japanese Orthopedic Association for cervical myelopathy (JOA), and walking test. All clinical outcomes were determined by an independent nurse practitioner not connected with surgery.

Preoperative radiological assessment was performed by two radiologists blinded to the surgical situation. Spinal cord compression (mild, moderate and severe) and the presence of T2 weighted signal change in the spinal cord were assessed.

Statistical analyses were performed using Stata® 8. Data was analysed using the chi square test and Mann Whitney test.

Results: 24/81 (30%) of the patients were APOE ε4 carriers, similar to the prevalence in the general population. APOE ε4 carriers had a poorer outcome six months after surgery as determined by: walking test (p=0.01), JOA (p=0.05) and Nurick grades (p=0.03) and were also more likely to suffer from further progression of the disease. Outcomes at one year follow-up were worse for the walking test (p=0.03) and Nurick’s grades (p=0.05) compared to the six months follow-up. Radiological analyses revealed that those individuals with APOE ε4 allele were symptomatic with less spinal cord compression than those without the gene (ε2, p=0.01).

Conclusions: We have found a significant association between possession of APOE ε4 allele and poor prognosis in patients undergoing decompressive surgery for cervical spondylotic myelopathy. Carriage of APOEε4 was associated with less neurological recovery 6 months after surgery and subsequent deterioration in long term follow-up (1 year). APOE ε4 carriers also appear to become symptomatic with a lesser degree of spinal cord damage. The findings suggest that the gene product plays an important role in the response to spinal cord injury, which may have future therapeutic implications.

Nunec disc arthroplasty for cervical radiculomyelopathy improves quality of life: a three year follow-up

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Co Authors: David Choi
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Background Context: Cervical radiculomyelopathy results in symptoms that may have a considerable impact on quality of life. The primary aim of cervical disc replacement is to improve symptoms and maintain normal cervical movement; the NuNec disc arthroplasty uses radiolucent biomaterials and has a unique locking mechanism to prevent disc extrusion.

Purpose: To report quality of life outcomes after NuNec disc arthroplasty.

Study Design/Setting: Patients undergoing surgery for cervical radiculomyelopathy completed quality of life outcome measures pre-operatively and 3, 6, 12, 24 and 36 months after surgery.

Patient Sample: Twenty nine patients with cervical radiculomyelopathy at single or multiple spinal levels, mean age 49 years.

Outcome Measures: Neck disability index (NDI), visual analogue scale (VAS) for neck and arm pain, Short-Form 36 (SF36) and Euroqol EQ-5D.

Methods: Outcome measures were prospectively collected from consecutive patients who underwent surgery for NuNec disc arthroplasty at a single institution. Results were analysed using t-test for continuous data and Wilcoxon signed-rank test for ordinal data to assess changes over the follow up period.

Results: All outcome measures showed gradual improvement, the NDI, VAS neck, SF36 physical composite score and EQ5D demonstrated a significant improvement at six months (p<0.01,
p=0.03, p=0.05, p<0.01 respectively). After one year the scores reached a plateau and were sustained for the three year follow up period, with the exception of VAS neck and arm, which tended towards pre-operative levels.

Conclusions: Over three-years the NuNec disc arthroplasty has demonstrated an improvement in quality of life with the largest benefit seen at six months post-operatively.

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**Plenary Session 1 - Cervical Spine**

Anatomical effect of rotation on atlantoaxial joint: a pilot MRI study

**Main Author:** Narendra K Rath

**Co Authors:** Kathleen Lyons, Xin Yang, Len D M Nokes, Michael J H McCarthy

**Affiliation:** University Hospitals of Wales

**Background Context:** There is a paucity of MRI studies looking at the anatomical changes that occur during spine motion especially at the atlantoaxial joint in the cervical spine (C1-C2). The majority of the literature focuses on range of movement and does not investigate into isolated rotation and subluxation at atlantoaxial motion segment.

**Purpose:** To provide normal variant data for better understanding of effect rotational at atlantoaxial joint.

**Study Design/Setting:** MRI based pilot study

**Patient Sample:** Ten volunteers with inclusion criteria male, age 20-30 years, height 5'6" – 6', BMI 20-30 and no previous back problems. The EQ5D, Neck Disability Index, Oswestry Disability Index, PHQ 9 and GAD 7 score were within normal range in the sample population.

**Outcome Measures:** MRI based radiological measurement of rotation of C1 over C2 vertebra and subluxation of lateral masses of C1 over C2.

**Methods:** Standard supine MRI cervical spine in neutral and right and left maximum rotation of the head was performed using 1.5 tesla scanner. Sagittal and axial images were analysed by spinal surgeon and musculoskeletal radiologist.

**Results:** Mean age 22 years (range 20-25). The mean rotation of C1 over C2 on right and left rotation was 31 degrees (95% CI = +/- 3.3). The mean forward subluxation of opposite lateral mass to side of rotation is 66% (95% CI = +/- 2.8), whereas the same side lateral mass subluxes about 80% (95% CI = +/- 2.4) backwards.

**Conclusions:** The atlantoaxial joint accounts for a large proportion of total neck rotation and demonstrates more than 60% forward and 80% backward subluxation.
Wednesday 18th March 2015

**KEYNOTE SPEAKER**
**Richard Williams**

‘Odontoid fractures in the elderly’

Odontoid fractures are the commonest cervical injuries in patients over 65 years. The long, stiff, spondylitic and osteoporotic cervical spine is prone to failure against the lever action of the occipitocervical junction with moderate to low energy trauma. 12 month mortality averages 37.5% in this age range and optimal management is controversial.

Dilemmas in treatment centre on patient co-morbidity, performance status and poor potential for bony union. Elderly patients are poorly tolerant of rigid external immobilisation with some studies suggesting a considerably higher rate of mortality with the use of halothoracic orthoses. Alternatives include non-rigid orthotic collars and surgical intervention.

Current treatment algorithms take into account patient performance status using validated instruments such as the Karnofsky score to direct appropriate treatment. Highly functioning individuals living independently in a self care environment seem most appropriately treated by operative stabilisation to reduce medium term disability and to reduce risk of sudden death.

Operative stabilisation by odontoid screw fixation is vexed by the high rate of associated osteoporosis and is prone to early failure, generally by screw migration about the point of insertion. Stabilisation via C1-2 posterior fusion is time honoured and effective in utilising the better preserved laminar and lateral mass corticocancellous bone of the posterior C1-2 region to maximise implant purchase and reduce the risk of fixation failure. C1-2 fusion is associated with reduced cervical rotation by up to 50% and may present a problem for those patients who intend to return to driving a vehicle after successful treatment. Posterior cervical surgery is also associated with a higher rate of perioperative morbidity than anterior approach procedures.

In those patients unable to tolerate prone anaesthesia or in whom performance status mandates a more conservative approach to treatment, soft collar immobilisation is a reasonable alternative.

Current assessment and treatment principles will be discussed and expanded upon with case illustrations.

**KEYNOTE SPEAKER**
**Frank Feigenbaum**

‘Management of Tarlov cysts’

A Tarlov cyst is an abnormally dilated spinal nerve root. Accumulation of spinal fluid within the nerve root causes dilation of its dural covering. If sufficiently large, the dilated nerve root/arlov cyst can then cause symptomatic compression of adjacent spinal nerve roots, just like any other mass. This is particularly true of Tarlov cysts found in the sacral spinal canal, where they can produce a sacral radiculopathy pattern including sacral, buttock and leg pain, perineal pain and numbness, bowel and bladder symptoms, dyspareunia, and sexual dysfunction. Unfortunately a symptomatic Tarlov cyst cannot simply be removed since it is a spinal nerve root, and resecting it would produce an unacceptable deficit. Successful treatment must therefore involve getting rid of the cyst part of the nerve, but at the same time preserving the nerve. Most spine surgeons have been dogmatically taught to avoid or ignore Tarlov cysts since they are “always” symptomatic. This has created a population of dramatically under-diagnosed and inappropriately treated patients whose cysts are actually symptomatic, but have been relegated to endless pain clinic management or treatment for other misdiagnosed ailments. The purpose of this presentation is to discuss the distinctions between Tarlov cysts and other types of meningeal cysts, identify their typical presenting symptoms and radiographic findings, demonstrate a surgical technique for their treatment, and to review outcomes data from over 500 surgically treated patients.
**Plenary Session 2 – Back Pain Lumbar Degenerative**

**Radiological outcomes of Peek vs Titanium transforaminal lumbar interbody cages**

**Main Author:** Kiran Lingutla  
**Co Authors:** Suribabu Gudipati, Raymond Pollock, Paul Davies, Iqroop Chopra, Sashin Ahuja  
**Affiliation:** Welsh Centre for Spinal Trauma and Surgery. University Hospital of Llandough, Penlan Road, Cardiff CF64 2XX  
**Background Context:** There have been varied reports of implant subsidence depending on the type of implant used.  
**Purpose:** To radiologically assess disc parameters and subsidence between PEEK and titanium cages.  
**Study Design/Setting:** Retrospective analysis of Prospectively collected data.  
**Patient Sample:** Cohort of 54 consecutive patients operated by single surgeon from 2007 to 2011.  
**Outcome Measures:** Radiological analysis.  
**Methods:** 54 consecutive patients had TLIF (Transforaminal Lumbar Interbody Fusion) procedure at single lumbar level were included in the study. 26 titanium cages and 28 PEEK (Poly Ether Ether Ketone) cages appropriate for the patients were used. An independent radiological analysis was performed measuring both pre and postoperative disc/foraminal heights, global/segmental lordosis and evidence of subsidence.  
**Results:** Average age was 45 years at the time of surgery and mean follow up was 71 months. Statistical analysis was performed using SPSS 21. 2-tailed unpaired t-test was used and there was a statistically significant difference between titanium and PEEK cages in disc height (mean titanium = 0.046, PEEK = 1.36, mean difference 1.31 mm, p=0.0272), foraminal height (mean titanium = 1.36, mean PEEK = 0.41, mean difference 0.95mm, p=0.43) and global lordosis (mean titanium = 5.62, mean PEEK = 0.59, mean difference 5.03, p=0.09) but not in anterior disc height (mean titanium = 1.52, mean PEEK = 2.52, mean difference 0.85mm, p=0.30). There was significant difference in the frequency of subsidence between the 2 groups of cages (Fishers exact test, p=0.0003, titanium 20 cases vs PEEK 6 cases).  
**Conclusions:** Titanium cages restore better posterior disc height but have higher subsidence rates.

**Does duration of symptoms at presentation influence subjective outcome in patients treated with micro-discectomy and lateral recess decompression?**

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**Co Authors:** Sabina Saheen, Eleanor Thomas, Yasmine Nunwa, Duncan Henderson, Adnan Ahmad, Himanshu Sharma  
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**Background Context:** Evidences suggest that patients with short-term symptoms benefit more from micro-discectomy and lateral recess decompression procedures, while there is conflicting data on the role of surgical treatment in case of prolonged duration of symptoms at presentation (more than 1 & especially with more than 2 years).  
**Purpose:** The aim of this study was to evaluate whether the duration of symptoms at presentation affects the final subjective outcome.  
**Study Design/Setting:** Retrospective review of prospectively collected database from a single surgeon  
**Patient Sample:** Patients who had microdiscectomies and patients younger than 60 years old who had lateral recess or nerve root decompressions between August 2012 and September 2014 were included.  
**Outcome Measures:** Pre-op/postop PROMS (Patient related outcome measures) included ODI (Oswestry Disability Index), VAS-BP and VAS-LP (Visual Analogue Scale for back pain & leg pain); Neurological outcome, complication rate & patient satisfaction  
**Methods:** Data was categorised into 4 sub-groups; symptoms $\geq$ 6 months, 6 months to 1 year, 1 year to 2 years and $> 2$ years. A clinically significant result was an average improvement of more than 2 points in the VAS and of over 20% in the ODI.  
**Results:** Out of the 110 patients, 17 were excluded due to incomplete PROMs data. There were 50 male and 43 female patients. The level of micro-discectomy/decompression was L5/S1 (42), L4/L5 (40), L3/L4 (3), L2/L3 (2), L1/L2 and two levels (5). Mean improvement was- $> 6$ months (ODI 37.9%, VAS-leg 6.4, VAS-Back 4), 6 months to 1 year (ODI 26%, VAS-Leg 4.5, VAS-Back 3.5), 1 year to 2 years (ODI 18%, VAS-Leg 4.5, VAS-Back 3.9) and $> 2$ years (ODI 26%, VAS-Leg 4 and VAS-Back 4.3). These results demonstrated that there was a maximum improvement in ODI in those with a shorter duration of pre-operative symptoms, particularly in the 0 $> 6$ months group. Interestingly, there was a significant improvement in patients who have had symptoms for $> 2$ years.
**Plenary Session 2 – Back Pain Lumbar Degenerative**

**Conclusions:** Our study confirmed that early surgery has better subjective outcome, however, patients with symptoms beyond 1 and 2 years have a significant improvement as well. There was clinically significant improvement in PROMS throughout all four groups, suggesting that all patients with persistent radicular symptoms should be offered surgery regardless of duration of symptoms.

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**Oswestry Disability Index (ODI) and Visual Analogue Score (VAS) in pre-operative patients with radicular leg pain**

**Main Author:** Lisa Grandidge  
**Co Authors:** Michael Athanassacopulos, Lee Breakwell, Neil Chiverton, Marcel Ivanov, Rex Michael, Hesham Zaki, Ashley Cole  
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**Background Context:** The ODI and VAS are leading outcome measures to quantify pain and function in patients with back and radicular leg pain.

**Purpose:** To identify the relationship between VAS back, VAS leg and the components of the ODI.

**Study Design/Setting:** This is the first study from the British Spine Registry (Sheffield Surgeons only).

**Patient Sample:** 853 patients with radicular leg pain having unilateral, primary single level discectomies/decompression from 01/06/2012 to 09/07/2014. Revision, multi-level surgery and fusions were excluded.

**Outcome Measures:** Pre-operative ODI, VAS back and VAS leg.

**Methods:** 553 (64.83%) patients answered both pre-operative VAS and ODI.

**Results:** Mean VAS back was 6.3 and VAS leg 7.7 with 15% scoring VAS back greater than VAS leg. There is a significant correlation between VAS back and leg (r=0.45, p<0.01). Correlation of VAS leg scores to ODI pain intensity (question 1) and to total ODI scores are moderate (r=0.51 & r= 0.46 respectively). The correlation of VAS back pain scores with the ODI pain intensity and total ODI scores are lower (r=0.33 and r=0.36 respectively). All of these results are highly significant (p<0.01).

For the ODI questions, patients are most disabled for lifting, social life and standing and less disabled for personal care.

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**Sacroiliac joint fusion for low back pain: a systematic review and meta-analysis**

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**Background Context:** The sacroiliac joint is not widely considered as a cause of low back pain

**Purpose:** To determine whether sacroiliac joint fusion for LBP is effective in reducing symptoms

**Study Design/Setting:** A systematic literature review and meta-analysis was performed of observational studies describing outcome of SJF in patients with LBP

**Patient Sample:** Adult patients with low back pain

**Outcome Measures:** Self-reported measures for VAS pain, ODI, Majeed Score and SF-36 PCS/MCS.

**Methods:** The following databases were searched: PubMed, Web of Science, Embase, Medline and Google scholar. Two reviewers blindly searched and selected relevant studies and extracted data. The methodological quality of the studies selected for the meta-analysis was assessed using the Newcastle-Ottawa scale. Meta-analysis, performed using RevMan 5.1 was used to combine the studies for each outcome and forest plots were prepared. Outcomes were expressed as mean difference (MD).

**Results:** Five studies were included in the meta-analysis with a mean follow-up of 17.6 months. All outcomes showed statistical and clinical improvement: VAS pain MD: 4.64; 95% CI, 4.08 – 5.21; n = 456; p < 0.00001), ODI MD: 14.5; 95% CI, 8.4 – 20.6; n = 102; p < 0.00001), Majeed score MD: 35.8; 95% CI, -40.3 – -31.3; n = 140; p < 0.00001), SF-36 PCS (physical component summary) MD: 13.0; 95% CI, -16.4 – -9.7; n = 198; p < 0.00001), SF-36 MCS (mental component summary) MD: 8.5; 95% CI, -12.9 – -4.1; n = 198; p < 0.0002).

**Conclusions:** SJF is an effective method for relieving symptoms of LBP where the sacroiliac joint is the pain generator.
Cauda Equina Syndrome – The Prelude to an Evidence-Based Scoring System

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Background Context: Diagnosis of ‘Cauda Equina Syndrome’ (CES) can be challenging and delay in decompression can result in inferior outcome. CES is identified by cardinal ‘Red Flags’: eliciting these symptoms/signs are essential for assessment and medico-legal documentation, though they are not conclusive of the presence of CES.

Purpose: Establish the value of clinical symptoms/signs in patients with suspected CES.

Study Design/Setting: Observational Study

Patient Sample: Patients with Confirmed CES and with Suspected but MR negative

Outcome Measures: Presence or absence of cauda equina on MR

Methods: Observational study undertaken to consider associations between presenting symptoms, examination findings and CES. Prospective neurosurgical referrals, MR scans and operation notes were reviewed. CES treated surgically was the outcome and variables considered were: presence of sciatica, paraesthesia, sphincter dysfunction and motor weakness; perianal/dermatomal sensation; reflexes and anal tone.

Results: 158 patients were studied with 76 proven CES, 82 suspected but MR negative. Multiple logistic regression analysis showed unilateral sciatica ($p=0.009$), bilateral sciatica ($p=0.001$) perianal paraesthesia ($p=0.007$), altered perianal sensation ($p=0.056$), dermatomal ($p<0.001$) sensation and motor weakness ($p<0.001$) to be significantly associated with CES. Increased odds of CES were observed in patients with: unilateral/bilateral (OR=8.5; 63.1); perianal paraesthesia (OR=26.4); intact perianal (OR=3.26) and dermatomal (OR=9.26) sensation

Conclusions: This is the largest study conducted correlating presenting symptoms/signs with CES. We developed a parsimonious model that can be transformed to give a best estimate for a patient having cauda equina syndrome and thus assign higher probabilities of cauda equina to cases than controls in about 96% of patients. This study, along with previous research can prelude establishing a predictive scoring system for CES and support clinicians’ index of suspicion in future.

Is decompression alone a feasible option for lumbar stenosis patients with degenerative spondylolisthesis?

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Background Context: The SPORT trial suggests that lumbar stenosis in the presence of degenerative spondylolisthesis is best treated with decompression and a fusion procedure

Purpose: The aim of our study is to assess the efficacy of decompression alone in the setting of spinal stenosis with degenerative spondylolisthesis

Study Design/Setting: This study is a prospective case series of 83 consecutive patients with lumbar stenosis and degenerative spondylolisthesis treated by decompression, without fusion. Pre-op and post-op ODI, EQ-5D and VAS scores were collected prospectively. Data on revision rates and their indications were collected.

Patient Sample: There were 36 males and 47 females with a mean age of 66yrs. The mean follow up was 36 months (19 - 48 months). 29% had a 3 or more level decompressed.

Outcome Measures: ODI, VAS, EQ-5D

Methods: t- test and Mann-Whitney tests were used

Results: The mean pre-operative ODI, VAS and EQ-5D scores were 52, 61 and 0.25 respectively. The mean post-operative ODI, VAS and EQ-5D scores were 38, 36 and 0.54 respectively. There was significant improvement in all scores ($P<0.0001$). Revision rate for repeat decompression alone was 6% (5/83). Revision rate for conversion to fusion was 11% (9/83). Indications for fusion were back pain (n=6), back and leg pain (n=2), leg pain only (n=1) and sacral fracture following fall (n=1). Two patients had early return to theatre for haematoma evacuation. Overall return to theatre rate for any reason was 20% (17/83) at mean follow-up of 3 years.

Conclusions: Most patients do not require a fusion when decompressing for lumbar stenosis in the presence of degenerative spondylolisthesis.
Plenary Session 2 – Back Pain Lumbar Degenerative

Lumbar spinal stenosis with stable low grade spondylolisthesis – treatment alone with minimally invasive decompression – 2 year comparative outcomes.

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Co Authors: B Roy Chaudhary, R Mannion (Consultant Spinal Neurosurgeon)
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Background Context: Lumbar spinal stenosis (LSS) is a common surgical spinal pathology with many patients having concurrent degenerative lumbar spondylolisthesis (DLS). Surgical decompression for DLS has historically been better with fusion, however recent advances question the need for fusion in selected patients.

Purpose: Study objective was to assess surgical & patient reported outcomes following decompression alone in selected patients with DLS compared to those with no DLS.

Study Design/Setting: A single surgeon consecutive series of patients undergoing surgery for lumbar spinal stenosis with a minimum of 2 year follow up in prospective observational study.

Patient Sample: 157 patients (62 DLS/95 without DLS)

Outcome Measures: Primary outcome measures were Oswestry Disability Index (ODI) scores & re-operation rates. Secondary outcomes were pre & postoperative leg and back pain VAS scores & satisfaction ratings post-surgery & time to reoperation.

Methods: Decompression alone was chosen for patients with neurogenic claudication & no dynamic instability. All patients underwent bilateral decompression via a unilateral minimally invasive approach.

Results: Both cohorts were comparable for age & pre-operative ODI. There was significant ODI improvement in both cohorts (LSS mean baseline ODI improved from 40 to 23 at 2 years [p < 0.01] & in noDLS from 39 to 26 [p < 0.01]). The change in ODI was comparable in the two cohorts (p=0.18).

Conclusions: Using the aforementioned selection criteria DLS patients undergoing decompression alone have excellent intermediate term results comparable to LSS patients without DLS thus avoiding fusion operation.

Results of LLIF with Avenue L cage in lumbar degenerative disease

Main Author: Charlie Bouthors
Co Authors: Charles-Henri Flouzat Lachaniette, Alexandre Poignard, Jérôme Allain
Affiliation: Hôpital Henri Mondor (Créteil, France)

Background Context: The aim of minimally-invasive surgery is to reduce surgical morbidity with same rate of success than open procedures.

Purpose: To assess clinical outcomes and radiographic changes after minimally-invasive Lateral Lumbar Interbody Fusion.

Study Design/Setting: A monocentric retrospective study included all patients treated by LLIF performed for lumbar degenerative disc disease, spondylolisthesis and degenerative scoliosis. Data were collected prospectively.

Outcome Measures: Clinical outcomes were assessed at one year according to Visual Analogic Scale (VAS) lumbar/radicicular, Oswestry Disability Index (ODI), Short-Form 36 mental and physical (SF-36). The radiographic measurements were taken to assess change in the sagittal and coronal plane alignment. Fusion was analysed at 1 year with a CT scan.

Results: From 2010 to 2013, 60 patients underwent 74 LLIF. Mean follow-up was 19 months. Mean surgical duration and blood loss were respectively 141 min and 152 ml. EVA L/R and ODI were decreased of 57%, 66% and 49% (p<0,01) and SF-36 M/P increase of 62%/83% (p<0,01). There were a mean gain of 5° of regional lordosis (p<0,01) and 5 mm of disc height (p<0,001). Sagittal Vertical Axis decreased from 29 mm to 10 mm (p<0,001). Mean Cobb scoliosis angle and spondylolisthesis correction were respectively 62% (p<0,01) and 64% (p<0,01). 2 perioperative vertebral body fractures were reported. 8 patients experienced postoperative sensory deficit and 1 motor deficit that all recovered. Fusion rate was 87.5%. 2 patients required additional posterior decompression and fusion.

Conclusions: LLIF is effective in lumbar degenerative disease in correcting the coronal plane deformity and gaining lordosis. Excellent clinical outcomes are obtained with few complications.
Can we predict recurrence following microdiscectomy?

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Background Context: Microdiscectomy of the lumbar spine is commonly performed spinal for radiculopathy secondary to symmetric disc prolapse of the lumbar spine without causing cauda equine syndrome. Unfortunately it is also known that lumbar disc prolapse at the same level and side may recur subsequent to the surgery at a variable interval. However, there is limited evidence to demonstrate factors that could predict the risk of recurrence.

Purpose: The aim of this study is to evaluate lumbar spine intervertebral discs characteristics, and their association with recurrence of disc prolapse following primary microdiscectomy.

Study Design/Setting: Retrospective Cohort Study

Patient Sample: Consecutive patients who underwent primary microdiscectomy at a single spinal unit in over a 3-year period were reviewed and included in this study.

