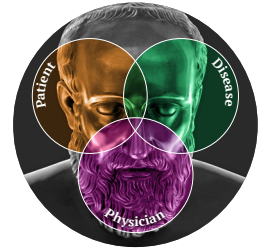




**BASS 2022 Abstracts**  
Belfast

The Journal  
of the British  
Association of  
Spine Surgeons

# Column & Cord



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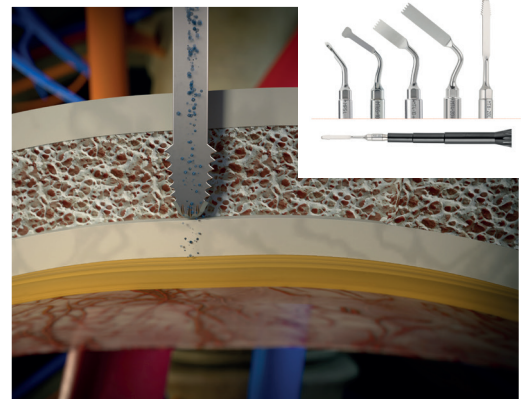
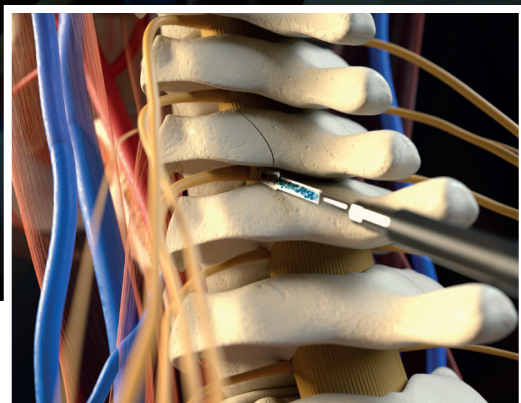
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#### Column & Cord

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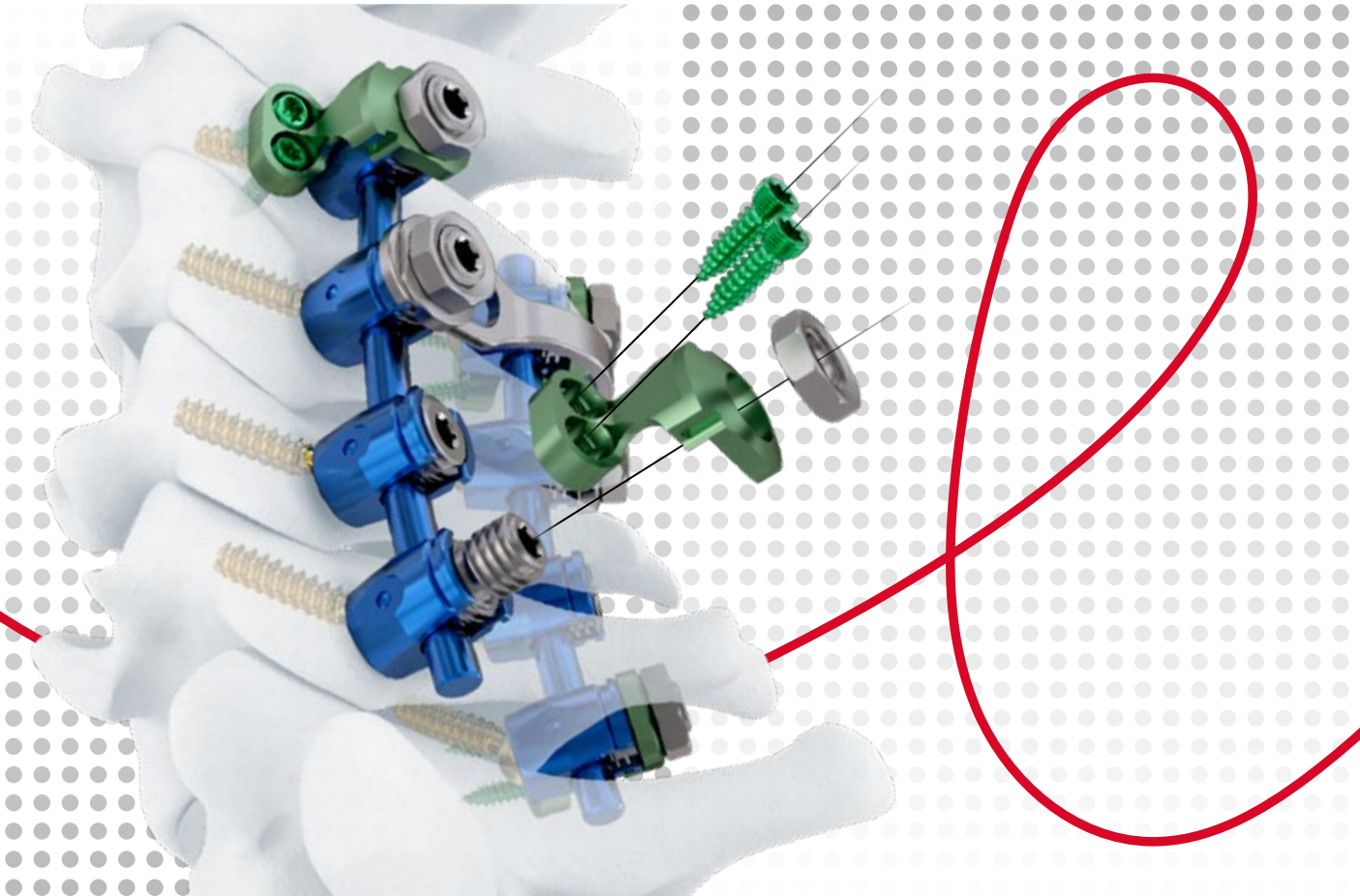
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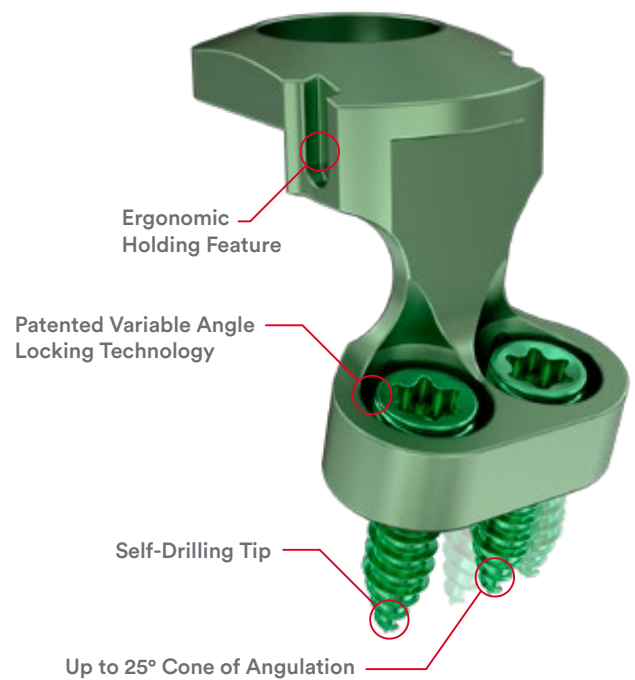
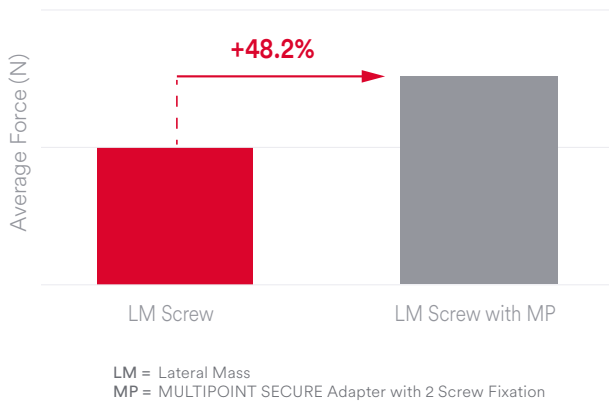
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## Editors letter

# Lies, damned lies and incorrect facts



## Tim Germon

Consultant Spinal Neurosurgeon,  
Derriford Hospital Plymouth  
Past President, British Association of Spine Surgeons

In his thought-provoking and entertaining article, David Jaffray concludes by emphasising the importance of being honest and not telling lies. This might be more difficult than it first appears. There are levels of dishonesty and lying. The quote, “There are three kinds of lies: Lies, Damned Lies, and Statistics”, was attributed to Mark Twain and by him to British Prime Minister Benjamin Disraeli, although that “fact” may be a lie. Telling an outright lie is one thing but we can also be economic with the truth. However, it is likely that the most common form of lying in medicine is perpetuating “facts” which have little substance. Training in medicine means learning vast numbers of “facts”, which have been passed down from one generation to the next, either in textbooks or by word of mouth. Potential doctors are not selected for medical school based on their ability to question authority and established “truths” are rarely questioned. I am sure propagating unsubstantiated ideas as fact, is common across the whole of medicine but is this lying?

There are many examples in the world of spinal surgery. When a person has back and leg pain it is commonly stated that this represents two separate problems, the leg pain being a

consequence of nerve root compression and the back pain emanating from some other nociceptive stimulus, thought to be by some, a form of instability. This distinction continues to be used as a justification for fusing a spine to treat back pain at the same time as decompressing spinal nerve roots to treat leg pain. As far as I can see, this dichotomous approach is founded in a purely speculative explanation of poor results following lumbar discectomy in the 30s and 40s.<sup>1</sup> At that time no imaging was used and surgery was far more destructive. Now we have MRI scanners and operating microscopes as well as multiple publications confirming that nerve root decompression reliably improves back pain, and yet the belief continues.<sup>2-4</sup> There are multiple other examples where a therapeutic effect is more wishful thinking than evidence based. Most obviously the suggestion that any treatment recommended in the absence of a diagnosis (most notably for non-specific low back pain) is likely to be effective and that spinal injections or denervation have any significant long-term effect. Evidence to the contrary will be warmly welcomed. ■

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## Original articles

# Beware the medicine man

**David Jaffray**

Consultant Orthopaedic Spinal Surgeon  
Robert Jones and Agnes Hunt Orthopaedic Hospital  
Oswestry  
UK

**M**y wife gave me this passage from the Bible. The Bible remains the best-selling book over many centuries, whilst the plethora of spinal journals are quickly dumped in the recycling bin. Whilst the Ten Commandments are crystal clear, what messages comes out of our spinal literature? In my experience the only people who read the articles are the editors and the authors. If the article is read and goes against the thoughts of the reader then it is ignored. Having written what I thought was a seminal paper on the futility of surgery for lumbar burst fractures validated by randomized trials, I reviewed the last five years literature on burst fractures. Nothing had changed. As my mother told me numerous times “Son, you cannot fart against thunder”.

So, when the editor of the new “Column and Cord” asked me to write on any spinal topic, I thought “what a waste of time”. Instead I chose to cover the whole spectrum of elective adult spinal surgery. Working in an Orthopaedic Hospital, I witness the benefit of total hip replacement one of the four elective procedures to benefit mankind, the others being a kidney transplant, a coronary artery bypass and cataract surgery. A hip replacement has to work, improve quality of life and last a minimum of ten years and failure is defined as the need for revision. Can we compete? Perhaps with spinal stenosis but little else. Natural history of common spinal conditions such as disc prolapse especially extrusions and sequestrations is so good as to question the rationale of conveyor belt discectomy. Even Mixer and Barr bitterly regretted describing the condition of disc prolapse many years after their publication in 1934. Technical advances often with highly expensive technology such as robotics, navigation etc may help with the initial surgeries but will the outcomes match the big four?

There has been an exponential expansion in spinal surgery in recent years. Given that all treatments for back pain in my experience were ineffective and no longer approved, what new conditions have filled the void? Adult deformity surgery in the

elderly has exploded. I must have overlooked this condition over thirty years. I look aghast at the complication rates highlighting re-operations, infections and metal work problems in the osteoporotic elderly. Similarly, I never fused a sacra-iliac joint and watch as I see one joint fusion quickly followed by the other joint. Even in the field of spinal stenosis surgery, interbody fusions abound, whereas in my day, in the elderly, the keep it simple procedure seemed to do well. The only beneficiaries would appear to be the implant companies As our late Professor O Connor from Australia said of the new pedicle systems years ago “why build a brick shithouse when a wooden one would do?” It was humbling for me to look back and note that in my last five years I tended to do routine conveyor belt spinal stenosis work to great effect in comparison to my earlier years when youthful enthusiasm embraced the ineffective. So, having outlined the futility of spinal publications, what can I advise the editor of this new journal? Abortion springs to mind but let’s not be totally negative. Publish only on operations that can compare with the big four and describe procedures that are futile. Using this criteria you would only need one edition annually at most. Remember that Albert Einstein wrote only one paper which changed the world which cannot be said of the thousands of peer reviewed spinal articles annually. Use the ninth commandment from the best publication, “You must not lie”. ■



## BASS 2022 Podium Abstracts

## Paper Session 1: Trauma

### Anterior-alone stabilisation in AO Type B and C subaxial cervical spine injuries in non-ankylosed spines - a major trauma centre experience

Shreedhar Aranganathan<sup>1</sup>, Mohamed Yassin<sup>1</sup>, Rajan Jandoo<sup>1</sup>, Lesley McKee<sup>1</sup>, Hussein Hassan<sup>1</sup>, Vinay Jasani<sup>1</sup>

<sup>1</sup>Royal Stoke University Hospital, United Kingdom

#### Introduction

Unstable subaxial cervical spinal injuries (AO Type B or C) were traditionally treated with combined anterior and posterior stabilisation. However, this is associated with higher morbidity of a second-hit phenomenon that occurs due to prolonged anaesthesia and extensive soft-tissue dissection. Our study aims to evaluate if anterior cervical decompression and stabilisation (ACDF) alone is adequate in achieving adequate stability.

#### Method

A retrospective review of prospectively collected data of adult patients with an unstable spinal injury (classified using the SLIC and AO) that presented to a major trauma centre was undertaken.

#### Results

Thirty-four patients admitted between April 2019 to August 2021 with a mean age of 58 years, male preponderance were included, with 24 of these following high-energy injuries. The mean SLIC score was 6 (range 4-8) and AO Classification showed 23 patients with Type B, 10 patients sustained Type C injury and 1 sustained an F4+N2 injury. Majority sustained a single-level injury that was treated with an ACDF. Two patients required a single-level corpectomy and 1 needed a two-level ACDF. Mean follow-up was 31 weeks with majority of patients attending at least for 15 weeks. One patient developed COVID postoperatively needing prolonged ITU stay. Two patients with post-operative dysphagia needed metal-work removal. One patient died during the post-operative recovery due to his associated injuries. No patient needed revision or a second-stage posterior stabilisation.

#### Conclusion

Our study demonstrates low complication rate with no cases needing subsequent posterior stabilisation after ACDF for unstable cervical spine injury.

### Management of Osteoporotic Vertebral Compression Fractures (MoVe Com): A BASS Trainee Collaborative Project

BASS Trainee Collaborative Project (2021-2022)<sup>1</sup>

<sup>1</sup>BASS Trainee collaborative project, United Kingdom

#### Introduction

NICE recommends cement augmentation techniques as treatment options for osteoporotic vertebral compression fractures. This study aims to assess the variation of practice, in terms of cement augmentation and non invasive techniques, within the UK for Type A thoracolumbar compression fractures (AO Classification).

#### Method

A survey was distributed electronically to all consultant spine surgeons. Experience, trauma network status, speciality (orthopaedic or neurosurgeon), trust location, management of Type A0-A4 compression fractures, choice of brace, follow up and surgical intervention were collected.

#### Results

We received 92 responses, 81% were orthopaedic surgeons the remainder were neurosurgeons. 55% worked in a Major Trauma centre and 45% in a trauma unit. Over half opted for no brace treatment for A0-A1. The majority considered a brace for A2 fractures, with 30% always providing a brace for A3 which increased to 42% for A4. 65% made use of an off-the-shelf brace whilst 13% opted for a custom made brace. 93% followed up their patients in clinic with the majority opting for repeated radiographs. If non-operative treatment fails, 40% opted for a surgical intervention within 3 months and 35% in 6 weeks. The most common indication for intervention was pain, if considering cement augmentation 82% would use vertebroplasty. This was most commonly done by surgeons followed by radiologists 30%.

#### Conclusion

The key theme from this study is the wide variation regarding treatment of Type A thoracolumbar compression fractures within in the UK.

### Mortality of Posterior Circulation Stroke (POCS) Following a Vertebral Artery Injury: A Single Centre Retrospective Review

Jonathan Sterne<sup>1</sup>, Greg McLorinan<sup>1</sup>

<sup>1</sup>Royal Victoria Hospital, Belfast, United Kingdom

#### Introduction

Vertebral artery injury (VAI) is a recognised complication of cervical spine fractures, particularly those involving the foramen



transversarium, C1-C3 and in cervical dislocation. The vertebral arteries provide blood to the posterior brain, cerebellum, brainstem and upper spinal cord.

### Aim

Our primary aim was to identify the mortality of POCS following VAI. Method Data was collected retrospectively from our fractures outcomes database. 619 patients were identified (2011-2017). The initial CT scan was used to identify fracture pattern and subsequent CT (CTA) or Magnetic Resonance angiogram (MRA) report was reviewed for evidence of VAI. Electronic care records were reviewed to identify management and neurological outcome.

### Results

122 of 619 (19.7%) fractures involved the foramen transversarium, 45 had dislocations (7.3%) and 332 had fractures of C1-3 vertebrae (53.6%). 100 patients underwent CTA or MRA. 20 patients had evidence of VAI (3.2%). Unilateral VAI was identified in 18 of 20 patients, 2 had bilateral VAI. Posterior circulation stroke (POCS) was identified in 6 patients (2 bilateral, 4 unilateral). Average age 66 (32-82). Four patients died as a direct result of VAI (1 bilateral, 3 unilateral). Each patient who died as result of VAI had a POCS. Time to death for each patient was 9, 33, 52 and 483 days (average 144 days).