Outcome Measures: Recurrence

Methods: Patient demographics, clinical documents, and images including pre- and post-operative MRI scans were reviewed. Pre-operative Images were assessed by a single consultant spinal surgeon who was blinded to the presence of recurrence of the disc prolapse.

Results: 131 patients who underwent primary microdiscectomy were identified and included. 15 patients developed symptomatic recurrence of disc prolapse at the same level and side. 10 of these patients subsequently underwent revision microdiscectomy. There was a trend between rate of recurrence and the preservation of normal disc signal and intra-nuclear septum of the prolapsed disc at primary procedure.

Conclusions: Our rate of recurrence was 11%. Characteristics of the prolapse disc on pre-operative images may provide information on the risk of recurrence following the primary procedure. Further study with larger population is required to further assess these relationships.
Wednesday 18th March 2015

KEYNOTE SPEAKER
Douglas Wardlaw

‘Evidence based vs practice based VTE prophylaxis in spinal surgery: Is there controversy?’

In my local spinal unit, we commenced venous thromboembolism prophylaxis in 1995. It consisted of 150mg Aspirin per day from 1st postoperative day (or Low Molecular Weight (LMW) Heparin in high risk patients), intermittent intra-operative calf compression and thromboembolic deterrent stockings. The latter were discontinued around 2004 due to lack of evidence of efficacy. The policy was largely driven by the literature and conventional wisdom at the time. We reviewed a large consecutive series of patients treated in the unit with and without prophylaxis from the beginning of 1985 to the end of 2003 and the policy appeared to make no difference to the low incidence of thromboembolism (0.27% overall). The need for VTE prophylaxis was discussed at the BASS AGM in Sheffield in 2009 and a survey of attendees showed that 7% would give chemical prophylaxis pre-operatively, 21% at 12 hours and 37% at 24 hours postoperatively. The BASS policy in 2003 recommended the use of intermittent calf compression for routine (low risk) surgery and LMH for intermediate and high risk patients during hospitalization. The use of prophylaxis has to be balanced against the risk of epidural haematoma with patient factors such as age, level of surgery, sex and neurological deficits being taken into account. It is the duty and responsibility of the surgeon to properly document the risk vs benefit in each patient. NICE guidance was published in March 2010 based solely on neurosurgical literature. Bryson DJ. et al (2012) published a survey of UK spinal surgeons and found that there was no clear consensus in the use of thromboprophylaxis in spinal surgery. Seventy one per cent of neurosurgeons and 23% of orthopaedic surgeons would use LMH in routine surgery. The literature shows that on screening for VTE that for a few patients there is evidence of preoperative VTE presumably due to reduced activity, and a significant number (up to 31%) have evidence of VTE developing postoperatively despite the low incidence of clinical VTE. Surprisingly perhaps a few patients show evidence of clinical or subclinical pulmonary embolism without evidence of venous thrombosis. There is evidence of risk of haematoma and bleeding in patients treated with LMH for epidural injections, but it is equivocal for routine surgery. The use of LMW heparin injections when started preoperatively in some studies does not increase the risk. When used it is recommended for LMH to be commenced at 24 – 36 hours post-surgery which is clearly safe. Most studies on VTE describe the use of intermittent calf compression almost as the standard although there is no hard evidence to show if it is indeed effective in reducing VTE. However the consensus is that it is the minimum safe prophylactic treatment. This makes it difficult to randomise a no treatment group with intermittent calf compression group. A recent survey of BASS members does appear to show a consensus in the use of intermittent calf compression for low risk patients with LMH heparin being used when felt indicated for intermediate and high risk patients. This is in keeping with BASS and NICE advice. Practice therefore does approximate available evidence.
Plenary Session 3 – Basic Science/Spinal Surgery

**Quality improvement project the effect of an enhanced recovery programme on length of stay and patient experience following elective spinal surgery at Musgrove Park Hospital**

**Main Author:** Alex Goubran  
**Co Authors:** Matthew Beebee, Lorraine Sandford, Sarah Woodhill, Emma Palfreman, Yee Leung, Pradeep Madhavan, Paul Thorpe, Michael Walburn  
**Affiliation:** Musgrove Park Hospital, Musgrove Road, Taunton, Somerset TA1 5DA  
**Background Context:** Enhanced recovery in arthroplasty surgery has demonstrated that with careful pre-operative planning, engagement and education; recovery, rehabilitation and the patient experience is improved. Historically, spinal surgery patients have an ill-defined care pathway with variable inpatient management, experience and satisfaction.  
**Purpose:** To improve the quality and reliability of care for elective spinal patients whilst reducing length of stay and improving patient experience.  
**Study Design/Setting:** This is a Quality Improvement study set in the Taunton and Somerset NHS foundation NHS trust.  
**Patient Sample:** All elective, inpatient spinal surgery patients for 1 year (350 Patients)  
**Outcome Measures:** The length of stay from surgery to discharge. Patients receiving pre-operative build up drink. Patient satisfaction questionnaire. Patients receiving laxatives. The recording of the estimated day of discharge. The daily aims of the patient rehabilitation recorded. Readmission of elective spinal surgery patients.  
**Methods:** We developed a specific aim to improve quality of care and reduce length of stay by standardisation of our processes. Key process changes were identified and tested using Plan Do Study Act (PDSA) methodology. The changes included i) standardising care for all patients ii) setting patient expectations with a perioperative "passport" iii) managing constipation early iv) standardising the analgesia regimen v) setting patients’ postoperative mobilisation goals on a daily aims board vi) rapid return to normal fluids and diet.  
**Results:** Length of Stay reduced from 5.8 to 2.6 days. Patient satisfaction increased from 85% to 97%.  
**Conclusions:** The results indicate that clinical engagement with a process that includes education; clearly defined standards and methods of rehabilitation will improve patient satisfaction and reduce length of stay.

**British Spine Registry (BSR) PROMS compliance and results after primary lumbar microdiscectomy**

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**Co Authors:** James Tomlinson, Michael Athanassacopolous, Lee Breakwell, Neil Chiverton, Marcel Ivanov, Rex Michael, Hesham Zaki, Ashley Cole  
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**Background Context:** How easy is it for Consultants to collect PROMS data without support? When should we collect PROMS after lumbar microdiscectomies?  
**Purpose:** To quantify leg and back pain before and after surgery, evaluate data collection compliance and timing of PROMS after surgery.  
**Study Design/Setting:** Prospective data collected in the BSR.  
**Patient Sample:** 853 patients underwent primary, single-level, lumbar decompressions/discectomies in Sheffield between 01/06/2012 and 09/07/2014.  
**Outcome Measures:** Primary outcome measure was change in VAS for back and leg pain.  
**Methods:** VAS scores are gathered prospectively as part of routine clinical care. Scores are obtained before and at six weeks (mean 55±15 days) and six months (mean 177±46 days) after surgery for leg and back pain.  
**Results:** The VAS scores were answered by 68% of patients pre operatively, 56% at 6 weeks and 22% 6 months post-operatively. 105 (12.3%) patients answered at all three intervals. Mean VAS back was 6.4 pre-op, reducing to 3.0 (6 weeks) and 3.5 (6 months) post-op (mean change -2.9). Mean VAS leg was slightly higher pre-op at 7.5, reducing to 2.5 (6 weeks) and 2.9 (6 months) post-op (mean change -4.6). Between 6 weeks and 6 months, VAS back worsened significantly (p<0.05) with no significant change in VAS leg.  
**Conclusions:** There was significant improvement in VAS back and leg scores post-operatively. Despite Consultant commitment, data collection rates using the BSR are poor. Administrative support is required to improve compliance. Significant worsening of VAS back between 6 weeks and 6 months means timing of post-operative assessment is important and needs defining, as most having this surgery are discharged early.
Functional outcome following surgery for giant thoracic disc herniation – retrospective cohort study

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Background Context: Giant thoracic disc herniations (GTDH) are defined as those occupying more than 40% of the spinal canal. We review the surgical management and functional outcome in a series of consecutive GTDH.

Methods: Observational retrospective cohort study. 28 patients were treated between July 2006 and October 2013. Percentage canal stenosis and presence of cord signal change were documented by a neuroradiologist. The Nurick grading system was used to assess pre- and postoperative myelopathy.

Results: Male to female ratio was 1:1 with a mean age of 59 [38 to 86]. One patient had two GTDH. 21/28 (75%) patients had discs occupying 70% or more of the canal. 24 patients had cord signal change. Discectomy was performed using transthoracic (17), costotransversectomy (9) and transpedicular (2) approaches. Mean Follow up was 13 months [1-88]. At last follow up, 16/25 (64%) patients improved neurologically by at least one Nurick scale, 6/25 (24%) had arrested progression of their myelopathy and 3/25 (12%) had worsening myelopathy. 3 patients died during the follow up period. All deaths were greater than 30 days post-op and from causes unrelated to surgery. Duration of symptoms prior to surgery did not correlate with functional outcome. The degree of canal compromise did not appear to be related to clinical outcome.

Conclusions: To our knowledge, this is the biggest published series of GTDH. Overall 64% of patients demonstrated improvement of their myelopathy related to surgery. Paradoxically, patients presenting with severe myelopathy had a higher rate of postoperative improvement compared to patients with milder signs of myelopathy.

The rootogram to success?

Main Author: Suribabu Gudipati
Co Authors: Kiran Lingutla, Michael J H McCarthy
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Background Context: The reported accuracy and clinical effectiveness of the nerve root blocks (NRB) has been variable and inconclusive.

Purpose: The purpose of the current study was to determine whether a confirmatory rootogram was associated with successful pain relief.

Study Design/Setting: Prospective observational cohort study over a 2-year period at a regional tertiary spinal unit

Patient Sample: Consecutive patients treated by a single surgeon

Outcome Measures: Radiological and PROMS

Methods: Patients with incomplete data, absence of images on system, missed follow up appointments and those moved out of the catchment area were excluded. An independent radiological analysis for the position of the needle, adequacy of the rootogram by the path of the dye and medial pedicle spill was performed. Both pre-operative and post-operative visual analogue scores for pain and Oswestry disability index scores were used as outcome measures.

Results: 106 patients were eligible (male = female) with a mean age of 53.5 years. Needle position was good in 100% whereas the image quality was deemed poor in 16%. There was a clear rootogram in 57% and medial spill in 50%. Successful pain relief was achieved in 60% but pain recurred in 1/3rd of these patients. Surgery was subsequently performed in 30% of the cohort. Only epidural spill was associated with successful pain relief (p=0.02). Lack of rootogram (p=0.03), lack of epidural spill (p=0.02), lack of both (p=0.006) was associated with subsequent surgery.

Conclusions: Medial epidural spill at the time of rootogram during NRB seems to be associated with successful pain relief.
Is there a relationship between prescribed medications and symptoms of cauda equina syndrome in patients with evidence of degenerative change in the lumbar spine?

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Co Authors: Alex Baker

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Background Context: The authors recognised that patients presenting to the Orthopaedic Spinal Rapid Access Service with symptoms and or signs of cauda equina syndrome (CES) may not have the diagnosis confirmed radiologically. Recognised side-effects of neuropathic medications commonly prescribed for radicular pain include: altered sensation, urinary incontinence or retention, and sexual dysfunction.

Purpose: To identify the relationship between prescribed medications and presenting symptoms and signs of CES in patients presenting without radiological evidence of CES.

Study Design/Setting: Retrospective cohort analysis

Patient Sample: 151 patients referred into OSRAS within a 6 month pilot.

Outcome Measures: MRI findings classed as -1. Evidence of CES. 2. Evidence of degenerative change or stenosis in the absence of CES. 3. Normal

Methods: Case notes of 151 patients were reviewed. Data collected included patient’s age, sex, prescribed medications presenting symptoms and radiological findings.

Results: 9 patients were confirmed CES. 34 patients presented with symptoms and or objective signs of CES in the absence of positive radiological findings. 16(47%) of these 34 were prescribed neuropathic medications. Further sub-group analysis demonstrated 15(44%) patients had radiological evidence of degenerative change or stenosis, of these 15 patients 10(67%) were prescribed neuropathic medications.

Conclusions: Patients presenting with CES in the absence of radiological evidence maybe prescribed neuropathic medications with side effects that may contribute to their symptoms. Therefore clinicians should take due consideration of prescribed medications as a possible cause of CES signs and symptoms. Further work is required to analyse data from a larger patient population in order to identify if particular medications carry a higher risk.
Influence of paraspinal muscle activity on lumbar inter-vertebral flexion rotation range

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Co Authors: Alan Breen

Affiliation: Faculty of Science and Technology, Bournemouth University

Background Context: Consideration of lumbar segmental flexion range (IV-RoM) is necessary when deciding on surgical procedures for spinal stenosis. Quantitative fluoroscopy (QF) can be used to measure this reliably in vivo.

Purpose: To explore the relationships between lumbar flexion IV-RoM and paraspinal muscle activity.

Study Design/Setting: Cross-sectional, laboratory based cohort study of the normal relationships between L2-S1 IV-RoM and surface electromyography (sEMG) changes.

Patient Sample: Convenience sample of 18 healthy male controls aged 22 to 36.

Outcome Measures: sEMG amplitude change, inter-vertebral laxity, lordosis, lumbo-sacral angle, segmental flexion IV-RoM.

Methods: Contemporaneous lumbar sEMG and QF motion sequences were recorded during controlled active flexion of 60° using electrodes placed over T9, L2 and L5. sEMG data were averaged over 5 epochs. QF was used to measure L-S angle, lordotic angle, IV-RoM and laxity from L2-S1. Correlation coefficients were calculated between all variables and IV-RoM. This was a PhD study in the Faculty of Science and Technology, Bournemouth University. The authors have no potential conflicts of interest.

Results: sEMG amplitude changes correlated with L4-5 and L5-S1 IV-RoM (r = -0.477 to 0.595). Lordosis correlated with IV-RoM at all levels except L5/S1 (r = 0.440 to 0.540). Laxity at L4/5 also correlated with IV-RoM at these levels (r = -0.534 to -0.640). All correlations were statistically significant (p<0.05).

Conclusions: Only the flexion ranges at L4-5 and L5-S1 were related to sEMG amplitude changes. However, IV-RoM also related to the degree of lordosis for all levels except L5-S1. These relationships may be important when planning surgery for spinal stenosis or rehabilitation for low back pain.

SPECT/CT fusion imaging as a preoperative planning tool for patients undergoing revision adult spinal deformity surgery

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Background Context: Revision adult spinal deformity surgery is a speciality requiring careful patient selection and meticulous preoperative planning. Often standard imaging modalities offer equivocal or inadequate information for operative planning.

Purpose: To evaluate the efficacy and utility of SPECT/CT as a diagnostic modality and preoperative planning tool in patients undergoing revision adult spinal deformity surgery.

Study Design/Setting: A prospective cohort study (n=16) performed over a 3-year period at a major tertiary referral centre for adult spinal deformity surgery.

Patient Sample: All consecutive patients requiring 1-stage, 2-stage or 3-stage revision sagittal plane deformity correction included.

Outcome Measures: Clinical outcome measures included EQ-5D, EQ-5D VAS, SRS-22, ODI and VAS Pain Scores.

Methods: SPECT/CT fusion imaging was performed preoperatively in conjunction with standard radiographs, normal CT and MRI. Clinical outcome measures were collected preoperatively and at 6 weeks, 6 months, 1 year and 2 years postoperatively.

Results: SPECT/CT fusion imaging demonstrated increased sensitivity for identifying regions of suspected pseudoarthrosis and facet degeneration when compared to both standard CT and MRI. There was a significant improvement in all clinical outcome measures assessed preoperatively and followed out to 2-years postoperatively. Mean ODI score improved from 53.88 to 12.0; VAS back pain score improved from 7.25 preoperatively to 2.0; VAS leg pain score improved from 4.38 to 0.91.

Conclusions: SPECT/CT fusion imaging is an excellent tool for the preoperative evaluation and management of patients requiring revision spinal deformity surgery. SPECT/CT identifies specific focal areas of pathology, including pseudoarthrosis and facet degeneration, enabling more accurate level selection for revision fusion surgery. Furthermore, this imaging modality was associated with excellent postoperative health related quality of life (HRQOL) outcome measures.
Developing a nurse-led nerve root block service

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Background Context: Changes within the NHS have led to innovative ways of working for nurses, with the expansion of roles into what was traditionally seen as medical. Delays in waiting for both therapeutic and diagnostic Nerve Root Blocks means meeting the 18-week target has been challenging within Orthopaedic Spinal Departments.

Purpose: The purpose of introducing a nurse-led Nerve Root Block service was to provide a safe and effective service whilst meeting the 18-week targets.

Study Design/Setting: Service review

Patient Sample: 272 patients

Methods: This paper describes the development of the nurse-led Nerve Root Block service, and discusses the training and collaborative working within the service. Despite extensive searches it was concluded that there was no formal training programmes to meet this situation, therefore one was developed using a WASP framework and the nurse spent 6 months shadowing a Consultant Interventionist Radiographer. All patients were reviewed by the referrer via telephone or outpatient consultation.

Results: A fast-track service for patients requiring diagnostic as well as therapeutic Nerve Root Blocks was set up in June 2013. Patients are pre-assessed, consented and receive their block within an outpatient radiology department. A service review of 272 patients was carried out, demonstrating 61% were discharged after one injection, with 54% of these reporting total pain relief or having significant sustained pain relief, 20% were listed for surgery and 20% for further investigations. Patients waiting times for Nerve Root Block have reduced from 18 weeks to 3 weeks.

Conclusions: A nurse-led fast-track service is a safe and effective means of meeting the 18-week pathway.
KEYNOTE SPEAKER
David Jaffray
‘My career evolution in managing back pain’

Millions of years of evolution have failed to produce a lumbar spine fit for purpose. Neither have I.

KEYNOTE SPEAKER
Peter Fritzell
‘Managing back pain in a surgical perspective – have we changed practice in line with EBM since 2000?’

Costs associated with management of back pain have been rising since 2000 and a relevant question is whether this increase, associated with both higher volumes and more costly procedures, is supported by evidence-based medicine; in other words, has it resulted in better patient-reported outcomes?

In Sweden, as in other countries, there is growing awareness that the primary focus on volumes and costs in managed care (as in NPM) must be abandoned. The search for new concepts that focus on outcome quality and value for the patient, in other words cost-effective care, has become a high priority.

Degenerative back pain conditions are extremely common, though surgical treatment is, relatively speaking, rarely indicated. Patient selection, often a challenging task, is crucial for a successful outcome.

We, the profession, have an important national and international mission to define and agree on how to select our patients, how to treat the individual, and how to measure outcome – including reporting cost-effectiveness.

This presentation will focus on the surgical management of some of the most common low back pain conditions that are amenable to surgery. How were these conditions treated fifteen years ago, and how are they treated today? Is there a difference, and if so, is it in line with EBM, or could it be driven by other factors?

The following low back pain conditions will be discussed:

- Chronic low back pain (DDD/segmental pain)
- Lumbar Disc Herniation
- Spinal stenosis
- Vertebral fractures (osteoporosis)
Management of vertebral compression fractures (VCFs) in multiple myeloma (MM) patients with balloon kyphoplasty (BKP)

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Background Context: MM is the most common haematological malignancy involving vertebrae and causing VCFs, leading to substantial morbidity, poor quality of life and increased healthcare costs.

Purpose: To retrospectively analyse outcomes of BKP for VCFs in MM patients referred to a Myeloma Spinal Service over a 7-year period.

Study Design/Setting: A retrospective analysis of prospectively collected outcome data.

Patient Sample: 274 MM patients presented with VCFs; 127 underwent BKP.

Outcome Measures: Visual Analogue Scores (VAS) for pain, and functional outcome scores (Roland-Morris Disability Questionnaire, Oswestry Disability Index, European Quality of Life-5 Dimensions) were assessed pre-and post-operatively.

Methods: 356 symptomatic VCFs levels were treated with BKP in 145 operations. Indications for BKP were persistent severe pain, spinal instability, neurological symptoms, fracture level and associated high risk for severe kyphosis. No funding or conflicts of interest.

Results: The most common fractured vertebral level was at T12 level 47(12%) followed by L2 37(9.6%) followed by T11 and L1 36(9.4%) vertebral bodies. 109 of the 379 VCFs levels were affecting the posterior wall. Median Spinal Instability Neoplastic Score (SINS) was 11 (10-13). VAS was improved from ≥6 to 1.1±2.0 following the BKP. 69% of the patients had rapid pain relief and their mobility and functionality was markedly improved within a median time of 6 weeks. In 61% of patients mobility improved gradually with an associated improvement of functionality.

Conclusions: In conclusion, BKP is a safe procedure for the management of symptomatic VCFs in MM patients. BKP provides rapid and sustained pain relief, may prevent deformity and maintain functional improvement and QOL.
Minimally invasive spine stabilisation for spinal metastatic lesions – case series & review of complications

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Background Context: Metastatic spinal lesions are treated for collapse related spinal pain and/or neurological compression. In the setting of reduced life expectancy, MISS would reduce morbidity compared with open surgery.

Purpose: The aim of the study is to review the outcomes and complications of the use of MISS in patients with spinal metastasis.

Study Design/Setting: This is a prospective case series of 52 consecutive patients with spinal metastasis treated by MISS.

Patient Sample: Data on primary tumour type and tumour scores from 52 patients treated by MISS.

Outcome Measures: Karnofsky performance status (KPS), Frankel grading, blood loss, time to discharge and surgical complications were assessed.

Methods: Mann-Whitney test for significance.

Results: MISS fixation was performed without decompression in 46% patients, with an average blood loss of 70mls. MISS was combined with limited open decompression in 54% patients with an average blood loss of 190 ml's. Decompression increased mean hospital stay by 6 days. Mean preoperative KPS was 54. At the time of discharge 42% improved, 50% remained the same and 8% worsened. 34% had neurological deficit at presentation; half of these had neurological improvement. 8% of patients required revision surgery for implant loosening at a mean follow up of 18 months.

Conclusions: This is a safe and effective way to treat this difficult group of patients. Morbidity from surgery is reduced significantly, with reduced complications, allowing patients to spend their last few months or weeks with a better quality of life.

Surgical treatment of sacral chordoma: prognostic variables for local recurrence and overall survival

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Background Context: Sacral chordomas (SC) are rare, locally invasive, malignant neoplasms. Despite surgical resection, adjuvant therapies, local recurrence (LR) is common and survival is poor.

Purpose: The objective of this study was to identify factors that have an impact on the overall (OS) and local recurrence-free survival (LRFS) of patients with SC.

Study Design/Setting: We utilised the AOSpine Knowledge Forum Tumour multicentre ambispective database.

Patient Sample: This consisted of surgically treated SC cases identified.

Outcome Measures: Local recurrence and survival.

Methods: Cox regression modelling was used to assess the effect of several pre-, peri-, and postoperative variables on OS and LRFS.

Results: A total 167 patients with surgically treated SC were identified. The male/female ratio was 98/69 with a mean age of 57 (SD=15) years at the time of surgery (18-89 years). The LR was 35% (n=57), death occurred in 30% of patients (n=50) during the study period (5 days to 16.2 years). The median OS was 6 years post-surgery, and LRFS was 4 years. In the univariate analysis, age (p<0.001) and preoperative motor deficit (p=0.003) were significantly associated with poor OS, and nerve root sacrifice showed a trend towards significance (p=0.088). Previous tumour surgery at the same site (p=0.002), intralesional resection (p<0.001), and tumour volume (p=0.030), were significantly associated with LR. In the multivariate models, age and motor deficit were associated with poor survival while previous surgery and intralesional resection were significantly related to LR.

Conclusions: This study identifies two predictive variables for mortality (age and impaired motor function) and two for LR (previous tumour surgery and intralesional surgery) in surgically treated SC.
A low cost spinal dural closure simulation for tomorrow's spinal surgeons

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Co Authors: Deborah Ferguson
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Background Context: Simulated surgical training dates back to Andreas Vesalius (1514–1564), who trained his students to perform cadaveric human dissection. Cost and availability have diminished the contribution of hands-on cadaveric training in today's curriculum. Modern simulators provide high-quality, time-effective training and may mitigate constraints on operative training arising from working-time restrictions. Sutured durotomy closure is a technically demanding surgical skill, with high-quality closure capable of averting cerebrospinal fluid leaks. We propose a low-cost dural closure simulation model as an adjunct to training in this fundamental skill.