### Conclusion

VAI was identified in 20 patients. The risk of POCS with VAI was significant, with 6 patients (30%) diagnosed. Four of these patients died as a result (66%). VAI had a mortality rate of 20% in this study.

## A Novel CT Indicator of Posterior Ligamentous Complex Disruption in Acute Traumatic Thoracolumbar Vertebral Fractures in Adults

Michael Price<sup>1</sup>, Robert Dunsmuir<sup>1</sup>, James Rankine<sup>1</sup>

<sup>1</sup>Leeds General Infirmary, United Kingdom

The thoracolumbar junction is a common site for fractures of the axial skeleton in both high and low energy mechanisms of injury. Initial radiological assessment should include CT scan if radiographs are abnormal or there are clinical signs or symptoms of spinal column injury as per NICE guidance, and the Thoracolumbar Injury Classification and Severity (TLICS) score can help to inform management. This predicts spinal stability through consideration of fracture pattern morphology, clinical neurological status and the structural integrity of the Posterior Ligamentous Complex (PLC). MRI is the gold standard for evaluating the PLC for completion of TLICS scoring, and carries additional advantages in pre-operative visualisation of soft tissues and neural elements, but is an expensive resource whose usage has to be rationalised. Numerous CT findings have been suggested to indicate PLC injury, including bony

abnormalities such as facet joint malalignment and pedicle fracture, soft tissue abnormalities such as interspinous widening, and radiographic measurements of local kyphosis. To our knowledge no study has reported the diagnostic utility of the midline fat pads seen deep to the ligamentum flavum at the bases of the spinous processes on mid-sagittal CT, which may be effaced or obliterated in PLC rupture. We present a literature review and validation study of this finding as a potential risk-stratifying tool for prioritisation of patients when MRI is not immediately available.

## Paper Session 2: Lumbar Degenerative

### Clinical and Radiographic Outcomes of Expandable Anterior Lumbar Interbody Fusion Cages

Nitin Adsul<sup>1</sup>, Kiran Divani<sup>1</sup>, Galatea Katzouraki<sup>2</sup>, Robert Lee<sup>1</sup>

<sup>1</sup>Royal National Orthopaedic Hospital, United Kingdom

<sup>2</sup>Nottingham University Hospital, United Kingdom

The potential benefits of expandable anterior lumbar interbody fusions include the ability to increase much collapsed disc height and provide finer control of lordosis. Controlled expansion may also prevent subsidence. This is a single-surgeon, retrospective review of prospectively collected data of a case series of 92 consecutive patients with 100 expandable cages. Pre and post-operative clinical and radiographic parameters were measured. These included standalone single level ALIF, two level ALIFs with posterior fixation, and ALIF(s) combined with OLIFs and posterior fixation for degenerative deformity correction. The average age was  $57.3 \pm 11.0$  years; 48 patients were female. Clinical Results at 12 months show an average reduction in VAS Leg 8.6 to 1.4, VAS Back 8.3 to 1.6, ODI 67 to 24 and an increase of EQ-5D 0.356 to 0.859. 66 patients reached 2-year follow-up and these PROMS were maintained. Anterior, middle, and posterior disc height significantly increased averaging  $4.9 \pm 3.3$ ,  $4.2 \pm 3.7$ , and  $1.7 \pm 2.3$  mm, respectively. Segmental and global lumbar lordosis significantly improved with in all cases. In cases of sagittal imbalance and PI/LL mismatch, all patients had normalization of these values. There was 100% fusion through all the cages with no cases of radiolucency. There were no reported implant-related complications and no cases required revision of the cage. Our experience of expandable ALIF cages shows excellent clinical and radiological outcomes at 1 and 2 year follow-up. The use of expandable ALIF cages is shown to be safe, durable, and effective for the studied patient population.

## Prevalence of, and factors associated with, falls in older adults awaiting surgery for neurogenic claudication

Suzanne McIlroy<sup>1,2</sup>, Sam Norton<sup>1</sup>, John Weinman<sup>1</sup>, Lindsay Bearne<sup>5</sup>

<sup>1</sup>King's College London, United Kingdom <sup>2</sup>King's College Hospital NHS Foundation Trust, United Kingdom <sup>3</sup>Kingston University and St Georges University of London, United Kingdom

### Introduction

Falls are the most common cause of injury related deaths in older adults, 30% of community-dwelling older adults fall each year. The symptoms of neurogenic claudication (NC) may put patients at risk of falls. The aim was to describe factors associated with falls in people listed for surgery for NC.

### Method

People aged  $\geq 50$  years, listed for surgery to treat NC, were assessed prior to surgery as part of an ongoing prospective, observational study investigating the predictive factors of post-operative walking. Measures included: self-reported falls over last year, distress (PHQ4), pain severity, back related disability (ODI), concern of falling (Short Falls Efficacy Scale International), lower limb function (Short Physical Performance Battery, SPPB), 6-minute walking distance (6MWD). Analysis included descriptive and correlation statistics.

### Results

Data from 75 participants were available: 45% female, mean age 70 years (SD 9.2), 47 (63%) had a fall in the last year, median number of falls 1 (upper quartile: 6). Age, gender, BMI, self-rated difficulty walking were not related to falls. Number of medications, distress, back pain at rest, ODI, concern of falling, SPPB and 6MWD were all related to falls ( $p < .05$ , correlation weak-moderate: 0.23-0.38).

### Conclusion

The prevalence of falls within a cohort of people awaiting surgery for NC is twice that of community-dwelling older adults. Clinicians should consider referring to pre-operative optimisation for older people (POPS) and post-operative rehabilitation services. Future work should explore whether surgery can reduce the risk of falls, this could have a significant impact upon the individual and healthcare costs.

## A survey of current practices of delivery of day case lumbar discectomy surgery in UK

Chiara Molteni<sup>1</sup>, Michael Reddington<sup>2</sup>, Ruth Newsome<sup>2</sup>, James Tomlinson<sup>2</sup>, Shreya Srinivas<sup>2</sup>

<sup>1</sup>University of Sheffield, Medical School, United Kingdom

<sup>2</sup>Sheffield Teaching Hospital NHS Foundation Trust, United Kingdom

### Introduction

Day case discectomy (DCD) has been found to be as safe as in-patient discectomy with better patient experience and post-operative recovery. We surveyed UK spinal surgeons to understand current attitudes and use of day-case lumbar discectomy (DCDs) across the UK.

### Methods

An electronic survey was sent to all practicing spinal surgeons in UK via the UKSSB newsletter. An internal pilot was performed before distribution to check usability and functionality. Participation was voluntary and not incentivised. Responses were collected over a 3-month period using a Google form with open/closed questions.

### Results

There were 27 (17 Orthopaedic/10 Neurosurgeons) responses and 18 respondents (66%) offered DCD in their practice. Median number of cases per annum was 10 (range 2-200). The top three patient selection criteria were primary surgery, single level surgery and BMI  $< 40$ . Observed benefits included improved patient satisfaction, shorter hospital stays, quicker return to function and logistic benefits for the hospital. Challenges included resistance to change from other theatre staff and anaesthetists, lack of access to physiotherapy, a dearth of suitable patients and unavailability of inpatient beds in case of complications.

### Conclusions

Our survey shows marked variation in the practice of DCD in the UK, despite a significant evidence base to support it. The implementation of DCD pathways has the potential to reduce the elective surgery backlog due to the SARS-Cov-2 pandemic, whilst also improving patient satisfaction and experience.

## Does Postoperative Radiographic Shoulder Imbalance Affect Patient Reported Functional Outcomes after Surgical Correction of Adolescent Idiopathic Scoliosis (AIS)? A Systematic Review

Siddharth Shah<sup>1</sup>, Akshay Gadiya<sup>1</sup>, Masood Shafafy<sup>1</sup>, Michael Grevitt<sup>1</sup>, Mohammed Shakil Patel<sup>1</sup>

<sup>1</sup>The Centre for Spinal Studies & Surgery, Queens Medical Centre, Nottingham University Hospitals, NUH Trust, United Kingdom

### Introduction

Shoulder imbalance is one of the key outcome measures for AIS surgeries. Conventionally, it is quantified as 'Radiographic Shoulder Imbalance (RSI)' using various measurement criteria. However, is the same outcome assessment pertinent from a patient's perspective? This systematic review aims to assess whether the postoperative RSI affects patient functional outcome (PROMs) post-AIS correction.



## Methods

Literature search performed across PubMed/Embase/SCOPUS/ProQuest/Cochrane database. Search criteria included combination of 'scoliosis' AND 'shoulder'/'shoulder balance'/'shoulder alignment'. PRISMA guidelines were followed. Absolute inclusion criteria was reporting on correlation of RSI and functional PROMs post-AIS correction. Studies having heterogenous population, isolated case reports, case series <5 patients and non-English literature were excluded.

## Results

551 citations were screened, 18 full-text reviewed; 8 fulfilling all criteria (7 non-randomized retrospective; 1 prospective) were qualitatively analyzed. Multitude RSI parameters (Radiographic-Shoulder-Height(RSH), Clavicle-Chest-Angle-Difference(CCAD), Shoulder-Height-Difference(SHD), Shoulder-Vertical-Difference(SVD), Clavicle-Angle(CA) and T1-Tilt) and PROMs (SRS-24, Spinal-Appearance-Questionnaire, Quality-of-Life-Profile-for-Spinal-Disorder, Satisfaction Grading) were recorded. Inhomogeneous data precluded meta-analysis. 5 studies reported no co-relation between RSI and patient's functional outcome. No correlation noted to any sub-variables of SRS-24, including self-image and satisfaction. One study reported significant correlation of patient-outcome with RSH/CA. Two studies(both same investigators & institute), reported significant correlation of postoperative-CCAD with patient's satisfaction. However, both used only non-validated/dichotomous 'Yes'/'No'-Satisfaction PROM questionnaire.

## Conclusion

Available evidence does not demonstrate correlation between RSI and 'validated' patient-outcome measures post-AIS correction. Those that do demonstrate difference, employ non-validated questionnaires, which should not be 'ideal'ed as benchmarks. The result challenges the convention of aiming balanced radiographic shoulder alignment for a successful outcome, and incites necessity for further research.

# Biphasic calcium phosphate with submicron surface topography combined with a novel polymeric binder in a rabbit posterolateral fusion study

Ruggero Belluomo<sup>1</sup>, Inazio Arriola Alvarez<sup>1</sup>, Nathan Kucko<sup>1</sup>, Huipin Yuan<sup>1</sup>, Joost de Bruijn<sup>1,2</sup>, William Walsh<sup>3</sup>, Rema Oliver<sup>3</sup>, Daniel Wills<sup>3</sup>, James Crowley<sup>3</sup>, Tian Wang<sup>3</sup>, Florence Barrère-de Groot<sup>1</sup>

<sup>1</sup>Kuros Biosciences BV, The Netherlands <sup>2</sup>Queen Mary University of London, The Netherlands <sup>3</sup>University of New South Wales, Prince of Wales Clinical School, Surgical and Orthopedic Research Laboratory, Sydney, Australia

## Introduction

Synthetic calcium phosphates with submicron topography are promising bone graft substitutes for spinal fusion. In this study, a synthetic biphasic calcium phosphate with submicron needle-shaped topography combined with a novel polyethylene glycol/poly(lactic acid) triblock copolymer binder (BCP-EP) was evaluated for spinal fusion.

## Methods

The polymeric binder and its degradation products were analyzed in vitro using various techniques (i.e. XRD, 1H-NMR, FTIR). Bioactivity of BCP-EP was evaluated by scanning electron microscopy (SEM) after immersion in simulated body fluid for up to 10 days. In vivo biocompatibility and performance of BCP-EP was assessed in a rabbit PLF model by radiography, manual palpation, histology and histomorphometry for up to 12 weeks. Twenty skeletally mature New Zealand (NZ) White Rabbits underwent single-level intertransverse process PLF at L4/5 using (1) ABG alone or (2) by mixing in a 1:1 ratio with BCP-EP (BCP-EP/ABG).

## Results

Polymer degradation analysis revealed rapid polymer hydrolysis into lactic acid and lactide oligomers and unaltered polyethylene glycol without altering the BCP granules and its surface features. Bioactivity of the material was confirmed from progressive mineralization of the granules' surface by SEM. In the rabbit model, histology demonstrated that BCP granules were in direct contact with tissues and cells after 3 days. After 12 weeks, material resorption and mature bone formation were observed, resulting in solid fusion between transverse processes for all assessment methods. BCP-EP/ABG showed comparable fusion rates with ABG at 12 weeks. No graft migration or adverse reactions were noted at the implantation site nor in distant organs.

# Management Strategies for the Painless Foot Drop: A systematic review of the literature and a Single Centre Experience

Saima Waseem<sup>1</sup>, Jonathon Kyriakides<sup>1</sup>, Srinath Ranjit<sup>1</sup>, Rohit Shetty<sup>1</sup>, Nitin Shetty<sup>1</sup>, Ramsey Chammaa<sup>1</sup>  
<sup>1</sup>Whittington Health NHS Trust, United Kingdom

## Introduction

Foot drop can uncommonly be a painless presenting symptom of degenerative spinal disorders such as disc herniation, spinal stenosis and degenerative spondylolisthesis. This systematic review aimed to summarise the literature on the management of patients with a painless foot drop and their rate of recovery, supplemented by our single centre experience.

## Methods

We performed a systematic review of Pubmed, EMBASE and Medline according to PRISMA guidelines. We undertook a retrospective review of case notes between 2015-2021 of all patients presenting with painless foot drop in our single centre assessing demographics and outcome.

## Results

83 patients were included, 71.4% were male with an average age of 48.7 years (range 27-84). 28.6% patients had bilateral painless foot drop. Disc herniation accounted for 41.9% cases, Spinal stenosis for 51.2% and Degenerative spondylolisthesis for 7.0%. The mean duration of symptoms was 60.8 days (1-180). 98.8% were managed operatively- 36.6% underwent discectomy, 43.9% had decompression and fusion, and 19.5% underwent fenestrated laminectomy with or without discectomy. 80.7% patients had symptomatic improvement, with 53% having a post-intervention MRC power grading of 4 or above. Painless foot drop patients were less likely to recover to MRC>3 than those with painful symptoms OR 0.36 (95% CI 0.10-1.27). A similar heterogeneity in management was found in our institution.

## Conclusion

This systematic review demonstrates a role for surgery in the management of painless foot drop. Randomised controlled studies are required to characterise the role of operative intervention in these patients to establish best practice.

# Paper Session 3: Deformity

## Effect of Non-fusion anterior scoliosis correction (NFASC) on thoracic and lumbar sagittal parameters in Adolescent Idiopathic scoliosis (AIS) patients? Is it detrimental?

Umesh Kanade<sup>1</sup>, Keyur Akbari<sup>1</sup>, Sajan Hegde<sup>1</sup>

<sup>1</sup> Apollo Hospitals, Chennai, India

### Introduction

Non-fusion anterior scoliosis correction (NFASC) has been successful in correcting coronal deformity, there is paucity of literature on its effect on sagittal parameters. We present series of 40 patients with a minimum follow up of 2 years. 72.5% of patients had a physiological sagittal profile after NFASC, while 27.5% retained physiological profile before NFASC. This study evaluates the effects of NFASC on sagittal parameters of spine.

## Methods

Data of 40 Adolescent idiopathic scoliosis (AIS) patients treated with NFASC were analysed. Coronal cobb's angle, Thoracic kyphosis (TK), Lumbar Lordosis (LL), Pelvic Tilt (PT) and Pelvic Incidence (PI) preoperatively, immediate post op and at final follow up were measured. A Post hoc analysis following repeated measures ANOVA test was used.

## Results

40 AIS patients(39F,1M). The mean age was 14.57 ±1.98 years (12-19). 14 Lenke type 1, 3 type 3, 18 type 5, and 5 type 6. Average 7.3 vertebrae were instrumented. Mean pre op thoracic and thoracolumbar/lumbar cobb's were 48 ±4 °and 44.5 ±2.5° respectively. Mean pre-op, immediate post-op, and at 2 years TK were 27.20 ±6.88, 30.83 ±5.85 and 31.09 ±6.06 respectively. Mean pre-op, immediate post-op, and at 2 years LL were 48.92 ±8.41, 47.23 ±7.58 and 48.32 ±6.06 respectively. There was no significant change in PI and PT preoperatively and at 2 years follow up.

## Conclusion

NFASC has a positive influence on TK without having any detrimental effect on LL. As a result, most of the patients achieved normal physiologic kyphosis, some maintained their pre operative alignment. NFASC offers positive effect on sagittal parameters.

## Non-fusion Anterior Scoliosis Correction (NFASC): A Novel Promising Modality for Treatment of Adolescent Idiopathic Scoliosis (AIS)– Early Results and Future Directions

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### Introduction

The gold standard for surgical management Adolescent idiopathic scoliosis (AIS) patients remains spinal fusion, but recently non-fusion anterior scoliosis correction (NFASC) has gained interest. NFASC is a fusionless revolutionary motion preserving treatment method for surgical management of AIS, but the technique is novel and there is a visible dearth in clinical data related to the procedure. This study evaluates the radiological and clinical outcomes NFASC in patients with AIS.

### Methods

45 AIS cases who underwent the NFASC with a mean 26±12.1months (12-48) follow-up, managed for structural major curve, between 40oand 80ohaving >50% flexibility on dynamic x-rays. Data collected include skeletal maturity, curve type, Cobb angle and patient outcomes SRS-22 questionnaire. A Post hoc analysis following repeated measures ANOVA test was used to examine statistically significant trends.