Purpose: To provide structured information on improvements in microsurgical skills following personalised instructed-simulator training.

Study Design/Setting: Prospective, cohort intervention comparing pre- vs. post-training performance

Methods: Twenty-eight neurosurgical trainees (year 1-8, Scotland) were assigned to instructed-simulator training on a durotomy closure model. Performance of a suture closure of a 5cm incision under a microscope was recorded. Pre- and post-training performance was evaluated by blinded raters for quality of closure, with a standardised tool.

Results: Significant differences in the ability of trainees to perform a high quality closure. Pre-training performance scores increased with seniority, with a steep learning curve. Improvement in performance was seen for most participants following training on the simulator.

Most participants reported the model was valuable to practising transferable microsurgical skills and supported recording results in their training portfolio.

Conclusions: Skill-specific simulated neurosurgical training can be implemented at a low cost. Our model by providing practice with feedback and the opportunity for assessment of trainees can improve the quality of tomorrow's spinal surgeons' dural closure at no risk to patients.

Anterior cervical transsternal approach for thoracic outlet neoplasms; a 15 year experience in two tertiary centres

Main Author: George Prezerakos
Co Authors: Pericles Pericleous, Parag Sayal, George Ladas, Adrian Casey
Affiliation: Victor Horsley Department of Neurosurgery, National Hospital for Neurology & Neurosurgery, Queen Square, London

Background Context: Mediastinal neoplasms, including mesenchymal, nerve sheath or sympathetic chain tumours in the region of the cervicothoracic junction present a technical challenge due to their inaccessibility. We report on our technique of anterior transsternal approach for directly accessing such lesions, comprising a bisection of the manubrium and sparing of the sternoclavicular joint and clavicle.

Purpose: To evaluate the efficacy and safety of anterior approaches to neoplasms involving the thoracic outlet.

Study Design/Setting: Prospective Observational Study

Patient Sample: 26 patients with thoracic outlet neoplasms involving vertebral/paravertebral structures operated through a transsternal or a thoracotomy approach in two tertiary referral London centres

Outcome Measures: i) Extent of resection ii) Major postoperative complications


Results: The cervical transsternal approach was successfully performed in 11 (30%) patients. 65% were female and mean age at operation was 46 years. Extent of resection was complete in 20 (80%) cases. No major postoperative complications occurred in the transsternal group whilst a plexus injury and vascular injury without cardiovascular or permanent neurological sequelae occurred in 2 out 13 patient patients (7%) in the thoracotomy group. Histological findings included schwannomas (n=7) and sarcomas (Ewing’s (n=2); leiomyosarcomas (n=4); liposarcomas (2); chondrosarcomas (n=4))

Conclusions: The anterior cervical transsternal approach offers excellent exposure of the thoracic outlet structures and permits safe and controlled resection and is a suitable choice in subclavian vasculature encasing tumours. It can be combined with standard thoracotomy techniques for locally invasive pathologies. It exhibits a low complication profile whilst avoiding the functional and cosmetic problems associated with the non-clavicle sparing alternatives.
Pathologic sternal involvement as a risk factor for severe sagittal plane deformity in multiple myeloma with concomitant thoracic fractures

Main Author: Joseph Butler

Co Authors: A Patel, A Benton, S Jassim, M Sewell, S Aftab, S Molloy

Affiliation: Spinal Deformity Unit, Department of Spinal Surgery, Royal National Orthopaedic Hospital, Stanmore, Middlesex, UK

Background Context: Skeletal involvement is observed in almost 80% of patients presenting with symptomatic multiple myeloma (MM). The vertebral column is the most frequently affected site by myeloma-induced osteoporosis, osteolysis and compression fractures. Multiple pathologic compression fractures can lead to significant spinal deformity which is then considered in some units for complex reconstruction because of the poor quality of life for the affected patients. We present a case series of pathologic thoracic compression fractures secondary to MM with concomitant sternal fracture that resulted in the development of a symptomatic severe kyphotic sagittal plane deformity.

Purpose: To assess the clinical and radiologic outcome of MM patients with thoracic spine involvement and concomitant pathologic sternal fractures with a resultant severe sagittal plane deformity.

Study Design/Setting: A prospective cohort study (n=391) was performed over a 7-year period at a national tertiary referral centre for the management of multiple myeloma with spinal involvement.

Patient Sample: All patients with symptomatic myeloma were enrolled. Exclusion criteria included monoclonal gammopathy of unknown significance (MGUS), asymptomatic multiple myeloma, plasma cell leukaemia and AL amyloidosis.

Outcome Measures: Pre-treatment and post-treatment clinical outcome measures utilized included EQ-5D, VAS, ODI and RMD scoring systems.

Methods: Clinical, serological and pathologic variables, radiologic findings, treatment strategies and outcome measures were prospectively collected.

Results: Thirteen MM patients presented with a severe symptomatic progressive sagittal plane deformity with a history of pathologic thoracic compression fractures and concomitant pathologic sternal fracture. The kyphotic deformity was worse in this group of patients when compared to the MM patients with thoracic fractures and no sternal fracture. All patients in the concomitant sternal fracture group displayed the radiographic features and spinopelvic parameters of positive sagittal malalignment and attempted clinical compensation. All patients had poor health related quality of life measures when assessed.

Conclusions: Pathologic sternal fracture in a MM patient with thoracic compression fractures is a risk factor for the development of a severe thoracic kyphotic deformity and sagittal malalignment. This has been demonstrated in our small series to be associated with a very poor health related quality of life. A greater awareness of this presentation and prompt referral to an appropriate service is recommended.

Surgical management of myeloma in the cervical spine

Main Author: Derek Cawley

Co Authors: Adam Benton, Susanne Selvadura, Charalampia Kyriakou, Kia Rezajooi, Sean Molloy

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Background Context: Myeloma of the cervical spine can affect the spinal cord, the vertebral column or both, potentially causing pain and/or neurological deterioration. Outcomes and management for this remain uncertain despite the various algorithms designed for neoplastic conditions of the spine.

Purpose: To assess a stability-based pathway for management of myeloma in the cervical spine.

Study Design/Setting: Retrospective review

Patient Sample: 20 patients with myeloma of the cervical spine. All patients had been treated and referred by the haematology-oncology service to the spinal service at RNOH Stanmore.

Outcome Measures: Frankel scores, VAS pain scores, plain radiography, CT and MRI scanning and SIN scores were evaluated in each case.

Methods: Comparison of presentation versus minimum 6 months follow up outcomes. Evaluation of serial monitoring as a guide to management.

Results: Five patients presented with neurological deficit, seven with pain and eight primarily with radiological findings. All patients were treated with a cervical collar or cervicothoracic orthosis. Serial evaluation demonstrated osseus remodelling and autofusion with clinical correlation in 11 patients who were thus treated conservatively. In 9 patients who did not demonstrate progression of osseus autofusion and remodelling, operative intervention was chosen. Stability was achieved in both groups. All patients demonstrated preservation of spinal
cord function except for one patient had residual neurological
deficit (Frankel C). One patient had moderate residual pain (VAS 4).

Conclusions: Serial evaluation of spinal stability with pain
assessment, neurological evaluation and multimodal imaging,
including CT and MRI serves to optimize decision making in
cervical spine myeloma management.

Sustained improvement in quality of life after
surgery for spinal metastases: cohort study of
922 patients

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Background Context: Metastatic spinal cancer is a common
condition that may lead to spinal instability, pain and paralysis.
In the 1980s, surgery was discouraged because results showed
worse neurological outcomes compared to radiotherapy alone.
However, with the advent of spinal stabilisation, the role of
surgery has regained centre stage.

Purpose: By analysing the largest surgical series of patients with
epidural spinal metastases, we sought to verify that surgery
provides sustained improvement in patients’ quality of life.

Study Design/Setting: Prospective cohort study: the
multicentre database of the “Global Spine Tumour Study Group”

Patient Sample: 922 consecutive patients with spinal
metastases who underwent surgery.

Outcome Measures: Self-reported: Pre- and post-operative
assessment of Euroqol EQ-5D quality of life, visual analogue
score (VAS) for pain Functional: Karnofsky score; Surgeon-
assessed: complications and survival

Methods: A prospective longitudinal study of consecutive
patients who were admitted for surgery to treat symptomatic
spinal metastases at 17 orthopaedic spinal units or
neurosurgical centres. Outcome measures were recorded to
determine whether spinal surgery influences quality of life.

Results: EQ-5D, VAS pain score and Karnofsky physical
functioning score improved rapidly after surgery and these
improvements were sustained in patients who survived up to
2 years after surgery. In specialised spine centres, the technical
intra-operative complication rate of surgery was low, however
almost a quarter of patients experienced post-operative
systemic adverse events.

Conclusions: Surgical treatment for spinal metastases keeps
patients walking, independent, and with little pain, resulting in
good quality of life. However, as a group, patients with cancer
are vulnerable to post-operative systemic complications, hence
the importance of appropriate patient selection.

Minimally Invasive Direct Lateral Corpectomy
(MIDLaC) of the thoraco-lumbar spine for
metastatic spinal cord compression

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Background Context: Conventional surgical approaches for
MSCC are associated with high mortality and morbidity. Multiple
scoring systems are utilized in patient selection for surgery.
Minimal-access minimally invasive surgery, with benefits of
reduced morbidity and equivalent efficacy, can be adapted
towards management of MSCC.

Purpose: To evaluate patient characteristics, clinical and
radiological outcomes of minimally invasive, lateral-approach
corpectomy(MIDLaC) for decompression and stabilization of
metastatic spinal cord compression(MSCC).

Study Design/Setting: Retrospective study of prospective
cohort

Patient Sample: Nineteen patients consecutively treated with
MIDLaC and pedicle screw fixation between May’12 and July’14.

Outcome Measures: Self-report measures: Pain VAS
Radiological measures: Sagittal deformity correction, vertebral
body height

Operative measures: Operation duration, blood loss

Clinical variables: Demographics, Tokuhashi score, mortality,
complications, opioid usage, Frankel grade

Results: All nineteen patients (mean age: 67.6±12.7 years)
successfully underwent MIDLaC with excellent neural
decompression. Operative duration was 188.4±30.3 min for
single-level MIDLaC, and 327.2±71.9 min for multi-level
surgery(p<0.0001). Mean blood loss per spinal level was 390.8 mL
with a decrease to 102.3 mL without renal cell MSCC. 47.4% of
patients had a Tokuhashi score of 0-8. There was one approach-
related complication and nil perioperative mortality. The overall
complication rate was 15.8%(n=3). The overall mortality rate
was 36.8%(n=7). 31.6% of patients improved by one or more
Frankel grades, and no patients demonstrated worsening
neurology post-operatively. VAS was significantly improved post-operatively ($p<0.05$). Vertebral body height was significantly increased (7.6 ± 8.1 mm, $p=0.002$), with improvements in lumbar lordosis (8.3 ± 7.3 degrees) and thoracic kyphosis (2.4 ± 7.1 degrees).

**Conclusions:** MIDLaC is a powerful, safe and effective approach to manage MSCC. The pool of eligible surgical candidates for MSCC can be expanded with MIDLaC.

![Figure 1. Pre-operative and post-operative Frankel grade. Note stable or improved Frankel grades in all patients.](image1)

**Figure 2.** Case 1. Pre-operative (left) sagittal computed tomography (CT) demonstrating T11 vertebral fracture with bony retropulsion and spinal cord indentation (arrow). Post-operative (right) sagittal CT showing a T11 corpectomy and insertion of an expandable titanium cage.

**Figure 3.** Case 2. Pre-operative sagittal (A) and axial (B) T2-weighted magnetic resonance imaging demonstrating metastatic involvement of T5, T6 and T7 vertebrae with pathological fracture of T6, kyphotic deformity and loss of cord signal secondary to bony retropulsion and anterior epidural tumour extension. Post-operative sagittal (C) and axial (D) computed tomography showing corpectomies extending from T5 to T7 with expandable titanium cage insertion and bilateral pedicle screw fixation with longitudinal adjoining rods (arrows).
Plenary Session 4 – Spinal Tumour

**Spinal osteoid osteoma: a multicentre retrospective cohort study comparison of results with appendicular osteoid osteoma**

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**Affiliation:** AO Spine Knowledge Forum Tumour  
**Background Context:** Osteoid osteoma is a benign skeletal neoplasm with a nidus generally considered to be less than 20mm.  
**Purpose:** The purpose of this study was to determine differences in epidemiological, clinical, and treatment outcomes in cases of osteoid osteoma occurring in the spine when compared to appendicular osteoid osteoma.  
**Study Design/Setting:** Ambispective database and literature review  
**Patient Sample:** Patients treated for spinal or appendicular osteoid osteomas  
**Outcome Measures:** Local recurrence and complication rates  
**Methods:** Utilizing the AOSpine Knowledge Forum Tumour multicentre ambispective database, surgically treated spinal osteoid osteoma cases were evaluated and compared to a literature review using PubMed (11 studies, 967 patients) of osteoid osteoma occurring in the appendicular skeleton.  
**Results:** In the appendicular skeleton cohort (mean age 21.3 years [range of 2-68; M:F 2.2:1]), the mean symptom duration prior to treatment was 15 months (range 1.5–108). Treatment modalities included surgical excision (n=87, 9%), CT-guided percutaneous drilling (n=153, 16%), and radiofrequency ablation (n=727, 75%). The overall recurrence rate using all treatment methods was 5.9% (n=57). The reported complication rate was 5.1% (n=48).  
In the 84 spinal osteoid osteoma patients (mean age 21.8 years [range 7-52; M:F 3.4:1]), the mean duration of symptoms before treatment was also 14.5 months (range 2-50). All treatment was by surgical resection. The overall recurrence rate was 7% (n=6) the complication rate was 7% (n=6).  
**Conclusions:** We found a similar demographic population and duration of symptoms in patients with spinal versus appendicular osteoid osteomas. Radiofrequency and surgical resection were the most common treatment modalities in appendicular and spinal osteoid osteomas, respectively, but with similar local recurrence and complication rates.

**Systematic review of en bloc resection in the management of Ewing’s Sarcoma of the mobile spine with respect to local control and disease free survival**

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**Co Authors:** M Sewell, PP Varga, N Quraishi  
**Affiliation:** Centre for Spinal Studies & Surgery, Queen’s Medical Centre, Nottingham  
**Background Context:** There is no consensus on the optimal method of local control in Ewing’s Sarcoma (ES) of the mobile spine. Recent reports have suggested en bloc resection may improve local control and survival.  
**Purpose:** Systematic review to answer the questions: (1) what is the outcome of en bloc resection for ES of the mobile spine with respect to local control and disease free survival? (2) How should residual ES of the mobile spine be treated?  
**Study Design/Setting:** Systematic review  
**Patient Sample:** Patients with Ewing’s sarcoma of the spine treated with en bloc resection  
**Outcome Measures:** Local control & Survival  
**Methods:** Systematic literature review between the years 1960-2014 in English that contained >5 patients. This yielded 204 articles, from which 4 were selected for detailed analysis. Literature was graded for quality, summarised and presented to a group of spinal oncology experts with consensus recommendations made.  
**Results:** All 4 studies were retrospective case series graded as very low quality evidence. Local control strategies included radiotherapy (RT) alone, surgery and RT, or surgery alone. There was no standardised outcome reporting across studies with respect to type of surgical procedure, margins and outcomes of interest (local recurrence/disease-free survival). When the en bloc procedures were pooled together, 2 of 21 patients (9.5%) developed LR, and 5 of 7 patients were disease free at a mean of 76 months. The other 2 patients had died at 10 and 29 months. No studies were identified detailing the treatment of residual ES of the mobile spine.  
**Conclusions:** There is no consensus on the optimal method of local control for spinal ES, or the treatment of residual disease. A weak recommendation supports that when en-bloc resection is technically possible, in combination with RT, this appears to provide superior local control than RT alone, or incomplete excision and RT. Effect on survival is indeterminate.
Friday 19th March 2015

KEYNOTE SPEAKER ‘Spinal tumour management and solitary spinal metastases’
Stefano Boriani

Alessandro Gasbarrini, MD,* Haomiao Li, MD,† Michele Cappuccio, MD,‡ Loris Mirabile, MD,‡ Stefania Paderni, MD,§ Silvia Terzi, MD,¶ and Stefano Boriani, MD*

Study Design. A semiprospective clinical study was conducted.

Objective. To evaluate the efficacy of a new treatment algorithm for spinal metastases.

Summary of Background Data. The surgical treatments in spinal metastases have been progressing in recent years, while the surgical indications have been controversial. A new treatment algorithm for spinal metastases was developed and prospectively applied clinically in our department since 2002.

Methods. This study included 202 patients with 206 lesions treated in January 1997 to December 2006 and continuously followed-up for more than 6 months or dead within this period. A total of 124 patients with 124 lesions were operated before 2002 were allocated to the control group and 78 patients with 82 lesions prospectively treated after 2002 were allocated to the prospective study group. The primary management were nonsurgical treatment, palliative surgery, debulking, and en bloc resection. Neurologic evolvement, postoperative survival time, and local recurrence/development rates were statistically compared as the indexes of treatment outcome.

Results. Although there was no significant difference of neurologic evolvement immediately after operation (P = 0.24), the prospective study group achieved significantly better neurologic function than the control group long time after operation (P = 0.03). No significant difference (P = 0.26) was shown in local recurrence/development rate comparison. The mean postoperative survival time comparison showed significant difference (P < 0.01).

Conclusion. The efficacy of the algorithm has been validated preliminarily by the significantly longer survival time and better long-time neurologic function evolvement in the prospectively study group. But the algorithm should continuously be in development and be updated with the latest improvement in metastatic treatment.

Key words: spinal metastasis, treatment strategy, surgical indication, prognosis. Spine 2010;XX:000–000

The spine is the most frequently affected site in bony metastases, with an incidence of 30% to 80% in patients suffering from systemic cancers.1,2 And more than 10% of patients with cancer will develop symptomatic spinal metastases.3 The clinical presentations of spinal metastases include pain, nerve function deficit, pathologic fracture, and deformity.4 Nowadays the simple laminectomy has been abandoned in spinal metastatic treatment, and the advantages of surgical treatment in the neurologic salvage and pain relief have been validated.5–7

The surgical indications for spinal metastases have been controversial and many strategies have been proposed with attempt to appropriately direct the option of surgeries in some previous studies.8–15 And the scoring systems are currently popular because of the straightforward approach of mathematic decision-making procedure.11–14 Nevertheless, due to the variable relevancy between different parameters of individuals and the complexity in clinical management, the application of a simple scoring system as a routine treatment strategy of spinal metastases seems not to be very reasonable.2,5,16

The metastasis is a systemic disease rather than a local illness, so the successful therapy for the metastatic disease of the spine should include the collaboration among oncologists, radiotherapists, and surgeons.4,17 Much indebted to a good understanding of the principles of oncologic management, a new treatment algorithm for spinal metastases, illustrated in a “flow chart” (Figure 1), had been developed and prospectively applied clinically since January 2002. To objectively evaluate the efficacy of the new treatment algorithm, we conducted this semiprospective study.

Materials and Methods

During the 10 years’ period from January 1997 to December 2006, 244 patients with 258 metastases were surgically treated in our department. This study included 202 patients with 206 lesions, followed-up continuously after treatment for more than 6 months or dead within this period. The present study was neither blinded nor randomized, but designed to be semiprospective for the controlled comparison of a prospective study group with a control group. In this study, the patients treated before 2002 were allocated to the control group and those treated after 2002 were in the prospective study group. A total of 124 patients with 124 lesions were operated before 2002 and 78 patients with 82 lesions prospectively treated since the algorithm commenced to be applied clinically. The demographics of the patients in the 2 groups are shown in Table 1. The lesions in sacrum and coccyx were excluded because of the special anatomies different from the mobile segments.
Early changes in sagittal spino-pelvic parameters after Scheuermann’s kyphosis correction

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Background Context: Sagittal spino-pelvic alignment is recognized as a main factor in the energy-efficient posture; however, still poorly defined in Scheuermann’s kyphosis (SK) patients. Surgical correction of SK is challenging with relatively high complication rate. A feared complication is that overcorrection of the thoracic deformity will cause large compensatory reduction in lumbar lordosis leading to spino-pelvic mismatch (e.g. flat back) which might pose our patients for revision operations. It is known that scoliosis patients further modulate their coronal plane parameters post-operatively.

Purpose: To describe changes in spino-pelvic parameters in SK patients

Study Design/Setting: Retrospective case series

Patient Sample: 29 patients (age 21±6 years, 86% males)

Outcome Measures: Whole spine lateral unsupported standing radiographs

Methods: Spino-pelvic parameters were measured before surgical correction of SK, at the first early postoperative follow-up (24±15 days) and at the latest follow-up (32±12 months).

Results: Thoracic-kyphosis: significantly corrected from 82±6° pre-operatively to 51±10° on last-follow-up. Lumbar-lordosis: reduced significantly from 70±9° pre-operatively to 43±10° in early-follow-up than increased significantly to 51±14° on last-follow-up. Pelvic-tilt: increased significantly from 14±8° pre-operatively to 21±11° in the early-follow-up than returned to its previous pre-operative values on last-follow-up (16±8°). Sagittal-vertical-axis: negative pre-operative values (-5±34 cm) significantly changed to positive values in early-follow-up (23±52 cm) to return back to negative values on the last-follow-up (-12±32)

Conclusions: This study found significant changes in most of the spino-pelvic parameters between the early and late post-operative-period. Spino-pelvic mismatch should not be assessed in the early post-operative-period as further modulation of balance will occur. Patients will increase their LL and shift their SB to their pre-operative values.

Clinical and radiologic outcome from 360-degree lumbar spondylodesis using porous tantalum cages in complex spinal reconstruction for degenerative lumbar spine deformity

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Background Context: This study presents 4-year results in patients treated with circumferential (360-degree) fusion of the lumbar spine carried out by posterolateral instrumented spondylodesis and anterior lumbar interbody fusion (ALIF) using the Zimmer TM-400 tantalum implant for replacement of an intervertebral disc.

Purpose: To assess implant performance, to evaluate fusion and to assess clinical and radiologic outcome of circumferential fusion using porous tantalum cages for ALIF in a 360-degree fusion.

Study Design/Setting: A retrospective cohort study was performed over a 4-year period.

Patient Sample: Implantation of 280 tantalum cages in 98 patients by the technique of anterior lumbar interbody fusion (ALIF) and posterolateral spondylodesis.

Outcome Measures: Preoperative and postoperative clinical outcome measures were assessed.

Methods: Radiographic and clinical follow-up was performed to document any implant related problems.

Results: No neurological, vascular or visceral injuries were reported. There were no rod breakages and no symptomatic non-unions. One revision procedure was performed for fracture. Mean VAS back pain score in our patient cohort improved from 7.5 preoperatively to 1.9 at latest follow-up, mean VAS leg pain score improved from 6.2 to 1.1 and mean ODI score improved from 51.1 to 18.3.

Conclusions: Porous tantalum cages have high strength and flexibility, in addition to having similar biomaterial properties to cancellous bone. Their use in 360-degree spondylodesis to treat degenerative lumbar spine deformity has been demonstrated to be very safe and effective, with excellent clinical and functional outcomes.
Correlation between spinopelvic parameters and clinical outcomes after 2-stage sagittal malalignment correction in a prospective adult spinal deformity cohort

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Background Context: Sagittal malalignment has been demonstrated to be a key driver of disability in the adult spinal deformity population. We attempted to assess the relationship between magnitude of global sagittal plane correction and postoperative health related quality of life (HRQOL) in patients undergoing 2-stage corrective surgery for adult spinal deformity.

Purpose: To evaluate the differences between spinopelvic parameters before and after sagittal malalignment correction and to assess the relationship between these radiologic parameters and clinical outcome scores.

Study Design/Setting: A prospective cohort study was performed over a 2-year period at a major tertiary referral centre for adult spinal deformity surgery.

Patient Sample: All consecutive patients requiring 2-stage corrective surgery were included (n=32)

Outcome Measures: Radiographic parameters and clinical outcome measures were collected preoperatively and at 6 weeks, 6 months, 1 year and 2 years postoperatively.