## Results

45 patients (43F, 2M) with a mean age of  $14.96 \pm 2.69$  years were included. The mean Risser score and Sanders's score was  $4.22 \pm 0.7$  and  $7.15 \pm 0.74$  respectively. The mean Main thoracic (MT) Cobb angle at first follow-up ( $17.2 \pm 5.36$ ) and last follow-up ( $16.92 \pm 5.06$ ) were lower than the preoperative Cobb angle ( $52.11 \pm 7.74$ ) ( $p < 0.05$ ). Mean Thoracolumbar/lumbar (TL/L) Cobb angle at first follow-up ( $13.48 \pm 5.11$ ) and last follow-up ( $14.24 \pm 4.85$ ) lower than the preoperative TL/L Cobb angle ( $51.45 \pm 11.26$ ). None of the patient had any complications till the recent follow up.

## Conclusion

NFASC offers promising correction and stabilization of curve progression in AIS with a low risk profile and proves to be a favorable alternative to fusion modality.

## Preoperative somatosensory evoked potential in patients undergoing Adolescent Idiopathic Scoliosis Surgery. Is there a need?

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## Introduction

Intraoperative neuro monitoring is the gold standard to reduce the risk of post-operative paralysis in adolescent idiopathic scoliosis (AIS) surgery but the role of pre-operative somatosensory evoked potentials (SSEPs) in AIS patients in the era of high quality MRI is not clear. The objective of this study is to determine if pre-operative abnormal SSEPs correlate with neuro monitoring changes during surgical correction of the deformity and if these changes provide any benefit to the patient.

## Methods

A retrospective cohort analysis of 207 patients who underwent AIS surgery was done. Preoperative SSEPs, baseline neuro monitoring after anaesthetic induction and intraoperative neuro monitoring findings were compared.

## Results

6 out of 207 patients (2.9%) had abnormalities in the preoperative SSEPs. All of these patients had normal baseline neuro monitoring after anesthesia and normal preoperative MRI. Two of these six patients with preoperative abnormalities had intraoperative motor evoked potentials (MEPs) alerts. Both of them improved after the increase of blood pressure and both patients had normal post-operative neurology. There wasn't any correlation between preoperative abnormal SSEPs and abnormal baseline monitoring ( $p = 0.619$ ), intraoperative monitoring alerts ( $p = 0.208$ ) or post-operative neurological deficit ( $p = 0.99$ ). The only factor that was associated to abnormal intraoperative monitoring was the use of halo-femoral traction ( $p = 0.01$ ).

## Conclusion

Preoperative abnormal SSEPs do not correlate with intraoperative decrease of SSEPs or MEPs and don't predict higher risk of intraoperative monitoring alerts or neurological deficit after AIS surgery. SSEPs should not be required as a routine preoperative investigation for patients undergoing scoliosis correction for AIS.

## Rod Link Reducer system in Adolescent Idiopathic Scoliosis: a retrospective observational trial

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## Introduction

The Rod Link Reducer (RLR) (Globus Medical, Pennsylvania, USA), allows direct three-dimensional correction of the spine deformity follows the direct vertebral rotation (DVR) theories. The purpose of this retrospective study is to compare RLR with Traditional Correction Technique (TCT) in two cohorts of patients with Adolescent Idiopathic Scoliosis (AIS).

## Method

Fifty-five patients (M:F = 6:49) between 2018 and 2020 were included. The first group ( $n = 22$ ) was treated by RLR while the second one ( $n = 32$ ) by TCT. All spines were classified as per the Lenke system. Length of hospitalization, days in Intensive Care Unit (ICU), operative time and blood loss were recorded. SRS-30 and SF-36 questionnaires were administered pre and postoperative. We collected radiological data: pre- and postoperative Cobb angles, coronal and sagittal balance, trunk and thoracic height.

## Results

RLR and TCT groups are homogeneous in age ( $p = 0.317$ ), sex ratio ( $p = 0.347$ ) and Risser stage ( $p = 0.222$ ). Between both groups there was no significant statistical difference in hemoglobin value, hospitalization length, days in ICU, operative times, SF-36, SRS-30, NRS and perceived satisfaction. RLR group shows a better improvement of correction of main thoracic (MT) curve (RLR  $54.2\% \pm 15.9\%$  / TCT  $38.1\% \pm 20.4\%$ ,  $p = 0.031$ ). Nevertheless, RLR group shows a worse thoracic kyphosis correction (RLR  $16.82^\circ \pm 9.13^\circ$  /  $27.12^\circ \pm 12.13^\circ$ ,  $p = 0.015$ ).

## Conclusion

RLR system allows a more effective MT curve correction than TCT systems, but it seems to give a hypokyphosis effect.

## Vertebral Body Tethering in Adolescent Idiopathic scoliosis with more than 2 years of follow-up- Systematic review and Meta-analysis

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### Purpose

To conduct a systematic review reporting on the early results of AVBT for patients undergoing surgery for AIS. We aimed to systematically evaluate the relevant literature pertaining to the efficacy of AVBT with respect to degree of correction of the major curve Cobb angle, complications and revision rates.

### Study Design

A systematic review of the literature on AVBT was performed for studies published between Jan 1999-March 2021 applying the PRISMA guidelines. Isolated case reports were excluded. Patient Sample: Of a total of 259 articles, 9 studies met the inclusion criteria and were analysed. Overall, 196 patients of (mean age 12.08 years) underwent an AVBT procedure for correction of AIS with a mean follow-up of 34 months.

### Results

196 patients of (mean age 12.08 years) underwent an AVBT procedure for correction of AIS with a mean follow-up of 34 months. There was a significant correction of the main thoracic curve of scoliosis (mean preoperative Cobb angle 48.5°, post-operative Cobb angle at final follow up of 20.1°,  $P=0.01$ ). Overcorrection and mechanical complications were seen in 14.3% and 27.5% of cases respectively. Pulmonary complications including atelectasis and pleural effusion were seen in 9.7% of patients. Tether revision was performed in 7.85%, and revision to a spinal fusion in 7.88%.

### Conclusion

This systematic review incorporated 9 studies of AVBT and 196 patients with AIS. The complication and revision to spinal fusion rates were 27.5% and 7.88% respectively. The current literature on AVBT is restricted largely to retrospective studies with non-randomized data.

## Postoperative Level of Care following Surgery for Adolescent Idiopathic Scoliosis (AIS)

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### Introduction

HDU level care has been the traditional default following AIS surgery; however, increasing demand has resulted in frequent on-day cancellations. Following the implementation of a ward level care pathway we reviewed the need for critical care in patients undergoing posterior AIS surgery. The anticipated and actual HDU need was compared, together with the latter's relationship to published pre-operative predictive variables.

### Methods

Prospective analysis of all operated AIS patients between 2018 and 2020 was performed. Post-operative care was defined as Ward or Critical Care, based on the pre-operative FEV1, FVC, thoracic Cobb angle and planned number of instrumented levels. Regression analysis was performed based on these four parameters and subsequent escalation to critical care dependency.

### Results

Of 105 patients included, 60% of patients actually went to HDU and 40% to the ward. However, the HDU admission criteria was triggered in only 19% of patients ( $p=0.012$ ). Binary regression analysis demonstrated all 4 variables to have poor prediction for critical care. Independent predictors of HDU level care were blood loss and need for allo-transfusion (Odds Ratios 1.006 and 30.6 respectively).

### Conclusion

Previously published preoperative predictors for HDU requirements have not been validated in this solely AIS population using a regression analysis model. The majority of AIS patients undergoing posterior surgery can be cared for safely on a general ward. The minority that will require HDU escalation cannot be predicted preoperatively. Blood loss sufficient to require allogeneic transfusion is an accurate predictor of the latter and SOPs for escalation drafted for this eventuality.

## Mechanical Complications in the Surgical Correction of Scheuermann's Kyphosis and the Restoration of Normative Spinal Sagittal Alignment

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Surgical correction of Scheuermann's kyphosis (SK) possesses a high rate of mechanical complications. We hypothesised that reducing mechanical complications could be achieved by restoring the thoracic curves according to the normative sagittal thoracic parameters as described by Roussouly et al. We conducted a retrospective cohort study in which 52 consecutive patients who underwent surgical correction of SK in our tertiary spinal referral center between 2010 and 2018 were reviewed. Seventeen patients were excluded due to added coronal deformity, less than 2 years follow-up, inadequate radiographs and previous spinal procedures.



Spinopelvic and spinal sagittal parameters were measured at end point (2 years post-operative of the first radiograph showing mechanical complications) and were analyzed. The rate of mechanical complications was assessed in relation to the deviation from the normative parameters. A total of 35 patients met our criteria and were included in our study group. The mean age was 21.5 years. Mechanical complications occurred in 16 patients (45%) with proximal junctional kyphosis 15 patients (42%) to be the most common. Revision surgery was undertaken in 4 patients (11%). Among the radiological parameters that were analyzed in a regression analysis, a higher pelvic incidence ( $P=0.02$ ), a more cephalad thoracolumbar inflexion point ( $P=0.005$ ), greater upper thoracic kyphosis Cobb angle ( $P=0.05$ ) and fewer number of lumbar vertebrae fused ( $P=0.02$ ) were all significantly associated with a greater risk of a mechanical complications. Knowing and understanding the normal sagittal alignment plays key role in preplanning and potentially reducing the complications in patients undergoing surgical correction for SK.