Methods: Radiographic parameters analysed included pelvic incidence, pelvic tilt, sacral slope, lumbar lordosis, thoracic kyphosis and sagittal vertical axis. Clinical outcome measures collected included EQ-5D, ODI, SRS 22 and VAS Pain Scores.

Results: Correction of sagittal malalignment was associated with significant improvements in HRQOL. Restoration of lumbar lordosis, pelvic tilt and sagittal vertical axis correlated with postoperative improvements in EQ-5D, ODI, SRS 22 and VAS Pain Scores at follow-up.

Conclusions: This study demonstrates that the magnitude of sagittal plane correction correlates with the degree of clinical improvements in HRQOL. This further underlines the need for spinal surgeons to target complete sagittal plane deformity correction if they wish to achieve the highest rates of HRQOL benefit in patients with marked sagittal malalignment.

The role of lumbosacral transitional vertebrae in the pathogenesis of degenerative lumbar scoliosis: an in vitro study

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Background Context: Many radiological factors have been linked to curve progression in degenerative lumbar scoliosis (DLS). However, the role of asymmetries at the lumbosacral junction in the development and progression of DLS has been little investigated.

Purpose: To simulate unilateral lumbosacral transitional vertebrae (LSTV) in lumbar cadaveric spines and to determine whether this increases coronal plane motion.

Study Design/Setting: Cadaveric study
Patient Sample: Thirteen human cadaveric spinal segments (L4-S1).

Outcome Measures: Coronal plane motion of spinal segments.

Methods: Spinal segments were mounted on a materials testing machine in pure compression at 1000N for 10 minutes. During loading, reflective markers on the vertebral bodies were used to assess coronal plane motion of the specimen using a MacReflex motion analysis system. Attaching a stainless steel plate from the sacrum to the L5 transverse process simulated a unilateral LSTV. This was performed sequentially on both sides, in random order, for each specimen. In each case, the initial loading was repeated and coronal motion was recorded. These series of tests were then repeated after vertebral endplate fracture. Coronal plane motion was compared between baseline values and the simulated right and left LSTV both before and after fracture.

Results: Pre-fracture, LSTV affected coronal plane motion by -0.21° and +0.20° (median values) on right and left sides respectively, compared to baseline, neither were significant (P<0.05). Post-fracture, LSTV decreased coronal plane motion by 0.18° and 0.09° on right and left sides respectively, neither were significant (P<0.05).

Conclusions: These findings provide evidence to refute that unilateral LSTV may be causative in DLS.
Optimising lumbar lordosis during PLIF surgery

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Background Context: Restoration of sagittal balance during fusion surgery is associated with improved outcome, less adjacent segment degeneration and improved pain scores.

Purpose: To determine factors associated with mono-segmental lordosis in patients undergoing single level posterior lumbar interbody fusion (PLIF).

Study Design/Setting: A retrospective radiological review

Patient Sample: 83 consecutive patients in a single surgeon series who had undergone single level PLIF with paired lordotic cages.

Outcome Measures: Mono-segmental lordosis and parameters related to intervertebral cage position and size.

Methods: The PLIF technique involved the insertion of identical lordotic cages and posterior decompression to optimize lordosis. The change in lordosis following surgery was related to cage shape and position. All distances were expressed as a ratio to the total length of the superior endplate of the lower instrumented vertebra to enable comparison between patients.

Results: Eighty-three consecutive patients underwent radiographic review. Following surgery, mono-segmental lordosis increased in 83% of cases by a mean of 5.73° (SD 7.21°). Anterior cage position (as signified by an increasing paired cage centre-point ratio) was significantly correlated with an increase in mono-segmental lordosis (P<0.01). In terms of cage size, increasing anterior cage height had a significant negative correlation with lordosis gain (P<0.01). Asymmetrical cage placement with increasing total cage length showed a non-linear negative trend with lordosis gain. There were no significant correlations between other cage shape parameters and lumbar lordosis.

Conclusions: Anterior cage placement is a key technical factor when trying to improve lumbar lordosis during PLIF surgery. In addition the cage should be of moderate height and length with symmetrical placement.

Can spino-pelvic parameters predict hardware failure in Scheuermann's kyphosis patients?

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Background Context: Proximal junction failure (e.g. screw pull-out, rod breaking and junctional kyphosis) are of the most common complications following surgical correction of Scheuermann’s Kyphosis (SK).

Purpose: This study investigates the relationship between patients’ spino-pelvic characteristics and occurrence of proximal junctional complications.

Study Design/Setting: Retrospective case series

Patient Sample: 29 patients

Outcome Measures: Measurement were performed on whole spine lateral unsupported standing radiographs preoperatively, at the first early postoperative follow-up (24±15 days) and at the latest follow-up (32±12 months).

Methods: Spino-pelvic characteristics of 8 patients (age 20±5 years, 7 males) who developed proximal-junction complications after surgical correction of SK were compared to those of 21 patients (age 21±6 years, 18 males) who did not have complication after similar operation.

Results: The preoperative and postoperative magnitude of the thoracic-kyphosis and lumbar-lordosis were similar in the complication and non-complication groups (p=ns). However, the pelvic-incidence and the preoperative sacral-slope were significantly higher in the complications group (52±11 vs. 42±10 and 38±9 vs. 27±7 respectively; p<0.05). Similarly, the preoperative sagittal-vertical-axis was significantly more positive in patients who developed proximal-junction complications (24±29 cm vs. -16±29 cm; p=0.002).

Conclusions: Patients who developed proximal-junction complications had higher pelvic-incidence, higher sacral-slope and more positive preoperative sagittal-vertical-axis. Patients with higher pelvic-incidence (and sacral-slope) should have higher expected lumbar-lordosis. When thoracic-kyphosis is corrected a compensatory decrease in lumbar-lordosis occurs. It is our opinion that as both groups had the same thoracic-kyphosis and lumbar-hyper-lordosis and underwent the same magnitude of correction. The reduction in lumbar-lordosis beyond the expected values caused spino-pelvic mismatch and failure.
Clinical outcomes using a novel extensile lateral psoas-preserving single incision surgical approach for anterior lumbar interbody fusion from L1 to S1

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Background Context: The lateral retroperitoneal approach has been utilized for many years for anterior interbody fusions (ALIF) from L1 to L5, however, a separate Pfannenstiel approach is used if access to L5/S1 is required. The traditional lateral transpsoas approach was developed to eliminate the need for an anterior approach surgeon and retraction of the great vessels, with the potential for shorter operative times. With this approach, L4/L5 is the most difficult level to access and L5/S1 is not accessible. Furthermore it is associated with a complication rate of up to 50%, the most common being anterior thigh numbness, radiculopathy, iliopsoas weakness and quadriceps weakness.

Purpose: To report a novel lateral psoas-preserving surgical approach to the lumbar spine, avoiding the approach related complications of the traditional lateral transpsoas approach and allowing access to L5/S1, and to evaluate clinical and radiologic outcomes from use of this alternative surgical technique in a prospective series of L1 to S1 anterior lumbar interbody fusions.

Study Design/Setting: A prospective series of patients (n=40).

Patient Sample: Patients having anterior lumbar interbody fusion using porous tantalum cages as part of 2-stage complex lumbar reconstructions from L1 to S1.

Outcome Measures: ODI and VAS Pain Scores

Methods: Data collected included surgical blood loss, perioperative complications and need for secondary/revision procedures. Preoperative and postoperative radiologic parameters and clinical outcome measures were assessed.

Results: Mean length of stay was 2.5 days. Mean blood loss was less than 200 mls. No transient or permanent neurological, vascular or visceral injuries were reported. One revision procedure was required on rheumatoid arthritis patient with advanced systemic disease who sustained a sacral fracture and required revision ALIF at L5/S1. There was significant improvement in all spinopelvic parameters and overall sagittal alignment. Mean VAS pain score improved from 8.1 to 3.2 and mean ODI score improved from 49.1 to 20.3.

Conclusions: The technique described is a safe, psoas preserving, one-incision approach that avoids the potential complications of standard transpsoas surgery. Additionally, it may be used in an extensile fashion to provide access from L1-S1 for multilevel lumbar surgery and complex reconstructive procedures, thus avoiding the need for a 2-incision approach.

Post-operative neurological observations: are you getting what you think you ordered?

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Background Context: A previous audit highlighted the need for a consistent approach to neurological observations in spinal surgery patients. A protocol was introduced in 2006 for use throughout the hospital.

Purpose: To assess compliance with protocol for post-op neurological observations

Study Design/Setting: Retrospective audit

Patient Sample: Patients admitted to the spinal surgery unit from July 29, 2014 to sept 02, 2014

Methods: The case notes of 19 patients who had spinal surgery were reviewed against our gold standards on post-operative neurological observations as specified from previous audits. The mean age of the patients was 47 years (17 to 78). The procedures performed were lumbar decompression and fusion (5), lumbar decompression (5), scoliosis correction (4), excision of vertebral tumour (2), discectomy and fusion (2), microdiscectomy (1).

Results: In this audit the frequency of neurological observations was specified in 94%. Observations were performed to protocol in 88% in recovery unit, 93 % in HDU and in 79% on the ward. Observations were documented in 95 %. Deterioration of observations were reported and actioned appropriately. Comparison with similar audits done in 2006 and 2012 showed sustained improvement.

Conclusions: Clinical audit was used to highlight the problems with monitoring of spinal surgery patients; further evaluation and implementation of the recommendations resulted in sustained improvement in delivery of healthcare.
The impact of a structured rehabilitation program as part of an integrated multidisciplinary treatment algorithm to enhance recovery in adult spinal deformity patients

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Background Context: Adult spinal deformity consists of a broad range of clinical and radiographic entities that can be associated with significant pain and disability. An integrated multidisciplinary approach is required to achieve optimal clinical outcomes in what is a complex range of disorders.

Purpose: To examine the impact of a structured rehabilitation program as part of an integrated multidisciplinary treatment algorithm for adult spinal deformity patients.

Study Design/Setting: A prospective cohort study was performed over a 2-year period at a major tertiary referral centre for adult spinal deformity surgery.

Patient Sample: All consecutive patients requiring 2-stage corrective surgery for sagittal malalignment were included (n=32).

Outcome Measures: ODI, VAS Pain scores

Methods: Details of physiotherapy initial evaluation, inpatient rehabilitation progress, details of bracing treatment and time to discharge were collected. Clinical outcome scores were measured preoperatively and at 6 weeks, 6 months and 1 year postoperatively.

Results: After second stage corrective surgery, the mean time to standing without assistance was 2.1 days, mean time to independent ambulation was 4.2 days, mean time to competent ascending and descending stairs was 5.6 days and mean time to moulded orthosis application 7.1 days. Successful progression through the structured rehabilitation program was associated with high clinical outcome scores and improved health related quality of life (HRQOL).

Conclusions: This study highlights the clinical and functional benefits of a structured rehabilitation program as part of an integrated multidisciplinary approach to the treatment of patients with adult spinal deformity. The introduction of this program contributed to the development of an enhanced recovery pathway for patients having adult spinal deformity surgery, reducing inpatient length of stay and optimizing clinical outcomes.
Thursday 19th March 2015

KEYNOTE SPEAKER
Brice Ilharreborde

'Challenges and techniques of lumbopelvic fixation in spinal surgery'

Spino-pelvic fusion can be required in numerous medical conditions, such as neuromuscular deformity, degenerative lumbar spine, L5S1 spondylolisthesis and tumours.

The pelvis fixation remains challenging due to a poor bone quality, neurovascular risks and the high stresses applied on this transitional zone. Fusions extending to the sacrum are therefore associated with increased morbidity and high rates of pseudarthrosis (5 to 52%).

The numerous techniques available, using the sacrum and/or the iliac wings, will be described and compared, based on the anatomy and the most recent biomechanical and clinical series of the literature.

In addition, the main risk factors for lumbo-pelvic pseudarthrosis will be reported, with an emphasis on the post-operative sagittal balance restoration.
A new treatment regimen for Potts disease with para-spinal abscesses and sinuses

Main Author: Kalpesh Vaghela
Co Authors: Alexander Vris, Veronica White, Alexander Montgomery, Arun Ranganathan
Affiliation: Royal London Hospital, Whitechapel, London E1 1BB

Background Context: Potts Disease is a rare manifestation of tuberculosis. The development of para-spinal abscesses and subsequent sinus formation can pose a significant therapeutic challenge. Traditionally, corticosteroids have been used in the treatment of compressive tuberculous lesions of the brain and spinal cord. The role of corticosteroid treatment in giant para-spinal abscesses and sinuses is not well documented in the literature.

Purpose: The aim of this study is to evaluate the role of the therapeutic effects of high dose oral corticosteroids on para-spinal abscesses and sinuses in conjunction with quadruple therapy.

Study Design/Setting: We conducted a retrospective review of all spinal tuberculosis patients attending the multidisciplinary clinic at the London Chest Hospital between 2006 and 2014.

Patient Sample: 156 patients were reviewed in the joint clinic of which 24 patients were treated with a new regimen of high dose oral corticosteroids with quadruple anti-tubercular treatment.

Outcome Measures: All patients had serial MRI imaging and/or CT scans.

Methods: No funding obtained and there are conflicts of interest.

Results: Para-spinal abscesses and sinuses were found to affect the dorsal lumbar spine, thoracic, cervical spine and sacrum in order of decreasing frequency. Of the 24 patients the 6 patients female, 18 were male. Mean age 33.7. 3 patients were UK nationals, 21 were non-UK nationals. Treatment with high dose corticosteroids was found to result in dramatic reduction in abscess size and healing of sinuses.

Conclusions: We propose the use of corticosteroids in conjunction with quadruple therapy as a 1st line non-invasive approach to the treatment of para-spinal abscesses and sinuses based on our experience.

Surgical percutaneous biopsy of discitis and vertebral osteomyelitis is significantly better than CT guided biopsy in identifying the causative organism

Main Author: Radu Popa
Co Authors: Luigi Magnano, Hanny Anwar, Lester Wilson
Affiliation: The Royal National Orthopaedic Hospital, Stanmore

Background Context: CT guided biopsy and blood cultures have become the most commonly taken samples in the search to identify the pathogen in discitis/osteomyelitis but have low reported yield rates. By performing surgical biopsy in theatre with fluoroscopy, the surgeon can ensure biopsy of the endplate and disc.

Purpose: To identify whether surgical biopsy in theatre improves biopsy yield rates versus CT-guided biopsy.

Study Design/Setting: Retrospective review of current service

Patient Sample: 30 consecutive patients referred to our institution with spinal infection

Outcome Measures: Culture of causative organism.

Methods: The clinical records of patients were reviewed to ascertain clinical presentation, treatment prior to biopsy, result of biopsy and final outcome.

Results: CT guided biopsy found the causative organism in 50% of patients, while surgical biopsy found the causative organism in 72% of patients (P<0.05).

Conclusions: This retrospective pilot-study demonstrates improved potential for confirming the causative organism in spinal infection with surgical biopsy. We intend to establish a prospective randomised control trial to confirm this.
Plenary Session 6 – Spinal Infection

SAPHO syndrome: clinical presentation, imaging and management and its relevance to spinal surgical practice

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Co Authors: Anne Duits, Richard King, Kia Rezajooi, Adrian Casey
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Background Context: SAPHO (synovitis, acne, pustulosis, hyperostosis and osteitis) is a rare syndrome and includes a group of chronic relapsing inflammatory musculoskeletal disorders in particular synovitis and aseptic osteitis with predilection for the anterior chest wall and the spine. Spinal lesions can often be mistaken for tumour or infection leading to unnecessary invasive procedures. Whilst the diagnosis is made on the characteristic radiological and clinical findings, it can often be very difficult to make, especially in the absence of skin lesions

Purpose: Our aim is to provide an overview of the heterogeneity SAPHO syndrome presents with and to make spinal surgeons / radiologists aware of SAPHO syndrome as a potential diagnosis for patients with multiple bone / spinal lesions thereby preventing unnecessary surgical intervention.

Study Design/Setting: Retrospective study

Methods: Retrospective review of 12 patients diagnosed with SAPHO syndrome with spinal involvement. No conflict of interest.

Results: 10 of the 12 patients presented initially with spinal symptoms of which pain was the main feature. 91% (11/12) patients had multilevel spinal involvement. Mean time between presentation and eventual definitive diagnoses was 18 months. 2 patients underwent vertebrectomy prior to diagnosis which was retrospectively not indicated. None of the conservatively managed patients developed cord compression or spinal deformity. 6 patients were treated with bisphosphonate infusions and were responsive but 3 needed further infusions for recurrent episodes

Conclusions: SAPHO should be considered as potential diagnosis in atypical vertebral lesions. Focussed history about past skin lesions and whole body MRI to look for associated features will prevent diagnostic delays et avoidable surgical interventions.

Surgical site infection (SSI) and airflow in spinal surgery – time for a national review?

Main Author: Anna Watts
Co Authors: James Tomlinson, Michael Athanassacopolous, Lee Breakwell, Neil Chiverton, Ashley Cole, Michael Ivanov, Rex Anthony Michael
Affiliation: Department of Spinal Surgery, Northern General Hospital, Sheffield

Background Context: Surgical site infections (SSI’s) are a significant cause of morbidity following spine surgery and can have a devastating effect on patient outcome. Measures to limit the risk of SSI’s include the use of recirculation laminar airflow systems in operating theatres.

Purpose: The efficacy of these different airflow systems and their effect on SSI’s is unclear with literature both for and against their use.

Study Design/Setting: This retrospective study compared SSI’s between two hospitals within the same trust using different airflow systems: recirculation laminar flow and conventional air flow.

Patient Sample: Adult patients undergoing either lumbar decompression or microdiscectomy at either hospital during 2013.

Outcome Measures: This was self-reported, and classified as either superficial or deep infection using clinical records. Laboratory results were also evaluated to identify infecting organisms.

Methods: A comprehensive review of patient records n=150. This included 75 patients operated in laminar flow theatres and 75 in conventional air flow theatres. Patient selection was randomised. No funding was obtained for this study.

Results: There were 4 SSI’s (1 deep and 3 superficial) in the conventional airflow group and 2 SSI’s (1 deep and 1 superficial) in the laminar flow group.

Conclusions: The superficial infection rate was higher in conventional air flow theatres. This is a small study which highlights a role for a national level study to assess the effect of theatre type on infection rates. The spinal registry could play a role in this.
**Plenary Session 6 – Spinal Infection**

**Challenges in managing extensively drug resistant spinal tuberculosis (XDR-TB): the journey from complete lower limb motor paraplegia to independent mobilisation**

Main Author: Jane Vanhoutte

Co Authors: Himanshu Sharma

Affiliation: Plymouth Spinal Services, South West Neurosurgery Unit, Derriford Hospital, Plymouth

**Background Context:** The management of patients with Spinal Tuberculosis has become increasingly complicated due to an increasing proportion of multi-drug & extensively resistant TB strains (MDR & XDR-TB). It is associated with significant proportion of morbidity and mortality.

**Purpose:** We report multiple challenges faced on managing such an interesting case whereby a patient with XDR-TB recovered from total lower limb motor paraplegia to independent mobility.

**Patient Sample:** Case presentation

**Results:** A 32-year-old man who recently immigrated to England from India presented with increasing back pain and reduced sensation below the level of T6. His past medical history was insignificant. On examination, he had proximal weakness in hip flexion bilaterally at outset. An MRI of his spine showed a lesion at T6/7 with a surrounding collection suspicious of spinal TB. A biopsy was conducted and samples sent for histology and microbiology, which confirmed granulomatous infiltration. Initially, the patient was managed with conventional first line TB antibiotic therapy based on high index of suspicion with poor response. He dramatically deteriorated neurologically and became near total paraplegic. Subsequent imaging highlighted progressive disease with increased cord compression. This deterioration warranted surgical intervention in the form of all posterior decompression and spinal stabilisation. His neurology further deteriorated immediate post-operatively. He was then diagnosed with MDR-TB and eventually with XDR-TB. His antibiotic therapy was tailored to the sensitivities. He developed tuberculous myelitis, which was treated with immunoglobulin therapy and plasmapheresis. He needed negative pressure room, barrier nursing, expensive multiple medications and prolonged neuro-rehabilitation. He had multiple side-effects from anti-tuberculous therapy. He remained inpatient for almost 9 month period due to variety of reasons. With the help of various members of the multi-disciplinary team, he has achieved independent mobility (elbow crutches for long distance and unassisted for short distances at 10 month follow-up).

**Conclusions:** Spinal tuberculosis with complete paraplegia with extreme drug resistance and tuberculous myelitis carries dismal prognosis. We report multiple challenges faced during management of this patient and very positive outcome with regaining independent mobility.

**The role of myelography in the MRI era**

Main Author: See Yung Phang

Co Authors: Katherine Whitehouse, Will Adams, Tim Germon

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**Background Context:** MRI has supplanted myelography as the investigation of choice for spinal pathology whilst techniques are still evolving to improve resolution & reduce susceptibility to artefact. Nonetheless, myelography is still performed, as an adjunct to MRI, although it is considerably more intrusive

**Purpose:** To investigate the indications and utility of myelography in the MRI era.

**Study Design/Setting:** Retrospective study of all spinal myelograms performed in a teaching hospital between 2008-2013

**Patient Sample:** Retrospective cohort

**Outcome Measures:** Comparison of images

**Methods:** Retrospective recording of indications, complications & information obtained from myelography over & above MRI.

**Results:** 134 spinal myelograms were performed in 119 people. 71 due to an MRI incompatible device, claustrophobia or obesity; 44 in people who had an MRI, of which indications were: 1. 26 where metal implants were causing MRI artefact of which myelography added diagnostic information in 5 & excluded a problem within an instrumented segment in 4. (2) 7 with equivocal root compression of which myelography added diagnostic information in 0. (3) 8 possible ventral herniation of the cord of which myelography added diagnostic information in 7. (4) 3 miscellaneous (patient movement, severe cervical deformity and claustrophobia) of which myelography added diagnostic information in 3. The 4 complications reported in the 44 cases were pain at puncture site, headache, epidural leak and transient drowsiness.

**Conclusions:** Myelography remains an important part of the imaging armamentarium. However, in this cohort of patients myelography did not contribute as much additional information as we might have expected. This suggests we should have a higher threshold for performing the investigation, particularly for people being investigated for equivocal nerve root compression present on the MRI.
Routine imaging after spinal instrumentation: is it necessary?

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**Co Authors:** George Cooper, Naveed Akhtar, Adrian Gardner

**Affiliation:** Royal Orthopaedic Hospital, Bristol Road South, Northfield, Birmingham, B31 2AP

**Background Context:** In other orthopaedic subspecialties the intra-operative fluoroscopic images are considered evidence that the construct is satisfactory. With the exception of scoliosis correction, is it necessary to repeat radiographs prior to discharge?

**Purpose:** A study was designed to assess if routine imaging before discharge alters the treatment plan in a patient who had spinal instrumentation.

**Study Design/Setting:** Retrospective audit

**Patient Sample:** Cohort of patients admitted to a spinal unit in a tertiary referral centre

**Outcome Measures:** Length of hospitalisation, Change in management

**Methods:** All patients who had spinal instrumentation from July to September, 2014 were examined. The case notes, fluoroscopy images and post-operative radiographs of these patients were reviewed.

**Results:** Of 55 patients who had spinal instrumentation, case notes were retrievable for 43. The treatment plan was changed in three patients (7%). One required a CT scan because the lumbar cage was tilted. One was revised because the implants were loose, another was revised because of loss of coronal balance. All the patients requiring revision had worsening pain or new neurological symptoms.

**Conclusions:** In patients who undergo spinal instrumentation, routine imaging before discharge did not alter the treatment plan, in the absence of new symptoms or worsening pain. Whole spine radiographs following scoliosis correction may still be indicated for assessment of coronal and sagittal balance.

The role of SPECT/CT fusion imaging in the preoperative evaluation of patients undergoing fusion surgery for symptomatic degenerative lumbar spondylosis

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**Co Authors:** JHJ Leong, MD Sewell, A Benton, J Platinum, ML Suarez-Huerta, S Selvadurai, S Molloy

**Affiliation:** Spinal Deformity Unit, Department of Spinal Surgery, Royal National Orthopaedic Hospital, Stanmore, Middlesex

**Background Context:** The surgical management of patients with intractable pain from symptomatic degenerative lumbar spondylosis, in the absence of stenosis or spondylolisthesis, remains controversial.

**Purpose:** To evaluate the efficacy and utility of SPECT/CT as a diagnostic modality and preoperative planning tool in patients undergoing fusion surgery for low back pain and/or leg pain.

**Study Design/Setting:** A prospective cohort study (n=25) performed over a 2-year period.

**Patient Sample:** All consecutive patients requiring lumbar spondylosis for back pain and/or leg pain included.

**Outcome Measures:** Clinical outcome measures included EQ-5D, EQ-5D VAS, ODI and VAS Pain Scores.

**Methods:** SPECT/CT fusion imaging was performed in conjunction with standard CT and MRI preoperatively to guide patient selection and surgical planning. Clinical outcome measures were collected preoperatively and at 6 weeks, 6 months and 1 year postoperatively.

**Results:** SPECT/CT fusion imaging demonstrated increased sensitivity for facet degeneration when compared to MRI. No difference was identified when comparing SPECT/CT to standard CT to assess disc degeneration. There was a significant improvement in all clinical outcome measures assessed preoperatively and followed out to 1-year postoperatively. Mean ODI score improved from 58.92 to 12.0; VAS back pain score improved from 7.46 preoperatively to 1.0; VAS leg pain score improved from 4.15 to 0.25.

**Conclusions:** SPECT/CT fusion imaging is an excellent adjunct to existing imaging modalities, facilitating accurate level selection in patients undergoing lumbar fusion surgery for low back pain and/or leg pain. Lumbar fusion surgery guided by SPECT/CT fusion imaging was associated with excellent postoperative health related quality of life (HRQOL) outcome measures.
Plenary Session 6 – Spinal Infection

The role of oblique spinous process abutment in the pathogenesis of degenerative lumbar scoliosis: an in vitro study

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Co Authors: Ian Harding, John Hutchinson, Ian Nelson, Michael Adams, Patricia Dolan

Affiliation: The Department of Comparative and Clinical Anatomy, The University of Bristol, Southwell Road, Bristol, BS2 8EJ, United Kingdom.

Background Context: Many radiological factors have been linked to curve progression in degenerative lumbar scoliosis (DLS). However, the role of asymmetries in the neural arch in the development and progression of DLS has been little investigated.

Purpose: To simulate oblique spinous process abutment (SPA) in lumbar cadaveric spines and to determine whether this increases coronal plane motion.

Study Design/Setting: Cadaveric study

Patient Sample: Thirteen human cadaveric spinal segments (L4-S1).

Outcome Measures: Coronal plane motion of spinal segments.

Methods: Spinal segments were loaded on a materials testing machine in pure compression at 1000N for 10 minutes. During loading, reflective markers on the vertebral bodies were used to assess coronal plane motion of the specimen using a MacReflex motion analysis system. Oblique SPA was simulated by attaching moulded aluminium strips (abutting at 45°) to the L4 and L5 spinous processes. In each specimen, both a right- and left-sided SPA was simulated, in random order, and compression at 1000N was again applied for 10 minutes while coronal plane motion was recorded. All tests were then repeated after vertebral endplate fracture. Coronal plane motion at baseline was compared with values following simulated right- and left-sided SPA, both before and after fracture.

Results: Pre-fracture, right- and left-sided SPA increased coronal plane motion by 0.28° and 0.27° (median values) respectively, compared to baseline, but only the former was significant (P=0.0301). Post-fracture, right- and left-sided SPA decreased coronal plane motion by 0.36° and 0.46° respectively, but only the latter was significant (P=0.0303).

Conclusions: These findings provide only limited evidence that oblique SPA may be causative in DLS.
Thursday 19th March 2015

KEYNOTE SPEAKER
Robert Dunn
‘Spinal Infection and the management of spinal TB’

Tuberculosis (TB) remains one of the world’s deadliest communicable diseases. In 2013, 9 million people across the world contracted it, resulting in 1.5 million deaths. With population migration and increasing HIV rates, TB is no longer restricted to the poor, underdeveloped regions. HIV is also increasing the extra-pulmonary manifestations which include spinal TB.

Diagnosis is challenging due to the insidious nature of the disease, variable presentation patterns and long culture periods. This has been improved with recent advances such as the on-site PCR techniques providing confirmation within a day or two with 90% plus sensitivity and specificity. Biopsy is mandatory due to the large differential diagnosis and increasing drug resistance.

Management is dictated by the host status as many are too ill to undergo massive reconstructive procedures. Medical management remains the mainstay of care. The surgical options range from drainage procedures such as costotransversectomy to the deformity correcting transthoracic debridements, anterior column reconstruction and instrumented fusion. Indications are based on deteriorating neurological status and existing or predicted deformity with a knowledge of natural history as a comparison. Regional circumstances such as theatre/ICU access and financial constraints also play a role in procedure and implant selection.

Despite severe neurological involvement in acute, active disease, recovery is usually expected (even ASIA A) due to the pathophysiology of the disease. In late presentation with healed disease, but severe kyphosis, this is not the case. The spinal cord damage is more permanent. The rigid deformities require more aggressive and risky procedures such as VCR to correct and circumferentially decompress the cord with poorer outcome.
In vivo MRI tracking of mesenchymal precursor cells labelled with iron oxide fluorescent nanoparticles (IODEX) in an ovine model of disc degeneration

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Purpose: Mesenchymal Stem Cell therapy is an evolving therapeutic approach to intervertebral disc regeneration. The objective of this study was to evaluate IODEX labelled Mesenchymal Precursor Cells (MPCs) with magnetic resonance imaging (MRI) and histological studies using an ovine model.

Methods: Disc degeneration (DD) was induced in the L2/3, L3/4, L4/5 lumbar discs of six adult female sheep utilizing a validated annular injury protocol. L1/2 and L5/6 discs served as untreated controls. Three months following annular injury, ovine IODEX labelled MPCs were injected into the degenerate discs. Three labelled MPC regimens were examined. Animals were euthanized at 2, 4 and 8 weeks post injection. 3T and 9.4T MRI was performed. Paraffin embedded histological sections of all discs were stained and scanned for FITC fluorescence.

Results: The histological studies and Pfirrmann grading scores of all injured discs confirmed DD. Hypointense signal areas visualized on 9.4T MRI in all MPC injected groups up to 8 weeks after implantation confirmed the presence of MPCs. Hypointense regions in the nucleus pulposus were significantly larger in discs injected with dead cells compared to live cells. 9.4T MRI sequences and histological studies provided evidence of MPC migration to the annulus fibrosus injury site.

Conclusions: This study has demonstrated the feasibility of tracking IODEX labelled MPCs in degenerate discs using MRI, and indicated MPC tracking to the site of annular injury. The histological studies also revealed ingrowth of capillaries, fibrosis and innervation of the injured annulus. Immunohistochemical studies are currently in progress to identify the MPC mediators responsible for disc repair.

Diffusion-weighted MRI assessment of adjacent disc degeneration after thoracolumbar vertebral fractures

Main Author: David C Noriega
Co Authors: Francisco Ardura, Ruben Hernandez, Israel Sanchez-Lite, Borja Toribio
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Background Context: Early degenerative disc disease after vertebral fractures is a common finding.

Purpose: To determine the water diffusion in the thoracolumbar discs adjacent to a previous VCF, using the mean apparent diffusion coefficient (ADC) and to analyse if a relationship exists between disc ADC and MR findings of adjacent disc degeneration after thoracolumbar fractures treated by reduction and cementoplasty.

Study Design/Setting: Surgical treatment: vertebral body reduction and cementoplasty through a MIS approach versus conservative treatment. MRI T2-weighted images, ADC mapping were performed after a mean follow-up of 32 months. Total of 60 discs, 3 per patient, analysed: infra-adjacent, supra-adjacent and a control disc one level above the supra-adjacent.

Patient Sample: 20 non-consecutive volunteers, treated for vertebral fractures (mean age, 50.7 years [45-56]) were included. There were 10-A3.1, 10-A1.2 fractures. Surgical treatment 14 cases, conservative in 6.

Outcome Measures: MRI T2-weighted images, ADC mapping were performed after a mean follow-up of 32 months. Total of 60 discs, 3 per patient, analysed: infra-adjacent, supra-adjacent and a control disc one level above the supra-adjacent.

Results: There were no differences between patients surgically treated and those following a conservative protocol regarding the average ADC values obtained in the 20 control discs analysed. The average ADC in the supra-adjacent level was lower than in the infra-adjacent (1.53±0.06 versus 1.35±0.12;p<0.001). Average ADC values of the disc used as a control were similar than those of the infra-adjacent level(1.54±0.06), as compared to surgically treated patients, discs at the supra-adjacent fracture level showed statistically significant lower values in cases treated orthopedically(p<0.001).

Conclusions: ADC measurements of the supra-adjacent disc after a mean follow-up of 32 months following thoracolumbar fractures showed that restoration of the vertebral collapse by minimally invasive vertebral reduction and augmentation prevent early posttraumatic disc degeneration.
The burden of back pain on a district general hospital

Main Author: Francis Brooks

Co Authors: Claire Spolton Dean, George Okwerekwu, Ashish Khurana, Abraham Manoj-Thomas, James Cordell-Smith

Affiliation: Royal Gwent Hospital, Newport

Background Context: Back pain is a major health problem to the Western world. It causes a significant burden to society in terms of lost days of work; health care resources and social benefits. To our knowledge no study to date has looked at the burden on a district general hospital in terms of the trauma admissions, which occur as a result of back pain.

Purpose: To assess the physical and financial impact that hospital admissions for back pain have on a large district general hospital in the Welsh NHS.

Study Design/Setting: Review of database

Patient Sample: All admissions in trauma database for back pain since the database began.

Outcome Measures: Days in hospital; cost of treatments

Methods: Review of information on a prospective kept trauma database

Results: Over 19,000 admissions have been recorded on our DGH trauma database in the 9 years since it was started, of which 1161 were due to back pain. These patients’ admissions totalled 43.3 years or 15,790 days (average stay was 13.6 days). 83.3% of individuals underwent an MRI scan but only 29% required any surgical intervention. 6.6% of patients had multiple admissions due to their back pain. Cost of these admissions was an estimated £6.6 million. With MRI scan this rose to around £6.8 million or £5857 per patient.

Conclusions: Back pain has a huge burden on the limited and stretched resources of the NHS. Reconfiguration of service to better serve these patients needs may be cost effective in the NHS and free up valuable hospital resources.

Risk factors for long term neurological deficit following intraoperative monitoring alerts: do interventions change the outcome?

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Co Authors: Finn Stevenson, Mary Curtis, Sean Molloy

Affiliation: The Royal National Orthopaedic Hospital, Stanmore

Background Context: Intraoperative monitoring (IOM) is consistently and convincingly reported to have high sensitivity and specificity for detecting neurological injury. However there is surprisingly little research or understanding in the literature to explain why some alert cases result in postoperative deficit but most do not.

Purpose: Do interventions change the outcome following intraoperative monitoring alerts.

Study Design/Setting: Retrospective review of 6700 cases.

Patient Sample: 110 patients with significant neuromonitoring changes intraoperatively.

Outcome Measure: Neurological deficit at 1 month and 1 year.

Methods: A retrospective case review was carried out using 110 spinal surgery cases from a single institution. All had been classified as red alerts due to predefined significant IOM trace changes. They were divided into two groups depending on whether they had experienced postoperative deficit following the red alert (NND+) or not (NND-). A range of patient, operative, monitoring and intervention factors were collected and Chi-squared and Fisher’s Exact test were used to find significant differences between the groups.

Results: 24 patients were NND+. Three factors were significant in determining which these were; patient age, blood loss and the monitoring modalities used. Interventions carried out did not differentiate NND+ from NND-.

Conclusions: There are few predictive factors in spinal surgery to define which patients will develop neurological deficit post-operative. Metalwork revision, steroids, imaging modalities used post-operatively, did not predict final neurological outcome. Patients less than 9 or with monitoring changes despite low blood loss had more chance of a real deficit post-operatively. Multi-modal monitoring was more accurate in predicting neurological deficit than SSEP alone.
Plenary Session 7 – Spinal Injuries and Trauma

A prospective multicentric observational study on the use of intravertebral implants for traumatic vertebral compression fracture treatment – 12 months follow up

Main Author: David Noriega
Co Authors: Francisco Ardura, Julien Baud, Helmut Ekkerlein, Emmanuel Fouloungne, Natale Francaviglia, Rainer Gumpert, Frank Hassel, Hervé Huet, Alexander Kunsky, Gianluca Maestretti, Mourad Ould Slimane, Guillaume Perot, Miguel Plasencia, Steffen Queinnec, Christian Renaud, Pascal Sabatier, Nicolas Theumann
Affiliation: Spine-Unit, University hospital Valladolid, Avda. Ramón y Cajal 7, 47005 Valladolid, Spain

Background Context: MIS-surgery and intravertebral implants for treatment of Vertebral Compression Fractures could be a solution for an anatomically correct fracture reduction and decrease of complications related to more invasive surgery.

Purpose: Confirm the safety and clinical performance of intravertebral implant placement in traumatic VCF.

Study Design/Setting: Prospective multicentric observational study in fourteen centres across Europe.

Patient Sample: 103 patients (mean age: 61.6 years (SD15.3), range: 18-88 years, 51 female, 52 male). 108 fractures were treated with intravertebral cranio-caudal expandable implants in combination with high viscosity PMMA bone cement. 58.8% of fractures are complex fractures: A2, A3 (A.3.1: 27.9%, A.3.2: 4.8%, A.3.3: 11.5%) and B fractures according to the AO Magerl classification. Mean fracture age 9.2 (SD7.8) days at surgery.


Methods: Investigators following local hospital routines.

Results: 78 patients at 12 months. The VAS score improved from 6.6 (SD2.6) preoperatively to 1.2 (SD1.7) at 12 months (p<0.001). The ODI, decreased from 76.6 (SD19.4%) preoperatively to 10.5 (SD14.7%) at 12 months (p<0.001). Immediate decrease in analgesics consumption and 12 months after surgery, 98.7% of patients used no medication or only mild analgesics. A reduction of vertebral kyphotic angle with 5.35°, from 14.52° to 9.17° postoperatively (p<0.001).

Totally 8 subsequent fractures (4 adjacent) reported in 3 patients (2.9%). No symptomatic cement leakage was reported. No device-related SAEs occurred during the follow up period.

Conclusions: Clinical and radiological results confirmed that this procedure is a safe and efficient intervention for the treatment of traumatic VCF.

Is radiation a limit for cone beam tomography-based image guided spinal surgery?

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Background Context: Patient, surgeon and operating room team radiation exposure during spinal instrumentation is a concern. CBCT based 3D image guidance does not use active fluoroscopy during instrumentation.

Purpose: Measure the radiation exposure at unshielded locations in the OR, surgical team and patients during spinal surgery

Patient Sample: Six unshielded badge dosimeters were placed around the OR, twelve skin-dosimeters placed around the pelvic, abdominal, thoracic and cervical area of the patient. 30 patients with scoliosis underwent a total of 102 high definition spins. Radiophysical department analysed the badge and skin dosimeters.

Results: 448 screws were placed from T3 to the sacrum. No intraoperative complication. Badges 3 to 5 meters from the gantry the radiation was minimum. Skin dosimeters dose when performed 1 high-definition spin was 5.8mSv, when performed 2 high definition spin was an average of 10.9 mSv. We calculated the dose for the uterus and ovaries being in between 0.6-0.7 mGy, and for testicles being 0.0022 mGy. There was a value calculated for each organ in the area of exposure

Conclusions: Radiation scatter from CBCT was not an issue neither for the surgeon nor the surgical team when placed not adjacent to the gantry. Though radiation exposure to the patient might be of certain amount as a global value, when analysed separately to each organ, the values are below the average exposure year-around humans get from the environment. These values should be statistically control with the benefits of proper screw placement.
**Audit on the effectiveness of a new orthopaedic spinal on-call rota**

Main Author: Adam Way  
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**Background Context:** In a District hospital spinal conditions are primarily assessed by the general Orthopaedic team. It is quite uncommon to have a dedicated spinal surgery on-call in a district hospital and there are no published literatures in this regard.  

**Purpose:** A retrospective analysis assessing whether there is improvement in patient pathway after the introduction of a Spinal on-call rota.  

**Study Design/Setting:** Retrospective analysis  

**Patient Sample:** We compared the data from 2010 (342 patients) prior to the start of the rota with 2012 (325) when the rota started.  

**Outcome Measures:** The readmission rates, length of stay, Time to intervention and the impact on the general orthopaedic take were assessed.  

**Methods:** Rota consisting of 4 Consultant Orthopaedic Spinal Surgeons was introduced. During the whole week between 8am to 8pm one of the Consultants would be available. Patients referred with spinal conditions were seen by the junior doctors covering general orthopaedic on-call and were discussed with the Spinal consultant. Patients presenting out of these hours were managed by the general orthopaedic on-call team and referred on to the spinal team the next day.  

**Results:** There was no significant difference in terms of the readmission rates. The average length of stay was reduced to half. The number of patients who had interventions quadrupled from 22% in 2010 to 86% in 2012.  

**Conclusions:** With the introduction of the spinal rota we were able to streamline the patient pathway and reduce the burden on the general orthopaedic team. We will need to do a re-audit using prospective data to see the consistency of the outcomes.

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**Comparing SPECT CT scan with other radiological modalities in diagnosing adult spinal pathologies**

Main Author: Julian Leong  
Co Authors: Mathew Sewell, Adam Benton, Johnson Platinum, Sean Molloy  
Affiliation: Royal National Orthopaedic Hospital, Brockley Hill, Stanmore, Middlesex HA7 4LP  

**Background Context:** Single-photon emission computed tomography (SPECT) CT has led to new possible application in spinal surgery.  

**Purpose:** This study aims to evaluate the value of SPECT CT scan in adult spinal pathologies, when compared to MRI and plain CT.  

**Study Design/Setting:** Retrospective study, single institution, single surgeon  

**Patient Sample:** All patients who had SPECT CT scans between 2010 and 2013  

**Outcome Measures:** Radiologist reported diagnoses in plain CT, MRI and SPECT CT  

**Methods:** Clinic letters, radiology reports were examined. Radiology diagnoses were coded by 3 fellowship trained spinal surgeons.  

**Results:** 314 SPECT CT scans were reported, 37 cases excluded for poor data. Of the 277 cases, the average age was 53 (17 – 87), 64% were for degenerative disease, 24% for adult deformity and 8% for trauma. 22% presented with neck pain, 16% with thoracic pain and 76% with lower back pain. 34% had previous surgery, the majority were instrumented spinal fusion.  

SPECT CT reported significantly more facet degeneration (161 vs 73), unhealed fracture (13 vs 6), pseudarthrosis (22 vs 3), costotransverse joint (11 vs 2), sacroiliac joint pathology (29 vs 1), and metalwork loosening (4 vs 0) than MRI. Compared to CT scan, SPECT CT reported fewer disc degeneration (121 vs 141), active pars fracture (8 vs 23) and sacroiliac joint pathology (29 vs 40). Agreement in diagnosis between SPECT CT and MRI was poor, 66% and 56% agreement was found for disc and facet pathologies respectively.  

**Conclusions:** SPECT CT complements existing imaging modalities for diagnosis of spinal pathologies, further work needs to be done to correlate with clinical outcomes.
The British experience of pedicle screw insertion using the O-Arm® imaging system and StealthStation® navigation system

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Co Authors: S Aftab, JS Butler, V Balaji, L Wilson, R Lee, S Molloy
Affiliation: Spinal Deformity Unit, Department of Spinal Surgery, Royal National Orthopaedic Hospital, Stanmore, Middlesex

Background Context: Rates of pedicle screw malposition using freehand or 2D X-ray guidance vary from 6.1 to 15%, with 0.1% experiencing permanent neurological compromise. Pedicle screw malposition rates are significantly lower with 3D navigation technology, ranging from 2% to 6%, with a lower re-operation.

Purpose: To assess the safety and accuracy of a navigation system.

Study Design/Setting: A retrospective study was undertaken over a 2-year period.

Patient Sample: All cases where O-arm® and StealthStation® systems were used.

Outcome Measures: The primary outcome measure was return to theatre rates for pedicle screw malposition.

Methods: Data collected included age, sex, pathology (degenerative, deformity, trauma, tumour), nature of surgical intervention, levels and number of levels, complications, screw malposition, immediate and late return to theatre for re-operation. Data was compared to the local rates of symptomatic pedicle screw malposition requiring return to theatre where 3D navigation was not used and compared to established literature.

Results: A total of 938 screws were inserted (934 thoracolumbar and 4 cervical), and 103 patients underwent spinal fixation using O-arm® and StealthStation® navigation. 73 were female and 30 male. The average age was 52.5 years. Sixty-four were revision cases and 39 primary cases. The average number of levels was 4.6. The distribution of pathology was as follows: 26 deformities, 63 degenerative, 1 infection, 6 trauma and 6 tumour. There were a total of 10 complications: 3 infections, 1 DVT, 1 PE, 1 fast atrial fibrillation (AF), 1 screw malposition, 1 non-union, 1 undisplaced vertebral body fracture and 1 nerve root compression following osteotomy. The percentage return to theatre for screw malposition using 3D navigation was 1% of patients and 0.1% of pedicle screws. No patients developed permanent neurological compromise.

Conclusions: Our experience of the O-arm® imaging system with the StealthStation® navigation system is in keeping with the world literature. The authors believe that these systems provide accuracy that is comparable to traditional 2D fluoroscopic techniques previously utilised in our institution. Based on our experience we advocate their use in the safe insertion of pedicle screws in complex revision deformity cases where original anatomical landmarks are absent or obscured. We also believe that radiation exposure is considerably less with navigation especially in these complex and revision cases.
Friday 20th March 2015

KEYNOTE SPEAKER
Marco Sinisi
‘Early and late surgical reconstructive possibilities in neurological disorders of the upper and lower extremities’

Traction injuries of the brachial plexus and lumbo-sacral due to severe trauma can lead to intradural lesions.

In the cervical lesion an avulsion is the form in which these lesions occur whilst in the lumbo-sacral lesion it is more often a rupture of the cauda equina.

The surgical repair of these lesions has been shown to be possible in some selected cases.

In the brachial plexus avulsion re-implantation into the spinal cord by means of nerve grafts has been performed. In intradural ruptures of the cauda equina some patients had been treated by nerve grafts from the proximal stump of the root to the femoral, sciatic and gluteal nerves. Recovery of basic upper and lower extremities can be obtained.

Muscle transfers can achieve functional recovery in less severe lesions of the peripheral nervous system. The requirements and techniques of reconstructive surgery are discussed.

KEYNOTE SPEAKER
Joost van Middendorp
‘The effects of the timing of spinal surgery after traumatic spinal cord injury’

The debate over the effects of the timing of surgical spinal decompression after traumatic spinal cord injury (tSCI) has remained unresolved for over a century. In a recent systematic review of studies evaluating the effects of the timing of spinal surgery after tSCI were searched for and a 15-item, tailored scoring system was used for assessing the included studies’ susceptibility to bias. Random effects and quality effects meta-analyses were performed. Models were tested for robustness using one-way and criterion-based sensitivity analysis and funnel plots. Results are presented as weighted mean differences (WMDs) and odds ratios (ORs) with 95 per cent confidence intervals (95% CIs). A total of 18 studies were analyzed. Heterogeneity was evident among the studies included. Quality effects models showed that – when compared to ‘late’ surgery – ‘early’ spinal surgery was significantly associated with a higher Total Motor Score improvement (WMD: 5.94 points, 95% CI:0.74,11.15) in 7 studies, neurological improvement rate (OR: 2.23, 95% CI:1.35,3.67) in 6 studies and shorter length of hospital stay (WMD: -9.98 days, 95% CI:-13.10,-6.85) in 6 studies. However, one-way and criterion-based sensitivity analyses demonstrated a profound lack of robustness among pooled estimates. Funnel plots showed significant proof of publication bias. In conclusion, despite the fact that ‘early’ spinal surgery was significantly associated with improved neurological and length of stay outcomes, the evidence supporting ‘early’ spinal surgery after tSCI lacks robustness as a result of different sources of heterogeneity within and between original studies. Future directions in acute, surgical tSCI research will be discussed during the lecture.
KEYNOTE SPEAKER
Michael Fehlings
‘Spinal Cord Injury management and prospects on the horizon’

The management of spinal cord injury (SCI) has changed dramatically in the last 25 years. These changes have been fuelled by advances in medical management, surgical techniques and rehabilitation approaches 1. Moreover, considerable advances have occurred in our knowledge around the pathobiology of SCI, including a delineation of the critical role of ischemia in initiating the cascade of biomolecular events known collectively as the secondary injury.