## Paper Session 4: Misc/Other

### An observational cohort study evaluating a C-reactive protein threshold for conversion from IV to oral antibiotics in non-iatrogenic spinal infection (NISI)

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#### Introduction

In NISI the mainstay of treatment includes intravenous antibiotics usually monitored with C-reactive protein (CRP) as an inflammatory marker. The threshold of conversion to oral antibiotics is often variable and time based resulting in uncertain outcomes or incomplete eradication of infection. We evaluated the use of a threshold of CRP < 21mg/l as a trigger to switch to oral antibiotics.

#### Methods

A prospective database was retrospectively interrogated to identify patients treated in for NISI. 151 patients were identified between Sept-2014 to Dec-2020. We evaluated the effectiveness of using the CRP threshold <21mg/l in preventing readmission or preventing further intravenous antibiotics. Outcomes were recorded. Mean follow up 42.46 months (range: 13-86 months).

#### Results

The mean CRP at which IV antibiotics were transitioned to oral was 20.38 mg/l (range: 3-147.20; SD-19.85). The median time taken to reach the CRP threshold was 35 days (range: 1-168 days). 18 out of 151 patients failed the oral phase at a median time of 30

days (range: 4-206 days) requiring repeat intravenous antibiotics. A non-parametric survival analysis using Kaplan-Meier method revealed that 88.08% of patients were not readmitted within 206 days of discharge when CRP <21mg/l was used as a guide to transition to oral antibiotics. A Logistic Regression analysis on comorbidities showed diabetes mellitus, hypercholesterolemia, cancer/immunosuppression and IV drug abuse significantly contributed to readmission in these cases ( $P$ -value<0.05 for each).

#### Conclusion

A CRP level less than 21 mg/l is a reasonable indicator for conversion to oral antibiotics in antibiotic management of non-iatrogenic spine infections.

### MSCC prognostication - best not to over-complicate it

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#### Background

Predicting survival is a key factor in selecting the appropriate treatment modality for patients with metastatic spinal cord compression (MSCC). Scoring systems are good at identifying patients at the extremes, but how do prognostic tools fair with the intermediate 'grey area' patients, where prognosis is less clear and treatment is at the discretion of the clinician.

#### Objectives

The aim of the study was to compare the modified Tokuhashi, Tomita and Oswestry spinal risk index (OSRI) in predicting the overall survival of all patients with MSCC, and to assess which did best with those patients falling in the 'grey area'.

#### Methods

A retrospective study was undertaken of all MSCC referrals over two year period (2016- 2018) who had an identifiable date of death. The survival period for each patient in the study was calculated. The modified Tokuhashi, Tomita and OSRI scores were calculated. The predicted survival from each of the three scoring systems was compared to the actual patient survival.

#### Results

202 patients were included in the study. Factors associated with a good prognosis include age below 75, KPS > 80, slow / moderate growing tumour and ASIA D or E. Modified Tokuhashi performed best in terms of sensitivity. OSRI performed best with specificity, PPV, NPV and accuracy. OSRI is also more reliable in identifying 'grey area' patients that are suitable for surgical intervention.

#### Conclusion

Overall, OSRI performs best in terms of predicting those patients suitable for surgical intervention, including those that fall into a more discretionary category.

## Spondylodiscitis: UK Single centre validation of Brighton Scoring System

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### Objectives

Comparative analysis of institutional management of spondylodiscitis vs the Brighton Spondylodiscitis Scoring system

### Methods

Retrospective analysis of patients referred between Jan 2019 to Oct 2021 via online portal: refer-a-patient and admissions files. Variables such as distant infection, immunosuppression, co-morbidities, and presence of neurological deficit were collected. Tuberculosis cases were excluded. The Brighton Spondylodiscitis Score (BSDS) was calculated, and patients stratified into low, moderate, and high risk for surgery.

### Results

100 patients were diagnosed with spondylodiscitis; mean age 68.6 years and predominantly male (62%). 93% of patients (n=93) were managed non-surgically, with average BSDS of 13. 60% of 93 patients were categorised as low risk, while 37.6% moderate and 2% high risk. Only 7 underwent surgical intervention with a mean BSDS of 18. Of these, 2 patients were classified as low, 3 as moderate and 2 as high risk of requiring surgery. 28% were diabetic and 60% had neurological deficit. Imaging demonstrated an abscess in all cases, which required drainage, this was chiefly (70%) located in the thoracic spine. All patients (2) categorised as high risk underwent surgery, whereas 8.5% deemed moderate and 3% as low risk had surgical intervention.

### Conclusion

BSDS insufficiently calculated the need for surgery in our cohort across all risk groups however, patients with a high score were highly likely to undergo surgical intervention. Abscess formation and neurological deficit had the greatest yield of requiring surgical intervention. We, therefore, propose a novel modified BSDS, based our study to improve the predictive capability of this scoring system.

## Rehabilitation outcomes in patients with Metastatic Spinal Cord Injury treated at the London Spinal Cord Injury Centre in the UK

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### Purpose

Metastatic Spinal Cord Compression is a devastating complication of cancer, affecting approximately 3000 patients per annum in England. However, access to rehabilitation services for MSCC patients is limited. The London Spinal Cord Injury Centre has set up a bespoke MSCC rehabilitation pathway from May 2013. We provide an updated review of the presentation and rehabilitation outcome of patients with MSCC admitted to the London Spinal Cord Injury Centre.

### Method

This is a retrospective analysis of data from a single specialist centre database of patients admitted with a diagnosis of Metastatic Spinal Cord Injury from May 2013 to December 2021.

### Results

40 patients with MSCC were admitted- 32 male and 8 female patients. The average length of stay was 6 weeks. 17(42.5%) patients had primary prostate cancer. Most patients (34(85%)) had thoracic MSCC. There was improvement in the Spinal Cord Independence Measure in all patients with an average significant improvement from 43.8 to 64.5 (p<0.001). There was no significant difference in SCIM scores between patients under 65 and over 65. 28(70%) received psychological input. 33(82.5%) patients were discharged home.

### Conclusion

Holistic multidisciplinary rehabilitation significantly improved functional outcomes, stakeholders' and care-givers' experience. This pathway should be practiced nationwide.

## Outcomes Of Spinal Surgery In Patients With Fibromyalgia: Results From The British Spine Registry

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### Hypothesis

Patients with fibromyalgia undergoing spinal surgery have poor clinical outcomes.

### Study Design

Observational cohort study.

### Introduction

Fibromyalgia is present in 2-8% of the population. Various spinal procedures have been thought to produce less favourable outcomes in such patients. The literature suggests that spinal surgery neither ameliorates the symptoms nor improves fibromyalgia patients' poor quality of life. We embarked on a first registry-based study to explore the patient-reported outcome measures (PROMS) in this group of patients to provide evidence to guide future treatments.

## Methods

Pre- and post-operative EQ-5D 5L index, EQ-5D 5L VAS and Oswestry Disability Index (ODI) were obtained from British Spine Registry (BSR) for patients with a diagnosis of fibromyalgia from June 2012 to June 2021 (nine years). Follow-up PROMS ranged from 6 weeks to 2 years.

## Results

303 patients were recorded on BSR with a diagnosis of fibromyalgia, 272 were females, and 31 were males. The mean age was 55 years old. 293 underwent surgery for various degenerative conditions (cervical: 93; lumbar: 200), 8 for trauma and 2 for tumours. 158 patients had completed PROMS. Follow up ranged from 6 weeks to 2 years. At 1 year, EQ-5D 5L index and EQ-5D 5L VAS increased for degenerative conditions but decreased for trauma and tumour patients. ODI decreased for lumbar degenerative conditions and tumours.

## Conclusion

The results from our study demonstrate that patients with fibromyalgia have improved outcomes with spine surgeries for degenerative conditions but potentially worse outcomes for trauma and tumour.

## Perioperative COVID-19 infection in spine surgery. Prevalence and complications

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## Introduction

International collaborative studies in different surgical specialties have reported high rate (51.3%) of pulmonary complications, and 23.8% 30 day mortality rate in association with perioperative COVID-19 infection. The aim of this UK multicentre study is to assess the prevalence of perioperative COVID-19 infection in spine surgery.

## Method

UK multicentre, retrospective study over a period of one years assessing the prevalence of perioperative COVID-19 infection in spine surgery (as in patients or within 30 days of discharge). Also assessed the rate of complication and mortality associated with perioperative COVID-19 infections.

## Results

A total of 1955 patients from five spinal hubs were included for analysis with an average age of 54.8 years. 19(1%) patients became COVID-19 positive. One patient needed ventilation. Three (15.8%) of the positive patients died within 30 days of discharge. The average time from surgery to a positive COVID-19 diagnosis was 14 days (SD8.8). Factors associated with infection include purple pathway ( $p = 0.044$ ), deformity procedures ( $p = 0.016$ ) and infection procedures ( $p = 0.014$ ).

## Conclusion

This study found a surprisingly low rate of COVID-19 infection rates in this UK setting for this group of spine surgical patients. The numbers of COVID-19 related ventilated patients and mortality) was also very low. These results suggest that the results of one surgical study should not be extrapolated to inform the practice of other surgical groups or settings.