This talk will discuss current medical and intensive care management of injury and current concepts in the role and timing of surgical decompression and reconstruction, with particular emphasis on the STASCIS trial 2. The current status of neuroprotective therapies will be examined with particular emphasis on the RISCIS trial 3,4, which is examining the potential role of the sodium-glutamate blocker riluzole in SCI.

The talk will also include a discussion of potential regenerative therapeutics such as neural stem cells 5, bioengineered strategies to bridge the lesion and approaches to counteract intrinsic inhibitory molecules such as Rho. Particular emphasis will be placed on the Cethrin trial of a recombinant Rho protein antagonist 6 for severe SCI.

01  Statistical significance of MRI in detection of chance type fractures of thoracolumbar vertebrae

Main Author  Khalid Hasan
Co Authors  Abdul Moen Baco, Shakeel Ahmed Malik
Affiliation  Hamad General Hospital, Hamad Medical Corporation, Doha, Qatar

Background Context  Chance type fractures, as defined by G Q Chance in 1948, is a flexion-distraction type injury of the spine. There is high suspicion of ligamentous injury on initial X-Rays and CT scan if there is anterior wedging exceeds 40 – 50%, inter-spinous distance widening of more than 20% or vertebral body translation. In case of ligamentous Injury, about half of all patients treated non-operatively will have poor outcomes. Intraoperative finding of ligamentous injury is the gold standard. Although MRI is considered a reliable diagnostic tool for detection of injury to posterior ligamentous complex but limited studies are available that evaluate the correlation statistically.

Purpose  Quantitatively assess the statistical significance of MRI in detection of suspected Chance type fractures of the thoracolumbar spine.

Study Design/Setting  All patients with thoracolumbar vertebral fractures that were operated at HGH, Doha, Qatar from January 2011 to January 2014 were retrospectively assessed. Intraoperative results and reported MRI were used for simple statistical calculations.

Patient Sample  Non purposive sampling (All eligible patients)

Outcome Measures  Sensitivity, specificity, positive predictive value, negative predictive value

Methods  Simple statistical calculations for the outcome measures mentioned above were done along with 95% confidence interval calculation

Results  
- Sensitivity 72.73 %
- Specificity 100 %
- PPV 100 %
- NPV 88.89 %

Conclusions  MRI is not a sensitive indicator for detection of ligamentous injury in Chance type fractures of thoracolumbar vertebra and a positive finding of ligamentous injury on preoperative MRI is highly predictive of injury to the posterior ligamentous complex.

02  Imaging detection of adjacent ligamentous injury associated with traumatic cervical spine fracture: implications for treatment

Main Author  Basem Awad
Co Authors  Margaret Carmody, Daniel Lubelski, Mohamed El Hawi, Jeffry Claridge, John Como, Thomas Mroz, Timothy Moore, Michael Steinmetz
Affiliation  Neurological Surgery Department, Mansoura University School of Medicine, 100 Al Gomhorrea Street, Mansoura, 35516, Egypt

Background Context  MRI is a vital tool for detection of soft tissue injury (STI) following cervical spine injuries (CSIs). However, high cost, prolonged imaging time, and limited use in hemodynamically unstable patients necessitates that the utility of MRI on all CSI patients be scrutinized.

Purpose  Develop guidelines for when MRI imaging should be performed in CSIs.

Study Design/Setting  Retrospective study.

Patient Sample  Patients treated for CSIs at a Level I trauma centre

Outcome Measures  Identify STI for each cervical spine fracture type and level, determined on screening CT.

Methods  Patients demographic, fracture characteristics, associated STIs were collected. STIs were further classified into: same level ligamentous injury, adjacent level ligamentous injury (ALLI), cord contusion, and traumatic herniated disc. ALLI was defined as anterior or posterior longitudinal ligament, ligamentum flavum, supraspinous or interspinous ligamentous injury.

Results  MRI was performed on 240/787 patients. Evidence of soft tissue injury was identified in 54.6%. ALLI was the most common STI-(80/240), which were then subdivided to either above, below or both above and below the concurrent fracture level. Patients with ALLI were significantly more likely to have injured C3-(p<0.01) and C5-(p<0.03), association with widened disc space-(p=0.03) and multiple CSI-(p=0.008). Respectively, 100% and 87% of patients with ALLI only above and only below had the whole ALLI included in the fixation strategy.

Conclusions  MRI found an associated soft tissue injury in about 55% of imaged patients. Multiple fractured cervical levels, fractures at C3 and C5, and widened disc space should all raise the treating physician’s level of suspicion for ALLI. Our data shows MRI directed treatment has substantial value.
### Patient and surgeons’ safety in spinal surgery: evaluating factors influencing the amount of radiation exposure in selective nerve root blocks

**Main Author**  
Ayhan Umar

**Co Authors**  
Sejung Park, Agniva Banerjee, Himanshu Sharma

**Affiliation**  
Peninsula School of Medicine & Dentistry

**Background Context**  
Selective Nerve Root Blocks are important and common interventional procedures done by spinal surgeons. Currently, there are no guidelines for spinal diagnostic and therapeutic procedures regarding acceptable range of radiation exposure.

**Purpose**  
Evaluate local radiation doses & screening times for Selective Nerve Root Blocks (SNRBs) and factors influencing radiation exposure.

**Study Design/Setting**  
Retrospective review of patients of a single surgeon

**Patient Sample**  
78 patients, 40 males and 38 females with a mean age of 58.6 years. The level of nerve root blocks were L3(6), L4(7), S1(6) and L5(61)

**Outcome Measures**  
Radiation dose in mGycm2 and duration of exposure

**Methods**  
78 Selective Nerve Root Blocks done under care of single spinal surgeon (HS) were reviewed. This included single & two levels nerve root blocks. Data were collected regarding radiation dose area product (DAP) measurement, screening times and third-quartile values used to establish DRLs.

**Results**  
The median dose of radiation was 685-mGycm2, mean duration of exposure was 13.21 seconds. Further analysis was done on higher radiation values between first and third quartiles of the distribution and various factors affecting amount of exposure with regard to age, gender, BMI, level of SNRBs, bilaterality, reproduction of characteristic pain on table, radiographers’ experience.

**Conclusions**  
Radiation exposure in selective nerve root blocks has minimum variation. Patients with obesity or difficult anatomy incurred larger radiation doses and increased screening time. Local diagnostic reference levels (DRLs) was established by collecting radiation dose & screening time data. We recommend that all spinal units in the UK evaluate their own DRLs and help in establishing national guidelines for fluoroscopy-guided SNRBs.
Metastatic spinal deposits or bovine tuberculosis infection?

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Background Context  Non-invasive bladder tumours have been treated with resection followed by intravesical Bacillus Calmette-Guerin (BCG) instillation since 1976. It is believed to exert its anti-tumour activity via local modulation of immune responses, which results in inflammation and subsequent elimination of malignant cells. Orthopaedic complications of this therapy are uncommon and include myco-bacterial osteomyelitis and reactive arthritis. There have been 5 previous published cases of spinal disc infection following BCG treatment making it a very rare complication.

Purpose
Study Design/Setting
Case Report
Patient Sample
Single Case
Outcome Measures
Methods  This case describes a 77 year old gentleman presenting to the spinal services with 10 months of back pain. 1 year previous to this onset he had undergone 3 intravesical Bacillus Calmette-Guerin (BCG) therapy for a bladder tumour following a transurethral resection. An MRI was arranged which showed Lesions at L1 involving the L1/2 disc, T12 involving the T11/12 disc and the T8/9 disc initially thought to represent multiple metastases. After discussion at the Multidisciplinary team meeting was thought to represent either multi-level infection or multiple level metastatic disease.

Results  A right transpedicular L1/2 biopsy was undertaken and samples sent for histological analysis. The samples taken did not show any evidence of malignancy but did show the presence of acid fast bacilli (mycobacteria) subsequent culture of the samples confirmed these to be BCG sensitive to Rifampicin, Isonaizid, Ethambutol but resistant to Pyrazinamide. The patient was therefore given a diagnosis of ‘BCG discitis’ was made and treatment with Rifinah (rifampicin and isoniazid) Ethambutol and Pyridoxine started. The patient has had significant improvement in symptoms with this therapy.

Conclusions  Spinal complications of intravesical BCG therapy are rare. Metastatic diseases spreading to the spine are much more common and the initial assumption after the multi-level pathology was that this represented metastatic disease. This case is important in highlighting that while rare BCG infection should be considered in patients who have spinal pathology after intravesical BCG therapy. Previous cases have assumed haematogenous spread. Interestingly, during the therapy course this patient's treatment had to be stopped due to prostatic symptoms after failed catheterisation for which he underwent a transurethral resection of the prostate, biopsy taken at this time showed a benign prostatic disease but also the presence of mycobacterium. Giving us a clear pathway for the haematogenous spread to the spinal circulation, the traumatic difficult catheterization allowed the inoculation of the prostate with the BCG mycobacterium which is supported by its presence in the biopsy tissue. The circulation of the prostate is well known to anastamose with the spinal circulation providing a route for haematogenous spread. In Summery this interesting and rare case Highlights the need to include iatrogenic mycobacterial infection as a differential for spinal metastases in this group of patients and also clarifies and supports a method of haematogenous spread.
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**07 Safety of stand-alone zero p device in anterior cervical decompression and fusion**

**Main Author**  
Manoj Khatri

**Co Authors**  
Lee Hoggett

**Affiliation**  
The Lancashire Teaching Hospitals NHS Trust, Preston

**Purpose**  
To assess the safety of Zero Profile Interbody fusion (Zero P) device in Anterior Cervical Decompression and fusion (ACDF) for degenerative cervical stenosis.

**Study Design/Setting**  
Retrospective review of clinical records and images

**Patient Sample**  
89 consecutive patients treated with Zero P interbody device from September 2009 to September 2012

**Methods**  
89 consecutive patients treated with Zero P interbody device from September 2009 to September 2012 were included in this retrospective study. Inclusion criterion: degenerative cervical stenosis with myelopathy, persistent radiculopathy after at least 3 months of failed conservative management. Exclusion criterion: Paediatric population; patients with infection, metastatic disease and trauma. There were 39 females, 50 males with mean age of 55 [ranging from 24 to 84 years] 56 (64%) had surgery at 1 level, 31 (35%) at 2 levels, 1 (1%) at 3 levels. Total number of levels operated were 121. Common levels operated were C5/6 (62%) and C6/7 (47%). Majority were operated due to radicular symptoms, 56 (64%) had radicular symptoms, 28 (31%) had myelopathy and 5 (5%) Myeloradiculopathy

**Results**  
All had a minimum of 6 months follow up (maximum 2 years). No patient had cage subsidence or extrusion. 1 had superficial infection which settled with antibiotics, 10 (11%) had dysphagia which settled in 6 to 12 weeks

**Conclusions**  
Our study demonstrates that ACDF with Zero P can be considered a safe option in management of patients with cervical degenerative stenosis. We would also recommend a prospective randomised study as a follow on to this retrospective study. Preoperative kyphosis or lordosis did not change the outcome or make the surgical technique any more difficult, hence this implant can also be used in these circumstances

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**08 Early experience with cervical endoscopic spinal surgery (CESS): a potential adjunct to ACDF/disc arthroplasty**

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**Background Context**  
HD camera technology has significantly improved endoscopic image quality, allowing safe disc resection from the cervical spinal canal. However, direct percutaneous approaches to the spine may be associated with neurovascular damage.

**Purpose**  
To determine short-term outcomes following CESS using an antero-lateral mini-open approach.

**Patient Sample**  
Nine consecutive patients (4 male and 5 female; mean age 55yrs) with a disc prolapse and neuralgia underwent CESS either as an isolated procedure (6) or in combination with ACDF (3). In single-level procedures a mini-incision was placed with just sufficient access to allow safe guide-wire placement. Marginal bone osteophytes were reamed.

**Outcome Measures**  
VAS and Neck Disability Index scores were logged onto the British Spine Registry.

**Results**  
All patients recovered well from surgery and those without an ancillary fusion were discharged same day. Discs were resected at C3/4 (2), C4/5 (1), C5/6 (5) and C6/7 (2). Neck pain VAS decreased from 6.6±1.6 pre-op to 1.6±2.1 at 3 months and pain in the most affected arm from 6.7±1.9 to 0.4±0.7 (p<0.001). NDI scores decreased from 33.2±19.6 to 9.4±11 (p<0.002). Two patients developed minor hoarseness; there were no other complications. At median follow-up of 6.6 months there have been no revision procedures.

**Conclusions**  
CESS was performed safely using a mini-open approach for single level disease. Visualisation allowed safe resection of disc material and the PLL if necessary. CESS may reduce the need for ACDF/disc arthroplasty at multiple levels by its use at levels adjacent to those with severe disease.
09  Minimally invasive anterior screw fixation for odontoid peg fractures – feasibility, outcomes and complications

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Co Authors  Kaushik Ghosh
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Background Context  Optimum management of Type II odontoid fractures remains controversial.

Purpose  To discuss the feasibility of surgical treatment of type II odontoid fractures with anterior screw fixation, its outcomes and complications in a single UK centre.

Study Design/Setting  Retrospective review in a single centre


Methods  Demographic details, mechanism of injury, presenting features, pre- and post-operative scan findings, complications and length of hospital stay were noted from records and scans.

Results  Fifty-four patients (M:F=23:31), age range 21-95 years (mean-72.5) underwent anterior screw fixation in the study period. All patients had neck pain, two had neurological deficits. Forty-eight patients were followed up for 3-18 months. Pre-operative scans showed a mean slip of 4.7 mm, sagittal angulation of 14.5 degrees and coronal angulation of 3.7 degrees. Post-operative scans showed a mean slip, sagittal and coronal angulation of 1.9 mm, 8.3 and 2.05 degrees respectively. More than 90% patients had improvement in neck pain. Forty-five patients (93.6%) had good stability at follow up. One patient needed posterior stabilisation. There was no correlation between extent of deformity correction and clinical outcome, including complications such as dysphagia and chest infections.

Conclusions  Anterior fixation of odontoid fractures can be achieved by minimally invasive techniques in spite of displacement or angulation of fracture fragments. Overall stability rate was more than 90% in the form of bony or fibrous union.

10  The Cumbria Spinal Service– 5 year audits of micro-discectomy and micro-decompression

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Background Context  In 2008 Cumbria Orthopaedic Surgeons ceased spinal surgery meaning no local provision was available. Spinecare UK negotiated a contract providing surgeon led triage Clinics in 3 NHS locations in Cumbria.

Purpose  To demonstrate a private company can provide a high quality service with audited outcomes of micro-discectomy and micro-decompression.

Study Design/Setting  Patients listed for lumbar decompression or microdiscectomy were assessed preoperatively and then followed up 12 months post-operatively

Patient Sample  326 Spinecare records of patients who underwent a lumbar decompression or micro-discectomy between 2009-13 were analysed.

Outcome Measures  3 outcome measures were used: Oswestry Disability Index Score (ODI); Pain Analogue Score and patient satisfaction

Methods  277 patients were contacted 12 months post-surgery and the post-operative ODI, pain and satisfaction scores were recorded and compared to pre-operative data.

Results  Decompression patients showed a mean ODI improvement (12%) and 3.0 point pain scale reduction. Micro-discectomy patients showed a mean ODI improvement (22.4%) and 4.3 point pain reduction.

Low complication rates (5.4% Dural tears, 1.4% infection) and complications did not adversely affect outcome. 97% of patients were either satisfied or highly satisfied with their level of care and post-operative outcome.

Conclusions  Patients showed a highly significant improvement in ODI and pain reduction one year post surgery with a low rate of surgical complication and high level of patient satisfaction. Spinecare with the support of local facilities provides a high quality service with robust audit data. We continue to provide this as sub-contractor to Spire Healthcare.
11 Microdiscectomy – a day case audit

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Background Context: Standard discectomy for lumbar disc prolapse is associated with significant surgical morbidity and prolonged recovery. In comparison, micro discectomy involves less surgical dissection and rapid recovery. As a day case procedure, it reduces hospital stay and it is cost-effective.

Purpose: To assess the functional outcome and pain relief post micro discectomy for lumbar disc prolapse performed as a day case procedure in adults (between the age of 20 to 45).

Study Design/Setting: Retrospective Study

Patient Sample: Patients with backache and leg pain with MRI evidence of lumbar disc prolapse between the ages of 20 to 50 were included in the study. All cases were performed as a day case.

Outcome Measures: Oswestry disability index and Visual analogue Pain scale

Methods: Retrospective review of the 50 micro discectomy cases that underwent micro discectomy as a day case. Preoperative and postoperative visual analogue pain scale and Oswestry disability index were recorded to see functional improvement and pain relief.

Results: Results showed that average pre-op Oswestry disability index was 82 and a visual analogue pain scale in the lower limb was in the range of 8-10. Postoperatively, average Oswestry disability index was 17 and visual analogue pain scale improved in more than 80% of patients to no leg pain or minimal discomfort (VAS 0-1).

Conclusions: Micro discectomy has more than 80% success rate in terms of functional outcome and pain relief when performed as a day case.

12 Pre-operative high body mass index has no effect in clinical outcome of lumbar spine surgery

Main Author: Athar M Siddiqui
Co Authors: Naffis Anjarwalla, Faiza Asmat
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Background Context: Patient with high BMI appears to have increased post-operative complications in form of SSI, Urinary Complications, increased anaesthetic/operative time and need for post-op Blood Transfusion. Established in literature following lumbar spinal surgeries. This gives a general perception that it is related to poor patient functional outcome as well.

Purpose: To look at the functional outcome comparing post-operative ODIs at 6–12 months follow-up after creating obese and non-obese categories.

Study Design/Setting: Retrospective Cohort Study

Patient Sample: 131 total. 19Discectomies/ 51 Decompressions/ 44 Fusions/ 17 Revisions.

Outcome Measures: Outcome measures were calculated by comparing post-operative mean ODIs in two groups as well as SSIs (percentage), Average operative time, Need for post op Blood Transfusion (percentage) in each group.

Methods: Data accumulated retrospectively Sep 2010 – November 2013 (from available data) for patient’s undergone lumbar spinal surgeries. 4 groups (discectomy/decompression/fusion and revision surgery) were created. Each group is then subsequently subdivided into non-obese and obese category using BMIs above or below 30. ODIs/SSI up to 30 days from the date of surgery requiring oral or IV antibiotics or washout. Operative time and need for blood transfusion post-operatively is been looked at using patient records in all 4 groups.

Results: Postoperative complication rate were higher in obese group each category but no significant difference was found in postoperative ODIs of obese vs non-obese category in all 4 groups. P-value <0.05 for cumulative data is statistically significant.

Conclusions: Increase BMI although is related to increase post op complication but not to poor functional outcome at medium term follow up.
Transforaminal interbody fusion of the lumbar spine – unilateral approach with contralateral percutaneous transfacet-tranpedicular screw fixation is it enough to secure positive outcome of minimal approach fusion?

Main Author: Andrew Wojcik
Co Authors: Petros Bountogannis, Zaid Sharif
Affiliation: Hinchingbrooke Hospital NHS Trust

Background Context: The results of conservative surgical interventions on lumbar spine were presented in numerous studies. The main indication for surgical intervention was chronic symptoms of back pain and leg pain with clear radicular component on clinical examination confirmed with radiological findings. In our experience patients following conservative posterior approaches for fusion required longer time of recovery, more intense postoperative pain control, more significant blood loss perioperatively.

Purpose: To introduce less extensive surgical approach in treatment of degenerative conditions of the lumbar spine; to minimise soft tissue damage comparing with open conservative approaches, to benefit from shorter postoperative recovery of the patients.

Study Design/Setting: Studies were based on clinical material assessed pre-operatively and post-operatively with outcomes criteria: ODI, VAS, Rolland-Morris, SF36. Patients were qualified for treatment depending on chronicity of their symptoms, lack of response to conservative and physiotherapy treatment for 18-24 months, radiological limits of degenerative condition involving one or two segments of the lumbar spine.

Patient Sample: 12 operated between 2011 -2014; age 22-55 years old. The main indication for surgical intervention was chronic symptoms of back pain and leg pain with clear radicular component on clinical examination confirmed with radiological findings. In five cases the technique was used for revision after earlier procedures. The period of postoperative follow-up 12-24 months.

Twelve patients were operated on one level (L4/5 or L5/S1), eight patients on both levels.

Patients with multilevel degenerative conditions, deformity, spondylolisthesis were eliminated from the group.

Outcome Measures: ODI, VAS, Rolland-Morris, SF36, radiological review

Methods: Preoperative and postoperative follow-up assessment based on questionnaires.

Radiological evaluation of outcome on changes affecting disc space and any signs of failing stabilisation.

Results: Minimal blood loss was observed during the procedure – 80 – 500 mls (mean 210 mls), time of surgery (3-6 hrs). Patients were mobilised following the procedure the next day, hospital stay 2-4 days.

Conclusions: The presented technique allows for selected patients to achieve expected results of decompression and fusion of operated levels, adding good pain control speedy recovery with short in-patient stay. The approach is technically demanding and poses in many cases challenge to a surgeon due individual anatomical characteristics of the patient.
## 14 Is there a seasonal variation of acute admissions for back pain

**Main Author**  
George Okwerekwu

**Co Authors**  
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**Affiliation**  
Royal Gwent Hospital, Newport

**Background Context**  
Some musculoskeletal conditions are influenced by the change in climate with symptoms worse in the cold damp winters but better in warmer weather. Anecdotal evidence has suggested that back pain may be worse in some patients during the colder months. To our knowledge no study has looked at weather there is an influence on temperature and rainfall on the admissions for back pain.

**Purpose**  
To assess whether colder and more damp weather conditions increase the admissions for back pain to a district general hospital

**Study Design/Setting**  
Retrospective review of a prospectively kept database

**Patient Sample**  
All consecutive patients entered in database since its start in 2004

**Outcome Measures**  
Rainfall and temperature

**Methods**  
We analysed the admissions for back pain since 2004 on a prospectively kept database with over 19000 patient admissions to a large district general hospital in the Welsh NHS and compared them with records of the weather during this time.

**Results**  
We identified 1161 patients who were admitted with exacerbation of back pain. We found that there was no correlation between month of admission and average temperature. We found that the average rainfall had no correlation between the admission levels seen. Peaks of admission were seen but these did not correspond with any dramatic change in weather climate.

**Conclusions**  
We conclude that due to the complex nature of what causes patients to suffer with back pain that there are many different influences. Whilst some patients may experience worsening of symptoms during these months this does not manifest itself across the whole population.

## 15 Spine Tango conservative treatment registry: implementation within a spinal outpatients department and early data analysis

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**Purpose**  
This study reports on the ongoing implementation of a data collection method using the Spine Tango Conservative tool (STCT) to input patient data in the Spine Tango Conservative online registry. The study also provides commentary on the challenges arising from its use in a hospital outpatient department

**Study Design/Setting**  
Implementation of a new standardised data collection tool and usage of an online data registry in a Spinal Outpatients Department

**Patient Sample**  
All new patients referred in to the osteopathy service within a spinal outpatients department

**Outcome Measures**  
Spine Tango Conservative Treatment, Oswestry Disability Index, Neck Disability Index, Euroqol – EQ5D, COMI Low Back, COMI Neck

**Methods**  
The STCT was used alongside compatible patient reported outcome questionnaires to build an enhanced data profile of patients attending a spinal outpatient department. Data were subsequently extracted to generate service specific clinical information. Pragmatic data regarding the implementation of the tool were extracted by manual analysis.

**Results**  
The developing database allowed for critical analysis and clinical audit of patient profiles and outcome measures following treatment. Data has informed referral criteria and guided clinical practice. Furthermore, it has revealed unexpected clinical outcome trends which require further investigation.

**Conclusions**  
The Spine Tango collection tools and registry provide versatile and detailed data regarding patient populations and outcomes, especially when used in conjunction with other appropriate outcome measures. Implementation of the STCT has created a database of outcome measures and patient profiles which allows for meaningful analysis. Though the registry is in its infancy, it has the potential of providing meaningful clinical data to enhance existing practice.
16 Do patient reported outcomes correlate with a patient’s expectation for lumbar back complaints?

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Background Context  Low back pain presents treating physicians with numerous challenges. The Hospital of Special Surgery, New York has produced a score to assess the patient’s expectations for lumbar spine surgery.

Purpose  To assess the concordance between patient expectations score and various patient reported outcome measures (PROMs).

Study Design/Setting  Prospective single surgeon study using private and NHS patient PROMs.

Patient Sample  Consecutive adult patients with lumbar spine complaints seen in the last year in the outpatient setting completed PROMs questionnaires.

Outcome Measures  HSS lumbar expectation score, EQ5D, VAS, ODI, GAD7, PHQ9, walking distance, disability benefit and previous spinal surgery.

Methods  There were 202 patients with an average age of 52.8 years (104 females and 98 males).

Results  There were no statistical differences between private and NHS patients except that no patients seen in the private sector received disability benefit. There was no correlation between the HSS lumbar expectations score and age, sex, previous surgery, private or NHS health sector, walking distance or GAD7. There was weak correlation with interruption of sleep (r=0.168; p=0.017), VAS leg (r=0.325;p=0.001), VAS Back (r=0.151, p=0.032), ODI (r=0.337, p=0.001), PHQ9 (r=0.182; p=0.012) and some sub-domains of the EQ5D (pain r=0.219; p=0.002; usual activities r=0.330, p=0.001).

Conclusions  Our results show that patient’s expectations correlated weakly with some but not all PROMs. The HSS lumbar expectation score may measure a new dimension and could offer a novel way of predicting outcome following lumbar spine surgery.

17 Facet joint injection role in spine surgery pitfalls and value of any long term benefits?

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Background Context  Back pain is always been a challenging problem to the Orthopaedic society, with so many conflicting pathological factors that can play a role, a more invasive approach might not be an ideal decision to have an optimum results, less invasive procedure like Facet joint injection can provide a valuable tool to refine or selection and can insure a good outcome, if further more invasive procedure will be needed.

Purpose  To introduce more appropriate approach in managing patients with back pain that have various causes and pathologies, that will minimizes complications and provide better assessment to these patients.

Study Design/Setting  Randomly selected patient who been treated with facet joint injection, have back pain and chose to go for less invasive procedure, have no urgent indication for more aggressive surgical procedure.

Patient Sample  101 patients underwent facet joint injection between January 2012 – May 2013 , 52 male 49 females with age range 27 – 91 average age 61 range of male patients 36– 91 average 58 range of female patients 27 – 90 average 66, 81 of our patients have back pain only 7 has back pain with sciatica, 13 back pain with root pain. Diagnosis, 50 of our patients have degenerative disc disease, 11 Spondylolisthesis, two with Scoliosis, 17 have Spinal stenosis, 21 with mechanical back pain, ASA grade 18 have ASA grade 1 , 54 have ASA grade 2 , 21 have ASA grade 3 and 8 have ASA grade 4.

Outcome Measures  Complication rate during after procedure were assessed 6 weeks, 3 months and 6 months pain score checked, need of surgery in the first year further referral to pain clinic, need further injections, no need any further spinal interventions.

Methods  Clinical outcome checked in clinic after the procedure in 6 weeks and three months and 6 months later, use of pain score system and patients satisfaction, as well as final outcome two years after the procedure.

Results  No intra or post procedure complication were recorded 70 of our patients noticed significant relief after 6 weeks and 34 had significant relief after 3 and 6 months after the procedure, 22 of our patient been discharged 18 of them had one injection per year and 4 had two injections 13 out of the 21 patient with mechanical back pain did not respond facet joint injections.

Conclusions  Facet joint inject is a safe procedure that can have an important role in Spine Surgery it can also can be a good technique to prevent unnecessary surgery, however it has to follow the proper guideline and indications.
**18**

**How not to get a bad back**

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**Background Context**  Traditionally, lifting is taught in lumbar extension but, in the author’s experience, is more comfortable and, therefore, stronger in flexion.

**Purpose**  To produce objective evidence to show that lifting is more comfortable in lumbar flexion than extension.

**Study Design/Setting**  57 subjects were asked to perform a maximal comfortable static lift in the stooped position with straight knees, then bent knees (as traditionally taught) and then lumbar flexion (backward pelvic tilt) using a computerised dynamometer (lbs/second) to record maximal load. These three static lifts were performed in different orders to compensate for possible variation due to fatigue/recruitment.

**Patient Sample**  49 patients undergoing physiotherapy for back pain and 9 physiotherapy staff were tested. Ages range from 20 to 84.

**Results**

- 52 of the 57 subjects lifted more in lumbar flexion. 43 were patients and 9 were staff, 3 of which had back pain.
- The increase in force lifted with bent knees compared to straight knees was 13%
- The increase in force lifted with lumbar flexion (pelvic tilt) compared to bent knees was 48%
- The increase in force lifted with lumbar flexion (pelvic tilt) compared to straight knees was 66%

**Conclusions**  These results support the empirical finding that patients can avoid provoking their back pain when lifting by flexing the lumbar spine and also lift more.

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**19**

**A report on the early results of the BacJac interspinous distraction device: a prospective study in patients with lumbar spinal stenosis**

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**Purpose**  This is a report on the early clinical outcome of the BacJac interspinous distraction device in patients with lumbar spinal stenosis.

**Study Design/Setting**  Prospective study

**Patient Sample**  21 consecutive patients

**Outcome Measures**  Visual Analogue Scores for leg pain, back pain, the Oswestry Disability Index, Zurich Claudication Questionnaire and walking distance.

**Methods**  This is a prospective study on a group of patients who underwent surgery from February 2010 to December 2012. There were 21 consecutive patients who had insertion of a BacJac. Data prospectively recorded Visual Analogue Scores for leg pain VL, back pain VB, the Oswestry Disability Index ODI, Zurich Claudication Questionnaire ZCQ and walking distance WD. Scores were recorded pre and post-operatively and at final review. The follow up period varied from 6 to 40 months.

**Results**  We found all clinical outcome measures improved following surgery. Mean scores for VL improved from 76 to 27, for VB from 49 to 24 and for ODI from 42 to 26 at final follow up. There were also improvements noted in ZCQ scores and patient-reported walking distance. We also noted a high rate of osteolysis (76%) around the implant at 1 year from insertion.

**Conclusions**  This small prospective study suggests that there is a role for the use of the BacJac interspinous distraction devices in selected patients. Osteolysis, around the implant remains an issue although this did not appear to compromise the early outcome in this study.
Outcome of primary lumbar discectomy in the military population

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Background Context: Lumbar disc prolapse could have a profound impact on military personnel. Very few studies have been published about the outcome of lumbar discectomies in this group of high demand patients.

Purpose: A retrospective study assessing the outcome with specific focus on return to military duties following lumbar discectomies.

Study Design/Setting: Retrospective analysis.

Patient Sample: 64 patients underwent lumbar discectomies from January 2006 to December 2009. 49 patients who had unilateral single or two level discectomies were included. The mean age was 35. 86% were men. 82% were in the Non-commissioned ranks. L5–S1 was the commonest level (61%).

Outcome Measures: We looked at the complication rates, length of stay, revision rates, further injection therapy and return to military duties.

Methods: Data was collected using clinical notes, electronic records, PACS and information from the local defence administrative office. Patients with degenerative spinal stenosis, bilateral discectomies were excluded.

Results: 2 patients had persistent postoperative dermatomal sensory deficits. One patient had pulmonary embolism. 4 patients underwent revision surgery. 20% needed further spinal injections. 29 patients are still serving and 10 have retired after completing their service. 10 patients (20.4%) were medically discharged due to ongoing back problems.

Conclusions: Our results were comparable with published studies on lumbar discectomies in military patients. 1 in 5 patients had to be medically discharged. But compared to the civilian population the demands are extremely high in the military personnel. Hence patients have to be warned during the preoperative consenting process about the possibility of an end to their military career. Further prospective study with more numbers would be useful.

Personalised daily aims boards reduce elective spinal surgery lengths of stay

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Background Context: Enhanced recovery pathways are now accepted best practice in elective orthopaedic surgery. Such pathways are multifactorial in their composition and here we focus on a single element within our own new Spinal Surgery enhanced recovery programme – the personalised daily aims board.

Purpose: To establish the impact a multidisciplinary patient specific daily aims board has on patient satisfaction and inpatient length of stay (LoS).

Study Design/Setting: An 8 week, “2 to the power 3 full factorial” study design was utilised to establish the individual and combined impact that daily aims boards had on a District General Hospital’s elective spinal surgery population.

Patient Sample: 56 consecutive elective spinal surgery patients over an 8 week rolling timeframe.

Outcome Measures: Reduction in Inpatient LoS, Patient service satisfaction questionnaires.

Methods: The aims boards were used in isolation, omitted entirely or used in combination with analgesia/patient diary interventions in a standardised sequence over an 8 week period. Satisfaction and LoS was recorded each week. Sequence replicated to account for patient heterogeneity.

Results: Daily aims boards in isolation reduce average LoS by 1 day. Patients deem them an excellent method of communication.

Conclusions: Personalised daily aims boards are a simple method of communication between patients and the MDT. They enable clear, individualised post-operative goal setting which in turn encourages patient activation and ownership of their recovery. Aims boards in isolation reduce an inpatient’s LoS by one day. Such boards can also be utilised in combination with other interventions to further reduce LoS and improve patient satisfaction.
Reported NHS statistics versus reality check on elective spinal surgery cancellations: what to believe, whom to blame & how to fix?

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**Background Context**
Elective surgery last minute cancellation remains a major issue for NHS both for financial reasons and for quality of health care services provided and patient satisfaction. According to NHS England statistics, the overall cancellation rate in the last two years was only 0.8%. Among the cancelled operations, only 4.2% of patients were not treated within 28 days.

**Purpose**
The aim of this study was to identify the reasons responsible for last minute cancellations for elective spinal surgical procedures and to provide problem-based solutions for strategic planning and improvement in theatre efficiency & utilisation.

**Study Design/Setting**
Elective theatre bookings and cancellations data were collected retrospectively from one spinal surgeon’s logbook between August 2012 and October 2014.

**Patient Sample**
The nature of the cancelled operation and the reason of the cancellation which were divided in three groups as suggested by NHS statistics were documented prospectively. The timeframe between the cancellation and the time of treatment was documented.

**Outcome Measures**
The reasons for cancellations were divided in three groups: Hospital non clinical, hospital clinical and patient reasons.

**Methods**
The total cost of these cancellations was calculated estimating that one theatre hour costs £1.000. The average time for a nerve root block booking was considered as half an hour, two hours for a decompression or micro-discectomy and four-five hours for instrumented fusion.

**Results**
There were a total number of 500 bookings for elective surgery and 77 cancellations. The mean rate of cancellation for each year was 14.6%. Hospital non clinical reasons accounted for the 68% of the cases, while in 20% it was a patient element that led to the cancellation and finally hospital clinical reason in 12%. The overall cost of these cancellations for this period of time was £186.000 and the yearly cost was £89.000. Regarding the 28 days target post cancellation, 20.7% did not meet this target due to emergency cases. One third of cases were due to recurring theme of lack of beds & over-running lists.

**Conclusions**
This study showed that actual reality is much different to reported figures in NHS statistics. Our cancellation rate (target 1%; real-15%) and 28 days criterion (target <5%; real 20%) was not met as per national NHS rates and guidelines. The most common culprit to blame was emergency spinal procedures. We increased theatre capacity as extended & Saturday lists to improve output as well as put patients as ‘standby’ on the list. Better patient-centred communication, reorganising theatre lists, robust pre-operative assessment, improving prioritisation of the patients who were cancelled once in order to avoid recurrence of same theme could reduce last minute cancellations.
**23** Role of printed consent form in lumbar spine surgery

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**Background Context** Data from NHS Litigation Authority demonstrated significant litigation burden on the NHS attributable to spinal pathologies and surgery. This finding could be attributable to patient dissatisfaction. Previous study had demonstrated poor rating of the written description of the planned operation was significantly associated with discontent.

**Purpose** The aim of this study is to evaluate whether the efficacy of the consent process and patient satisfaction could be improved by printing operative details, including the benefits and risks of lumbar spine procedures, onto standard Consent 1 form endorsed by the NHS.

**Study Design/Setting** Case-Control Study

**Patient Sample** Consecutive patients who underwent lumbar spine procedures performed by a single surgeon were included in this study.

**Outcome Measures** Patient Satisfaction

**Methods** Patients who received hand-written consent form and those who received printed consent form were asked whether they understood the information provided by the consent process and their satisfaction. Patients were also asked if they found any particular element in the consent process aid their understanding.

The time taken for the consenting session where the hand-written or printed consent form was signed were also analysed.

**Results** Overall patients were satisfied with the consent process with a trend towards printed consent form. Examples using real life objects appear to aid patients in understanding risks of spinal surgery. Time taken for the consenting session using printed consent form appear to be shorter with no ill effect on patient's understanding.

**Conclusions** Printed consent forms are useful in providing clear and legible information to patients undergoing spinal procedures, and may improve overall satisfaction.

**24** A retrospective cohort study of prevalence of modic changes following symptomatic lumbar disc prolapse

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**Background Context** Vertebral end-plate changes called ‘modic changes’ have been described in patients suffering from discogenic back pain

**Purpose** To retrospectively review a database of patients with symptomatic lumbar disc prolapse for the prevalence and type of modic changes in MRI scans done atleast 1 year apart

**Study Design/Setting** Database review

**Patient Sample** 213

**Outcome Measures** Imaging

**Methods** Consecutive patients with symptomatic lumbar disc prolapse and on a waiting list for lumbar discectomy were identified from the medical records of a regional spinal centre. Serial MRI scans taken atleast an year apart were reviewed and the presence of modic changes and its type were recorded.

**Results** 456 disc prolapse levels were identified from 213 patients. Modic changes were identified in 129 levels (28.3%) at diagnosis which increased to 167 levels (36.62%) at the minimum of 1 year follow-up. Among the changes noted, Type 2 was the predominant type (65.89%) followed by Type I (22.48%), mixed (6.2%) and Type III (5.43%) changes. At follow up, these changes persisted at 64.67%, 20.35%, 11.38% and 3.59% respectively.

**Conclusions** Symptomatic lumbar disc prolapse is associated with modic changes at vertebral end plates, the commonest of which are Type 2 changes, which also persisted to be at 1 year follow up scans
Factors which influence pain and function following lumbosacral decompression in patients aged 50 and over: a single centre experience

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Background Context: Lumbosacral decompression (LD) is a common procedure carried out in the management of degenerative spinal disease.

Purpose: Investigation into leg and back pain and disability following LD in patients >50

Study Design/Setting: Retrospective single centre study

Patient Sample: n=50

Outcome Measures: Difference in leg and back pain was assessed via the Visual analogue scale and function was determined via the Oswestry Disability Index

Methods: Pre- and post-operative clinic letters were used to collect data on age, gender, previous spinal surgery, single versus multiple level decompression, number of comorbidities, psychiatric diagnoses, smoking and alcohol use, osteoarthritis, obesity and duration of symptoms greater or less than 12 months. The data was analysed using IBM SPSS 21 statistics software, linear regression was carried out and a p value<0.05 was determined as significant.

Results: The median follow up was 12 weeks (6-24) however 4 patients were lost at follow up, this included 1 death of a cause unrelated to the surgery. The complication rate was 6% including 2 superficial wound infections and 1 episode of transient ischaemic attack. The median age was 67 (50-87). 44% (22/50) were male and 52% (28/50) were female.

Smoking history and previous spinal surgery were significant determinants of post-operative back pain (p=0.004 and 0.041 respectively). Duration of pain less than 12 months was significantly associated with greater improvements in back pain and function (p=0.028 and 0.048 respectively).

Conclusions: Smoking history, duration of pain and previous spinal surgery significantly affect long term outcomes following LD.
**Functional outcomes of microdiscectomy – does obesity affect early postoperative outcomes?**

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**Background Context**  
Lumbar Disc pathology remains one of the leading causes of back pain with a multitude of surgical options. Choosing the best management option remains a challenge for many practitioners due to the individualized needs and variables of each patient. Obesity poses a challenge to surgeons regarding anaesthesia, positioning and adequate exposure which required longer incisions. Studies showed that in selected patient population, microdiscectomy achieved favourable short and long term outcomes with most patients achieving a good to excellent recovery on Macnab Classification up to 10 years post operatively. Studies also showed that obesity was not associated with increased risk of herniated nucleus pulposus after microdiscectomy. However, increased BMI was associated with significantly increased estimated blood loss (EBL) and operative time without affecting the surgical outcomes such as length of hospital stay, recurrent disc herniation, and intraoperative durotomy.

**Purpose**  
The purpose of this study is to find out if the quality of life and pain are affected by BMI following microdiscectomy. The researchers are unaware of any similar studies.

**Study Design/Setting**  
This is retrospective and prospective study to evaluate patients who already have had microdiscectomy at Hamad general hospital by one team.

**Patient Sample**  
50 patients

**Outcome Measures**  
Patients were interviewed and Short Form 12 (SF-12) and Visual Analogue Scale (VAS) scores were obtained and compared between 2 group of BMI to their preoperative counterparts.

**Methods**  
Study subjects were identified through the microdiscectomy registry at Hamad Medical Corporation. 50 patients who had microdiscectomy over one year prior to the closure of the study were enrolled. The study population was divided into two groups according to their BMI. Group A had BMI less than 25 kg/m² while group B included those with a BMI equal to and above 25 kg/m². Patients’ medical records were reviewed for demographics, complications and radiographic findings. Patients were interviewed and Short Form 12 (SF-12) and Visual Analogue Scale (VAS) scores were obtained and compared to their preoperative counterparts.

**Results**  
Statistical analysis showed no significant differences in SF-12 or VAS scores between the 2 groups at one year follow up.

**Conclusions**  
In the early post-operative period, quality of life and pain following microdiscectomy is not affected by the patient’s BMI.
27 An audit of patient outcomes following lumbar spine decompression and dynamic spinal stabilisation (DSS) surgery

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Background Context Spinal fusion has been the gold standard of care for surgical treatment of degenerative low back pain for many years. Over the last three decades there has been increasing interest in motion preservation techniques in the treatment of degenerative low back pain.

Purpose To evaluate patient outcomes pre and post DSS surgery

Study Design/Setting A prospective study.

Patient Sample A series of 25 patients, 14 female, who underwent DSS by a single surgeon from 2008 to 2010.

Outcome Measures Pain VAS, Oswestry Disability Questionnaire, Roland and Morris Disability Questionnaire, Low Back Outcome score and Centre of Epidemiologic Studies - Depression

Methods A database recorded the patients undergoing DSS surgery at the above institution. The outcome measures were completed by the patient pre-operatively and were posted to the patients at 6, 12 and 24 months post-surgery with an SAE. Reminder letters were posted to those who did not return the questionnaires at 24 months. Data was analysed with SPSS version 17. The Wilcoxon signed-rank test was used for statistical significance p<0.05

Results Compared with preoperative assessments, statistically significant improvements were observed in the pain VAS (p<0.002), CESD (p<0.006), RMDQ (p<0.005), ODI (p<0.001) and LBOS (p<0.004) at six months post-operatively. Patients continued to maintain significant benefits at 12 months and at 2 years post operatively in pain, depression, disability and function scores

Conclusions Improved clinical results in pain, depression and functional scores were found following posterior dynamic stabilization without fusion applied to lumbar decompression.

28 Does the economy have an influence on back pain admissions?

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Background Context Back pain is a major source of disability. We have recently been through one of the toughest financial recessions of recent times and there has been an increase on the demands of the NHS and increased scrutiny of those patients who are receiving disability benefits.

Purpose The aim of this study was to identify if the recession had an effect on the number of admissions for back pain in a district general hospital in an economically deprived area.

Study Design/Setting Review of admissions from a prospectively kept database

Patient Sample All patients admitted with back pain to an acute orthopaedic take

Outcome Measures GDP and Inflation.

Methods We searched a prospectively kept trauma admission database for patients admitted with lumbar or back pain and identified 1161 patients

Results The database contains over 19468 admissions for the period between 2004-2013. We identified 11616 patients who were admitted over this period. The average pre-recession percentage of back pains admitted per annum (pa) made up 4% of the total trauma intake. Following the recession this increased to an average of 8% pa, peaking in 2013 at 9.7% pa.

When compared to the rate of inflation and the GDP we are able to see a clear trend, with the highest inflation rate and lowest GDP preceding the highest back pain admissions by a year.

Conclusions Multiple variables can be used to account for the increase in back pain admissions and the recession is one of them. The biopsychosocial model of healthcare behaviour is clearly reflected in these admissions.
**30 The vertebral tropism unit (VTU). Clinical importance of a novel spinal unit research model studying zygoapophysial joint tropism in the spine**

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**Background Context**  
Zygoapophysial Joint (ZAJ) orientation varies by less than 7° between the two sides, but if it exceeds 7° this is defined as tropism.

**Purpose**  
To study the effect of ZAJ Tropism through a new research model called Vertebral Tropism Unit (VTU) changing the reference point for exerted forces and studying the relationship between Tropism and pathologic fractures.

**Study Design/Setting**  
Retrospective double blind study

**Patient Sample**  
63 patients with pathological spinal fractures

**Outcome Measures**  
Physiologic Measures: MRI scans

**Methods**  
No funding was obtained and there were no conflicts of interest. The sagittal plane orientation of the ZAJ of 324 vertebrae in 63 patients were measured on MRI scans. All ZAJ were stratified into lumbar and thoracic, fractured and non-fractured, and then classified according to the presence of tropism. The correlation between tropism and fractures, demographics pertaining to age, spinal level, and morbidity were studied.

**Results**  
From the 415 ZAJ pairs studied, 23 were excluded because of insufficient imaging leaving 388. In 155 Thoracic ZAJ pairs, there were 92 with a fracture, 39% demonstrating tropism; and there were 63 with no fracture, 43% demonstrating tropism. In 237 Lumbar ZAJ pairs, there were 144 with a fracture, 73% demonstrating tropism; there were 93 with no fracture, 42% demonstrating tropism.

**Conclusions**  
Our study suggests the VTU model identifies a correlation between the emergence of pathological fractures in the spine and tropism which is statistically significant and clinically important.
Morphometric measurements of the pedicles in the spondylolisthesis

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Background Context: Symptomatic lytic spondylolisthesis is treated by spinal stabilization. We believe that in lytic spondylolisthesis the pedicle anatomy is different from the normal.

Purpose: To analyse the morphometric characteristics of the lumbar spine pedicles.

Study Design/Setting: Descriptive comparative observational study at a regional tertiary spinal unit.

Patient Sample: Patients with spondylolisthesis treated at the regional spinal referral centre and were compared with age matched cohort of randomly selected patients without listhesis.

Outcome Measures: Radiological measurements.

Methods: Radiological measurements including the transverse and vertical height of the pedicle, sagittal angles were compared with the normal population without the defect. Patients with incomplete scans were excluded.

Results: A total of 40 patients were eligible to participate in the current study with equal distribution in the both groups. The control group was age and gender matched to the patient cohort. In all the measurements the pathological cohort had the smaller size pedicles compared to the control group. The average width of L4 and L5 pedicles is 9.8mm and 11.2mm respectively (p<0.001), similarly the vertical height of L4 and L5 are 9.4 and 10.5 mm respectively. The sagittal angles of L5 and L4 were 60.7 and 63.5deg respectively (p<0.012).

Conclusions: The current study high lights and stresses the importance of the variable anatomy in this cohort of patient group and needs to be taken into account while performing spinal stabilization as the pedicle of the isthemic listhetic vertebra is narrow and is medially directed.
**32** Patient Reported Outcome Measures: comparing PROMs data across a variety of spinal operations

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**Background Context** The aim of spinal surgery is to improve patient quality of life, alleviate pain and promote improved general health. PROMs quantify a patients perceived health status, functional status and health-related quality of life at a particular moment in time, and are increasingly being used in the NHS to stratify and compare patient health. PROMs are assessed through standardised patient surveys e.g. SF-36, which presently is the recommended outcome measure for spinal disorders. PROMs may aid a surgeon in improving patient quality of life beyond assessing patient health on a case-to-case basis. It may be used to compare patient outcomes between operations allowing inconsistencies to be identified.