## Efficacy of intra-operative spinal cord monitoring in patients undergoing spinal surgery for tumours

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## Introduction

Intra-operative spinal cord monitoring (IOM) is commonly used in complex spinal surgery. The aim of this study is to investigate the efficacy of IOM in the spinal tumour surgery.

## Method

All patients who underwent surgery for spinal tumours with IOM between 1st January 2006 to 1st January 2017 were identified. IOM was prospectively analysed and categorised in to amber, or red alert. Patients' notes were retrospectively reviewed to identify those with a new post-operative neurological deficit.

## Results

During the study period 511 patients underwent surgery for spinal tumours with IOM. 296 Patients were male. The mean age was 46 +/- 20 years old. 60 patients had intradural tumours. 262 of the patients underwent multimodal IOM. 43 (8.4%) patients developed a new post-operative neurological deficit; 12 sensory, 11 motor, 13 motor and sensory, 2 autonomic and 5 involving all neural functions. During IOM 39 patients had amber and 38 had red alerts. A red alert demonstrated a sensitivity of 37.2%, specificity of 95.3%, positive predictive value (PPV) of 42.1%, negative predictive value (NPV) of 94.3%, and overall accuracy of 90.4% for identifying patients with a new post-operative neurological deficit. A red or amber alert demonstrated a sensitivity of 53.5%, specificity of 88.5%, PPV 29.9%, NPV 95.4%, and accuracy of 85.5%. Multimodal IOM did not improve sensitivity or specificity for identifying post-operative neurological deficit.



**Conclusion**

IOM has a high specificity and NPV for identifying patients with post-operative neurological deficit in patients undergoing tumour surgery. Addition of amber alerts improves its sensitivity.

## Early Mobilization After Incidental Durotomy: A Systematic Review

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**Objective**

To systematically evaluate the relevant literature regarding the outcomes of mobilization within 24 hours after incidental durotomy with respect to the length of hospital stay, minor and major complication rates.

**Methods**

A systematic review of the English language literature dating up until December 2021, was undertaken using search criteria ((Dural Tear Or Durotomy) and ( Mobilization Or Bed rest)) and the PRISMA guidelines.

**Results**

Of a total of 243 articles, 11 studies met the inclusion criteria and were analyzed. Overall, 533 patients (mean age 61.1 years) had an incidental dural tear and were mobilized within 24 hours and were followup up to an average of 23.4 Months. Primary repair was performed in 95.8% of the cases. The average hospital stay was 3.65 days. Twenty-two out of 533 (4.1%) patients had a major complication that required reoperation while the rate of minor complications was 27 out of 230 (11.7%). Additionally, 203 patients (mean age 72.8 years) were mobilized after 24 hours; 95.6% ( 194/203) underwent a primary repair with an average hospital stay of 6.4 days. There was a significant reduction in the risk of minor complications due to early mobilization ( 13/102 (12.7%) vs 33/106 (31.1%) 95CI: 0.27, 0.80), but no significant difference in major complications ( ( 12/106 (11.3%) vs 11/134 (8.2%) 95CI: 0.72, 3.35).

**Conclusion**

Early mobilization within 24 hours after incidental dural tears appears to be safe and did not need lead to a significantly higher re-operation rate compared to more prolonged bed rest.

## Paper Session 5: Commissioning, Governance & Patient Pathways

### A retrospective analysis of vertebral fragility fracture hospitalisation of older adults in England over a 3 year period

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**Introduction**

Vertebral fragility fractures (VFF) are the most common osteoporotic fracture. VFF can result in significant pain requiring hospitalisation. However, there is little data on patient numbers, hospital bed days and costs, contributed to by these patients.

**Methodology**

We report a retrospective analysis of patients aged 55 years and over admitted to hospitals across England from 2017-2019. ICD-10 classifications for VFF and OPCS codes were used to identify admissions and patients who had undergone vertebral augmentation (VA).

**Results**

There were 99,240 (61% Female) patients admitted during this period, with 64,370 (65%) patients aged over 75. There was a 14.3% average increase in admissions annually. Patients aged over 75 years accounted for 1.5 million bed days, costing £465million (median length of stay (MLOS) 14.4 days). In comparison, those aged 55-74 years, accounted for 659,000 bed days, costing £239 million (MLOS 10.7 days). The majority of patients (84%) were admitted under a non-surgical speciality and were primarily older (median age 76.8 vs 67.6 years, MLOS 8.2 vs 6.0 days). 1755 patients underwent VA (1.8% of the total cohort). 775 (44.2%) of these were aged 75 years and over. The MLOS and cost per patient admission was lower in the VA group compared to those managed non-surgically (MLOS 2.4 vs 10.8 days,  $p < 0.01$ , cost £4737 vs £7250).

**Conclusion**

Hospitalised VFF patients represented a significant number, cost and use of bed days. Those undergoing VA had a significantly shorter length of stay. Further studies are necessary to define those who may benefit from early VA.

## A preliminary study on the association of cervicobrachialgia and frozen shoulder: The double crunch hypothesis

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For patients to present with ipsilateral cervical and shoulder symptoms simultaneously is not uncommon. The anatomic relationship between the brachial plexus and the shoulder is well known. There is, however, limited published evidence documenting the correlation between cervical radiculopathy and shoulder adhesive capsulitis (AC). Previously published papers have hypothesised a few potential mechanisms as to how both pathologies could correlate. The most likely cause being a relative immobilisation of the shoulder arising from a painful radiculopathy, resulting in the cascade of inflammation and neovascularisation seen in AC. The aim of this study was to demonstrate a correlation between C4/5 foraminal stenosis and ipsilateral glenohumeral AC, something that has not been done previously. All patients undergoing ultrasound guided glenohumeral hydrodistension over a five-year period were identified. Of these patients, all that had also undergone MRI scans of the cervical spine over the same period were identified. 32 patients were included in the study. We conducted an MRI-based case-control study. Ipsilateral and contralateral (to the AC) severity of foraminal stenosis at C4/5 was graded. McNemar exact test was used to measure the significance of the correlation. Statistical analysis revealed a significant correlation between C4/5 foraminal stenosis and ipsilateral glenohumeral AC ( $p < 0.00001$ ). The results of this study establish a correlation between C5 nerve root foraminal stenosis on MRI and AC. We aim to investigate prospectively the clinical significance of this finding. We hypothesise that C5 radiculopathy is a possible risk factor for frozen shoulder.

## Prospective study on the role of electronic consent as an adjunct to the traditional consent method in spinal surgery

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Informed consent enables patients to participate in their medical care. Poor consent can lead to costly litigation claims in spinal surgery. Efforts to standardise the consent process in the UK include BASS's "three-legged stool" and GMC's "7 principles of consent and decision making" publications. Electronic consent (eConsent) supports the ethical and legal standards of consent

and could improve patient care. We aim to study the value of eConsent as an adjunct to traditional consent process. Patient satisfaction with eConsent platform (consentpatient) and traditional consenting was assessed with a survey including a validated Client Satisfaction Questionnaire (CSQ-8). We studied twenty patients who underwent a spinal procedure. Majority (70%) preferred a combined method of consent with those under 50 expressing a preference for eConsent alone. Over two-thirds (67%) reported using eConsent helped decrease preoperative anxiety. Mean CSQ-8 score was 30/32 for traditional method and 27/32 for eConsent ( $p$ -value 0.07). Older patients (>50 year-olds) were less satisfied with eConsent compared to younger ones, CSQ-8 scores 26/32 and 28/32, respectively ( $p$ -value 0.46). Higher education level was associated with significantly reduced satisfaction with eConsent, CSQ-8 scores 31/32 and 24/32 for patients with secondary vs tertiary education ( $p$ -value 0.001). eConsent, although a novel concept in practice, has been observed to be a significant positive adjunct when utilised in conjunction with the traditional consent process. Satisfaction scores amongst patients within the study have demonstrated that the majority preferred a dual or even only eConsenting. Sub-group analysis suggested younger patients may prefer electronic platform over the traditional method.

## Spinal Sarcoma Priority Setting Partnership

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We aim to raise the profile of spinal sarcoma throughout the U.K. spinal community through this James Lind Alliance Spinal Sarcoma Priority Setting Partnership (PSP). Spinal sarcomas often present late in the disease course once patients develop neurological symptoms. These symptoms may mimic other benign spinal, neurological or musculoskeletal conditions, contributing to a late diagnosis. Early diagnosis is essential, as it allows surgery to be less complex with fewer complications, making adjuvant therapies such as chemotherapy and radiotherapy more effective and this will ultimately improve patient prognosis. However, research to date has involved collaboration between clinicians and researchers without fully considering the needs of patients and their carers. A PSP is urgently required to increase national awareness of these rare cancers, promote early investigation and diagnosis, and bring together patients and clinicians. Clarifying their needs will allow future research to address the issues which matter most to the sarcoma community. Our primary aim is to bring together the spectrum of clinicians, patients, carers and charities to determine the top 10 research priorities in Spinal Sarcoma.

We are currently surveying the U.K. sarcoma community guided by a steering group of patients, charities, clinicians and scientists to identify the unanswered questions about spinal sarcoma. By the time of this presentation in March 2022, we will outline the main unanswered themes in Spinal Sarcoma.