**Purpose** To determine whether there was any difference in PROMs between a series of varying spinal operations. In addition patient satisfaction with various PROMs was assessed.

**Study Design/Setting** Observational study. Hull Royal Infirmary, Hull and East Yorkshire Hospitals NHS Trust.

**Patient Sample** 115 patients who had undergone spinal operations. These patients had a baseline and 1 year follow-up score of the SF-36

**Outcome Measures** Self-report measures: Pre-operative and post-operative SF-36 scores

**Methods** A total of 115 patients were stratified into 12 operation subtypes. Patients received a written questionnaire, the SF-36, comprising 36 validated questions assessing patient quality of life through 8 substratified outcome measures relating to physical and mental health. These were: physical functioning, physical health, emotional health, energy/fatigue, mental health, social functioning, pain and general health. After a period of 1 year patients received a second, identical SF-36. Responses were transformed into a scale between 0% (no disability) and 100% (maximum disability). Operation subtypes were then compared within each substratified outcome measure and inconsistencies identified. No funding obtained. No conflict of interest.

**Results** Post-operative improvements were reported for each operation across each substratified outcome measure except general health. Lumbar foraminotomy patients reported the worst outcomes in every domain.

**Conclusions** Changes in PROMs vary depending not only on the pre-operative health status, but also on the type of operation carried out. This suggests some procedures may be more effective when considering QALYs, and may lead to limited resources being targeted at those procedures that have enhanced PROMs.

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**33** Magnetic growing rods in paediatric deformity patients: are they MRI compatible? An in–vitro study

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**Background Context** Adjustable growing rods that elongate within an external magnetic field have revolutionised the management of early-onset paediatric deformity. This patient group includes those with underlying neuromuscular conditions that may require further MR imaging of the neuroaxis. This is currently contraindicated due to the rare earth magnet housed within the rod.

**Purpose** We have investigated the behavior of the MAGEC (Ellipse Technology) rod to determine whether MRI adversely affects the properties of the rod or causes any detrimental consequences including elongation, shortening, heating or significant artifact to outline implications for this patient group.

**Study Design/Setting** In-vitro analysis

**Methods** We conducted an in-vitro experiment using MAGEC rods secured in an MRI compatible restraint system using a 1.5T Philips MRI. Repeated gradient echo multi-scan sequence MRI of the neuroaxis was performed assessing force exerted, elongation, rod properties post-imaging and temperature changes. We used a phantom model to evaluate the amount of artifact induced.

**Results** During repeated MRI the MAGEC rod elongation mechanism was not triggered. The ability of the rods to lengthen after MRI was not enhanced or impaired and no significant heating effect was demonstrated. The assessment of imaging with a phantom model did reveal a significant degree of artifact up to 30cm and therefore only MRI of the head and cervical spine could be interpreted.

**Conclusions** This study has demonstrated that there are no detrimental effects of MRI on the MAGEC rod while the degree of artifact demonstrated implies only imaging of the head and cervical spines will be interpreted with rods in–situ.
34  The L1 incidence angle – a novel and reliable measure for lumbo-sacral alignment

Main Author  Dominique Rothenfluh
Co Authors  Praveen Inaparthy, Dennis Dominguez, Jean Carlos Queruz, Jeremy Reynolds
Affiliation  Nuffield Orthopaedic Centre, Oxford University Hospitals NHS Trust, Oxford OX3 7HE

Background Context  Lumbo-sacral malalignment as described by pelvic incidence-lumbar lordosis (ΔPILL) mismatch has been linked to disability, higher shear stress and increased risk for adjacent segment disease.

Purpose  The present study describes the L1 incidence angle which is a simple measure geometrically equal and more accurate than PILL mismatch.

Study Design/Setting  retrospective

Methods  The L1 incidence angle (L1IA) is defined by a line perpendicular to the L1 endplate bisecting the bi-coxo-femoral axis and a line connecting the midpoint of the bi-coxo-femoral axis to the midpoint of the sacral plateau.

On 60 standing radiographs of the whole spine, ΔPILL and L1IA were measured by two raters. The intra- and inter-rater reliability of the L1IA compared to conventional measurement of PI and LL were assessed using Pearson’s correlation and the limits of agreement according to Bland-Altman’s analysis using the R statistics package.

Results  The average values for ΔPILL and L1IA measured were -4.63±16.5° and -3.66±15.1° respectively for rater 1 and -2.33±15.3 and -2.27±15.8 for rater 2. Pearson’s R was 0.977 (p<0.001) for intra-rater reliability and 0.844 (p<0.001) for inter-rater reliability indicating a strong to good correlation. The Bland-Altman analysis revealed intra-rater limits of agreement between ΔPILL and L1IA of +3.3° to -3.5°. The inter-rater limits of agreement for PILL were between +12.5° and -15.5° and for L1IA between 7.3° and -8.3°.

Conclusions  As per our results, the inter-rater variability seems to be bigger for ΔPILL than L1IA. L1IA shows a higher measurement accuracy of ±7.5° compared to ΔPILL. L1IA is therefore a reliable method for initially assessing the degenerative lumbar spine.

35  Sagittal balance correction using anterior only motion preserving hybrid construct

Main Author  Eyal Behrbalk
Co Authors  Ofir Uri, Peter Rehousek, Broniek Boszczyk
Affiliation  The Centre for Spinal Studies and Surgery, Queen’s Medical Centre

Background Context  Sagittal balance (SB) is the most important factor effecting life quality in adults with degenerative spine deformity. Surgical correction of sagittal imbalance resulting from degenerative disc disease remains challenging. Current methods of SB correction are based on posterior osteotomies and instrumented fusion, unfortunately, with high complication rate. This study presents an alternative method for SB correction by reconstructing the anterior column height using ALIF and TDR implants potentially reducing the hardware failure, wound infection and patient’s height reduction associate with posterior approaches while preserving lumbar spine motion.

Purpose  This study presents an alternative method for SB correction by reconstructing the anterior column height using ALIF and TDR implants potentially reducing the hardware failure, wound infection and patient’s height reduction associate with posterior approaches while preserving lumbar spine motion.

Study Design/Setting  Case series

Patient Sample  5 patients

Outcome Measures  Radiographic outcome (SB, Pelvic Incidence-[PI], lumbar lordosis-[LL] and thoracic kyphosis-[TK]) were reviewed retrospectively at a mean of 35±10 months follow-up.

Methods  Five women (mean age 64±4 years) with degenerative spine deformity and symptomatic sagittal imbalance were operated on using an anterior-only approach. Four of them underwent retroperitoneal approach performing ALIF at L4-5, L5-S1 and TDR at L2-3, L3-4 and one underwent trans-peritoneal approach with visceral rotation performing ALIF at T12-L1, L1-2, L4-5 and TDR at L2-3 and L3-4.

Results  At the latest postoperative follow-up the SB was corrected from 71.2±36 mm to 6.7±30 mm (p=0.023) – balanced spine. LL increased from minus 10.2±16 degrees (kyphotic LL) to 40.7±18 degrees (p<0.001) to match the PI. TK was secondarily increased from 23.7±10 degrees to 40.5±14.3 degrees (p=0.022). No hardware failure, infection, neurological injury noted.

Conclusions  These radiographic results suggest that anterior-only approach with hybrid construct of ALIF and TDR may offer a safe and effective method of restoring SB and anterior column height while maintaining spine motion in patients with degenerative spine deformity and symptomatic sagittal imbalance.
The quality and access to information among scoliosis surgical patients pre-operatively

Main Author  Salam Ismael  
Co Authors  Maryam Kazeem, Gayle D'Souza, Alex Gibson  
Affiliation  The Royal National Orthopaedic Hospital  

Background Context  The provision of preoperative information is important in minimising levels of pre and post-operative anxiety, decrease clinical symptoms and manage expectations.  

Purpose  Explore scoliosis surgical patient's access to information and the quality of information given by surgeons and preoperative assessment nursing staff.  

Study Design/Setting  Retrospective observational study  

Patient Sample  Convenient sample  

Outcome Measures  Questionnaire scaling quality of information and access to information outlets.  

Methods  A sample of 46 patients admitted to the RNOH between February-July 2014 for scoliosis correction surgery. The piloted questionnaire was completed by patients pre-operatively. Access to information was explored and we scaled the quality of information given, concerning different aspects of planned surgery on a scale of 1; ‘excellent’ to 5; ‘bad’.  

Results  The mean age was 20 years (13-69); with 76% females. 50% of patients were provided website details by their surgeons pre-operatively. 67% of patients accessed information from websites while 46%and 24% of patients gained information from YouTube videos and GP respectively. 80% of female patients accessed websites compared to 55% in males. Generally the quality of information given by surgeons was better than same type of information given by nursing staff; with slightly less quality of information provided on anaesthesia and recovery by both surgeons (mean score=2) and nurses (mean score=2.5)(P=0.05)  

Conclusions  Generally the quality of information regarding scoliosis was good but improving information provision by nursing staff is required. We need to deliver more information regarding anaesthesia and recovery. We could develop video material as part of information pack and wider project like “Spinal Scoliosis School” to address patient education.

The quality of spinal surgery consent forms: do we tell our patients all risks and benefits associated with their surgery?

Main Author  Salam Ismael  
Co Authors  Alex Gibson  
Affiliation  The Royal National Orthopaedic Hospital  

Background Context  Informed consent is an essential part of surgical practice. Patients who undergoing surgery need to be fully informed of the risk and benefits associated with their surgery.  

Purpose  Objective was to evaluate the practice of informed consent in patients undergoing spinal surgery in the royal national orthopaedic hospital(RNOH)  

Study Design/Setting  Retrospective Observational Study  

Patient Sample  Convenient sample  

Outcome Measures  Complying with International Spinal Surgery information Sheet (ISSIS) (risks and complications of surgery)  

Methods  Study conducted at the spinal surgery unit at the RNOH. We reviewed convenient sample of 80 consent forms of operations performed at spinal surgery department between January and May 2014.  

Results  79% of consents carried by registrars while 12.5% and 8.7% consented by consultants and senior house officer respectively. Only 26% of patients received their copies of the consent form. Surprisingly, no risk of spinal cord injury and nor risk of dura tear recorded in 11% and 75% of consents respectively. The majority of cases were involving fusion; however 22.5%, 39% and 35% of the forms did not include pseudoarthrosis ,non-union and failure of metal work as risks respectively. 35% of the consents mentioned risk on life and pain as possible complications. 12% of consented patients risks of anaesthesia mentioned to them. Hardly any of the patients informed of the risks of haematoma, blindness or revision surgery.  

Conclusions  The quality of existing spinal surgery informed consents at our hospital is less than ideal. There is a great need to develop comprehensive spinal specific consent forms that include all possible risks and benefits using agreed international tools and guidelines.
Preoperative anxiety and desire for information among scoliosis deformity surgical patients

Main Author: Salam Ismael
Co Authors: Kazeem Maryam, Gayle D'Souza, Alex Gibson
Affiliation: The Royal National Orthopaedic Hospital (RNOH)

Background Context: Preoperative anxiety is a common problem that affects patients undergoing surgical procedures in general and can affect their clinical outcomes, expectations and satisfaction.

Purpose: To determine preoperative prevalence, level of anxiety and its correlation to the desire for information among scoliosis surgical patients.

Study Design/Setting: Prospective Observational Study

Patient Sample: Convenient sample

Outcome Measures: Amsterdam preoperative anxiety and information scale (AAPI)

Methods: Our cohort was sample of 46 scoliosis patients admitted to the royal national orthopaedic hospital between February and July 2014 for scoliosis correction surgery. We surveyed adolescent and adult patients undergoing surgery under the care of four different spinal surgeons and asked them to answer piloted questionnaire. We measured pre-operative anxiety using (AAPI) which is validated tool independent of age and sex. Questionnaire filled by patient preoperatively.

Results: The mean age of our cohort was 20 years (13-69) and 76% were females. Mean anxiety score for surgery was 7 compared to 5.7 anaesthesia related (P <0.0002). Mean total anxiety score among our patients was 12 (Scale 4-20). The mean score for information desired by our patients and pre-operative pain score were 6.6(scale 2-10)-and 4.8(scale 0-10) respectively. With higher level of anxiety there is more desire for information by our patients with positive coefficient value 4.3(P value 0.01) and mainly surgery related information. The patients with high pain score preoperatively had higher anxiety score (P value < 0.001).

Conclusions: Our patients experience high levels of preoperative anxiety mainly surgical with significant regression relationship between their level of anxiety and level of information desired by the patients. Preoperative counselling clinics and more information will help in reducing preoperative anxiety.

Pedicle screw insertion – theatre or the lab?

Main Author: James Tomlinson
Co Authors: Sarah Wilson, Dave Roberts, Jake Timothy
Affiliation: Health Education Yorkshire and the Humber, Willow Terrace Road, Leeds LS2 9JT

Background Context: The use of simulation in surgical training is rising. Pedicle screw placement is technically demanding with potentially significant complications if screws are malpositioned. The anatomy department has recently started producing Thiel cadavers which differ in their properties to formaldehyde cadavers.

Purpose: The purpose of this pilot study was an initial assessment of the suitability of three cadaveric tissue types for learning spine instrumentation techniques.

Study Design/Setting: The study was performed during a cadaveric spine course. Participants were blinded to cadaveric tissue type.

Patient Sample: Outcome Measures

Methods: The spines of three cadavers, preserved using Thiel, Crossado and traditional formaldehyde techniques respectively were exposed. Each was draped so surgeons were blinded to cadaver type. 10 surgeons placed pedicle screws in each cadaver in turn, with qualitative feedback via questionnaires.

Results: Six consultants and four fellows participated. 6/10 surgeons felt the Thiel cadaver gave realistic screw insertion feel (4/10 did not), 2/10 felt the formaldehyde was realistic (5/10 did not, 3/10 undecided) and 7/10 felt the Crossado gave realistic screw insertion (2/10 did not, 1/10 undecided). The soft tissues were felt to be most realistic in the Thiel cadaver and least in the formaldehyde cadaver. All participants felt screw insertion should be learned in a simulated setting initially.

Conclusions: There was unanimous support for learning spine instrumentation in a simulated setting.

It remains unclear which type of cadaveric preservation technique gives the most realistic reproduction of live surgery, but based on this study both Thiel and Crossado preserved cadavers present potential options. Thiel bodies also have a long potential lifespan.
The effect of cross links on rotational stiffness of scoliosis constructs

Main Author: Richard Pilling
Co Authors: El-Nasri Ahmed
Affiliation: University Hospital of North Staffordshire

Purpose: The purpose of this study is to investigate what effect cross links have on scoliosis constructs and whether cross links may be used instead of pedicle screws at the apex of the deformity.

Study Design/Setting: Biomechanical Study using Synthetic models

Methods: The rotational stiffness of six different construct designs was investigated on scoliotic sawbone models with zero, one or two cross links. In three of the constructs the screws at the apex were removed. Testing was performed to an average torque of 3Nm and rotation was detected using electromagnetic motion tracking system.

Results: The stiffness in axial rotation of all constructs increased with the number of cross links, however the difference was not statistically significant. In constructs with apical screws the stiffness increased by 3.01% and 12.9% for one and two cross links respectively. In constructs without apical screws the increase was 1.64% and 14.3% for one and two cross links respectively.

The total stiffness of the construct increased with the addition of apical screws by 20%, 21.7% and 18.8% for zero, one and two cross links respectively. This increase was statistically significant using a paired t-test (p= 0.01142).

Conclusions: On the basis of these results we conclude that the use of cross links in scoliosis correction surgery is not necessary. Pedicle screws positioned at the apex of the scoliosis curve statistically increase the stiffness in axial rotation and are therefore necessary to promote an environment suitable for bony fusion.

Posterolateral instrumented lumbar fusion in patients spondylolisthesis treated with locally harvested bone and allografts mixed with bone marrow

Main Author: Sejong Park
Co Authors: Ayhan Umar, Agniva Banerjee, Himanshu Sharma
Affiliation: Peninsula School of Medicine & Dentistry

Background Context: Iliac crest bone grafts have long been considered the gold standard for achieving fusion in low grade spondylolisthesis, however, they are associated with prolonged donor site morbidity.

Purpose: To evaluate the amount of fusion, the incidence of non-union & subjective outcome of instrumented postero-lateral lumbar spinal fusion with low-grade spondylolisthesis treated with locally harvested bone and allografts mixed with bone marrow.

Study Design/Setting: Retrospective review of prospectively collected database from a single surgeon, at Derriford Hospital.

Patient Sample: Referred patients with spondylolisthesis.

Outcome Measures: Self-report: back pain - severity, location, duration; leg pain - severity, side, duration; and ODI (Oswestry Disability Index).

Physiologic: serial radiological analysis. Functional: ODI

Methods: The data was collected through patient case notes, operation notes, pre-op/post-op patient related outcome measures, peri-operative complications and serial radiological analysis until fusion was achieved.

Results: We reviewed 55 patients (39 degenerative and 15 spondylolytic spondylolisthesis). The average duration of back pain and leg pain at presentation was 11.15 and 4.01 years respectively. The improvement was significant for back pain (7.8 to 2.4), leg pain (7.1 to 1.7) and ODI (50.23% to 28.45%). Peri-operative morbidity included one dural tear, 36% incidence of blood transfusion, one superficial wound infection treated with wash-out and two cases of rod loosening due to mechanical rather than biological reasons.

Conclusions: This study confirmed comparable outcomes in a cohort of instrumented postero-lateral lumbar spinal fusion as outlined. This was similar in both sub-groups of degenerative and lytic listhesis. There was improvement in the pain as well functional scores in both sub-groups.
**Poster Presentations**

**42** The advantages of performing anterior column reconstruction prior to pedicle subtraction osteotomy in staged revision adult deformity surgery

**Main Author** Joseph Butler  
**Co Authors** M L Suarez-Huerta, H Yu, A Benton, S Selvadurai, S Molloy  
**Affiliation** Spinal Deformity Unit, Department of Spinal Surgery, Royal National Orthopaedic Hospital, Stanmore, Middlesex  

**Background Context** Revision adult spinal deformity surgery is a complex and technically challenging often requiring staged surgery, three-column osteotomies and often quite extensive spinal instrumentation. In order to minimize the significant complications associated with these cases, we attempted to develop a safe and effective treatment algorithm for the management of revision adult deformity.

**Purpose** To evaluate the incidence of complications and the radiographic and clinical outcomes from two-stage reconstruction including three-column osteotomy for revision adult spinal deformity.

**Study Design/Setting** A prospective cohort study was performed over a 2-year period at a major tertiary referral centre for adult spinal deformity surgery.

**Patient Sample** All consecutive patients requiring 2-stage corrective surgery revision adult spinal deformity were included.

**Outcome Measures** Radiographic parameters analysed included pelvic incidence, pelvic tilt, sacral slope, lumbar lordosis, thoracic kyphosis and sagittal vertical axis. Clinical outcome measures collected included EQ-5D, ODI, SRS 22 and VAS Pain Scores.

**Methods** Radiographic parameters and clinical outcome measures were collected preoperatively and at 6 weeks, 6 months, 1 year and 2 years postoperatively.

**Results** Performing anterior column reconstruction followed by 3-column osteotomy and extension of instrumentation for revision spinal deformity resulted an excellent correction of sagittal alignment, minimal surgical complications and significant improvements in HRQOL. Restoration of lumbar lordosis, pelvic tilt and sagittal vertical axis were observed in addition to postoperative improvements in EQ-5D, ODI, SRS 22 and VAS Pain Scores at follow-up.

**Conclusions** Performing anterior column reconstruction prior to a three-column osteotomy minimizes the complications associated with three-column osteotomy and extension of posterior instrumentation. We propose a treatment algorithm for safe and effective treatment in revision adult deformity surgery.

**43** Two and three-stage revision sagittal plane correction obviating the need for three-column spinal osteotomy for severe progressive sagittal malalignment

**Main Author** Joseph Butler  
**Co Authors** M L Suarez-Huerta, H Yu, A Benton, S Selvadurai, S Molloy  
**Affiliation** Spinal Deformity Unit, Department of Spinal Surgery, Royal National Orthopaedic Hospital, Stanmore, Middlesex  

**Background Context** Long instrumented thoracolumbar fusions for scoliosis can result in a flat back deformity with distal degeneration and sagittal decompensation. Traditional teaching has been that these patients require a 3-column osteotomy and extension of instrumentation to the pelvis as part of their revision reconstruction to attain optimum sagittal realignment. Three-column osteotomies are technically demanding procedures with an associated risk of neurological injury, non-union and implant failure with rod breakage.

**Purpose** To describe a staged surgical technique to correct significant progressive sagittal malalignment, without the need for 3-column osteotomy, in patients with prior long thoracolumbar instrumentation for scoliosis and to evaluate the radiographic and clinical outcome from this surgical strategy.

**Study Design/Setting** A small cohort study (n=6) of patients

**Patient Sample** Patients with significant sagittal malalignment following extensive thoracolumbar instrumented fusions for scoliotic deformity.

**Outcome Measures** Radiographic parameters analysed included pelvic incidence, pelvic tilt, sacral slope, lumbar lordosis, thoracic kyphosis and sagittal vertical axis. Clinical outcome measures collected included EQ-5D, ODI, SRS 22 and VAS Pain Scores.

**Methods** Radiographic parameters and clinical outcome measures were collected preoperatively and at 6 weeks, 6 months, and 1 year postoperatively.

**Results** 3 patients had 2-stage anterior release and instrumented fusion followed by a posterior instrumented fusion and 3 patients with a large sagittal plane deformity had a 3-stage surgical technique. All patients achieved an excellent correction of sagittal alignment, with no surgical complications and excellent health related quality of life (HRQOL) outcome measures at follow-up. Blood loss in this small cohort of patients was significantly below that published in the literature for revision procedures requiring a 3-column osteotomy. There was no symptomatic non-unions or implant failures including rod breakages.

**Conclusions** We present a safe and effective surgical strategy to treat the complex problem of progressive sagittal malalignment in the previously instrumented adult deformity patient, avoiding the need for 3-column osteotomies in the lumbar spine.
Scoliosis creates tropism or tropism causes scoliosis. Cause and effect or vice versa?

Main Author  Thomas Pagonis
Co Authors  David Sharp
Affiliation  Mid Essex Hospital Services NHS Trust, Broomfield Hospital Spinal Unit, Chelmsford, Essex

Background Context  Zygoapophysial Joint (ZAJ) orientation varies by less than 7° between the two sides, but if > 7° this is defined as tropism. Scoliosis is a complex three-dimensional deformity.

Purpose  To study the presence of Tropism in paediatric spine and correlate the levels initially affected to the lack or presence of further levels affected retrospectively.

Study Design/Setting  Retrospective double blind study
Patient Sample  271 paediatric patients spine MRIs
Outcome Measures  Physiologic Measures: MRI scans

Methods  No funding was obtained. No conflicts of interest. Sagittal plane orientation of ZAJ of 271 patients measured on MRI scans for the past 8 years. ZAJ were stratified into lumbar and thoracic and classified according to the tropism presence and scoliosis. Files were investigated for consecutive MRIs. The correlation between tropism and scoliosis was investigated along with the pathology progression in consecutive MRIs.

Results  Out of 271 patients 9% had to be excluded (insufficient imaging). 18% of our patients had more than one spinal MRI. A statistically significant number of our cohort exhibited tropism in a scoliotic spine but our numbers did not have significant power to allow investigation in consecutive MRIs. Nonetheless in 11% (out of 18%) of our cohort where consecutive MRIs were present, a correlation between tropism emergence and scoliosis progression is presented.

Conclusions  Our study suggests a correlation between tropism and scoliosis and the progression of both pathologies with further investigation needed in bigger cohorts.
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### Forthcoming Meetings

#### 2015

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<td>British Scoliosis Society Annual Meeting</td>
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<td>Society of British Neurological Surgeons Biannual Meeting</td>
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<td>Jun</td>
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<td>14th International Phillip Zorab Symposium</td>
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<td>Nov</td>
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<td>Anglo-European College of Chiropractic Bournemouth, Local Hosts: AECC</td>
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<td>Wed 6-Fri 8</td>
<td>BritSpine 2016</td>
<td>Nottingham Conference Centre</td>
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<td>Eurospine 2016</td>
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#### 2018

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