## The development of a fast track Degenerative Cervical Myelopathy (DCM) pathway in a National Neurosurgical Service

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Degenerative cervical myelopathy (DCM) is a common, non-traumatic spinal cord injury normally characterised by progressive neurological impairment with an estimated 2% prevalence. In 2019, an internal audit of patients presenting to a national neurosurgical service identified that patients with clinical symptoms suggestive of DCM waited an average of 75 weeks for initial assessment. A DCM pathway was agreed between Consultant Neurosurgeons and Clinical Specialist Physiotherapists (CSPs) to ensure patients with suspected DCM referred via 'Dear Doctor' pathway were assessed in a timely fashion. From January 2020 – December 2021, the CSPs assessed 47 patients in consultant led neurosurgical clinics that had suspected DCM following paper triage of the referrals. Average wait time from receipt of referral to initial appointment was 45 days. 13/47 (28%) had suspected / confirmed DCM and 17/47 (38%) had cervical radiculopathy following clinical assessment. Of the 13 patients with suspected DCM following clinical assessment: 2 were discharged, 5 were wait listed for surgery, 2 was referred for imaging and 4 were offered a review appointment. The CSPs identified 25 additional patients with suspected DCM following clinical assessment where there was no referral information suggestive of DCM. 6/25 (24%) were listed for surgical intervention following initial clinical assessment. The implementation of a fast track pathway for patients with confirmed or suspected DCM has ensured timely assessment of patients within a national neurosurgical service. 28% of patients with suspected/confirmed DCM following paper triage of their referral had clinical findings of DCM following a clinical assessment.

## MRI "Sell-by Date" in Lumbar Spine Pre-Operative Imaging

Fabian Wong<sup>1</sup>, Sangan Patil<sup>1</sup>, Milan Patel<sup>1</sup>, Namratha Kaur<sup>1</sup>, Charlotte Sherpa-Blaiklock<sup>1</sup>, Joseph Robbins<sup>1</sup>, Sashin Ahuja<sup>1</sup>

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### Introduction

There is no clear consensus for a "sell-by date" for preoperative MRI scans for lumbar spine surgery. It is prudent to avoid repeat scans that are not necessary. The aim of this study is to assess the appropriate timeframe for repeating MRI prior to elective lumbar spine surgery.

### Methods

196 Consecutive patients awaiting lumbar spine discectomy, decompression or stabilization for spondylolisthesis were identified from pre-operative assessment clinics. Data collected included patient demographics, timing of pre-operative imaging, planned procedure and any changes to procedure performed.

### Results

178 patients over a 40-months period fulfilled the selection criteria and were included. 108 (61%) were for discogenic pathology, 45 (25%) for stenosis, and 25 (14%) for spondylolisthesis. 54 patients (30%) were listed for discectomy with a mean wait of 12 months from their listing scans; 28 patients proceeded with planned operation, with a mean wait of 8.7 months (Range 1-29; SD=7.4). 18 patients with mean wait of 15 months (Range 5-30; SD=6.5) had additional level surgery, and 8 patients declined surgery after 14 months (Range 1-27; SD=8.2) There was statistical difference ( $p=0.008$ ) when comparing the waiting time between these groups. However, there was no difference in the number of patients with radiological changes across groups on repeat MRI. There was no statistical difference for all of the above parameters for lumbar stenosis, or spondylolisthesis.

### Conclusion

While MRI within 12 months pre-operatively for discectomy may help to reaffirm surgical decision, repeating MRI prior to surgery for spinal stenosis or spondylolisthesis may not be necessary.

## Demographics of Patients with Improvements in Intra-operative Monitoring during Interventions for Cervical Myelopathy- Can we predict Improvements and Outcome?

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## Introduction

Intra-operative monitoring (IOM) aims to reduce the risk of neurological complications, however there is a subset of patients with improved IOM signals intra-operatively. Little is known about their demographics or outcome. This study aimed to identify demographic factors of these patients and if there was any effect on post-operative outcome.

## Methods

We retrospectively analysed all patients presenting for operative management for cervical myelopathy between 1st January 2016 -2021. Collected data included patient demographics, level of intervention, presence of MRI signal change pre-operatively and complications. Patients with improved IOM were compared statistically with those without.

## Results

56 of 84 operative procedures had available IOM data, with a mean age of 65.3 (37-87) and 39.3% female. 9 patients had an improvement, whereas 47 did not. Of those that had an improvement, there was no difference in mean age (64.8 v 65.3,  $p=0.92$ ) or % female (55.6% v 46.8%,  $p=0.77$ ), presence of signal change on MRI (60.6% v 53.2%) or multi-level decompression (66.7% v 66.0%,  $p=0.96$ ). 55.6% patients with improved IOM had post-operatively recorded symptomatic recovery. Rates of complication and symptomatic recovery were comparable between the two groups.

## Conclusion

There are no clear demographic determinants of improved IOM during cervical myelopathy. Further study is required to ascertain factors that may determine an improvement of IOM, and clarify its impact on outcome.

# Paper Session 6: Innovation

## Clinical & Radiological Outcomes Following the Use of Triangular Sacro-iliac Joint Cages in addition to S2AI screws (Bedrock Technique) to Enhance Spinopelvic Fixation

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The pelvis is an important caudal anchor point for long construct fusions. S2AI screws have shown less complications than iliac bolts and allow easier rod insertion. However as the SIJ isn't fused, problems with toggling, loosening and breakage persist. ~12% of patients also complain of SIJ pain. The Bedrock

technique involves adding triangular titanium implants across the SIJ (medial to lateral) above the S2AI screws. We assessed clinical & radiological outcomes of this technique. Pre-operative EQ5D, EQ5D VAS, ODI and VAS scores were obtained. Enhanced spinopelvic fixations using the Bedrock technique (under computer navigation) were performed in a tertiary specialist centre by two senior surgeons. We prospectively reviewed post-op PROMS at six months and one-year. Minimum f/u was 12 months (12-30 months) and all patients were assessed for SIJ pain. Of our 15 patients, 10 had degenerative scoliosis, two spondylolisthesis and positive sagittal balance and three had revision surgery for flat back fusions and metalwork failure. At 1 year, EQ5D improved from 0.28 to 0.70, EQ5D VAS from 44.50 to 76.80, ODI from 58.75 to 26.33, VAS leg from 6.65 to 1.41 and VAS back from 7.33 to 2.01. No patient complained of SIJ pain. CT scans at one year all revealed good evidence of fusion with bone growing through the SIJ cages and no cases of distal implant failure or screw loosening. Our clinical and radiological results show that the Bedrock technique in long construct adult deformity surgery yields good outcomes with no mechanical failure of the spinopelvic fixation.

## Patients' smartphone biometric apps: potential use in the collection of functional activity data outcome measures and in promoting increased engagement with post op rehabilitation

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## Introduction

With ever increasing ownership of smartphones, we examine their potential use both as an adjunct to other BSR/PROMS outcome measures and to facilitate greater engagement with postoperative rehabilitation.

## Method

We surveyed 120 consecutive adult spinal clinic patients with respect to mobile device use, documenting any activity data recorded by their SMART device. The cohort of these patients undergoing subsequent surgery was then followed prospectively, collecting pre/postoperative functional activity data.

## Results

94% of patients (aged 21- 93) routinely carry their mobile phone around with them. 88% are 'smart' devices (33 % iphone, 67% android). 52% of patients' devices were already collecting activity data but only 15% of the patients were aware of this. Patients' own estimated versus app- logged maximum walking time/distance tolerance correlated very poorly (range: 10% to 300%). 99% of smartphone owners and 92 % overall stated they would readily accept activity data collection for more objective monitoring of response to treatment. The operated cohort's smartphone biometric data apps recorded increases in mean walking distance (from 809 to 1445 metres), mean walking time

(from 17 to 26 minutes), average walking speed (from 1.7 km/h to 2.6 km/h, average number of steps taken (from 519 to 820) and stride length (from 52 to 58 cm) at 6-12 weeks post op. In addition, patients generally reported feeling more engaged in their rehabilitation.

### Conclusion

Smartphone biometric apps are acceptable to patients as a potential tool for collecting more objective pre/post operative function data, as an adjunct to collecting BSR /PROMs outcome measures.

## “Let’s Talk Backs” is a physiotherapy-led communication project with patients awaiting lumbar discectomy to explore patient satisfaction with information provided and understanding of the operation

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### Introduction

Spinal surgical waiting times are extensive, and patient symptoms can change or resolve during the wait, potentially meaning surgery is no longer required. These last minute cancellations often result in inefficient use of NHS resources. When patients are boarded for surgery, the indications, risks and benefits are explained. However, provision of written information is not guaranteed. Once boarded, these patients have no further scheduled contact until surgery is imminent. We surveyed patients and found that only 52% were satisfied with their clinic experience, 63% patients didn’t get enough information and 41% received none.

### Method

In 2021 we completed virtual telephone clinics with 148 patients to discuss current symptoms and potential surgical outcomes, risks and benefits. We sent written information and surveyed patients to assess satisfaction with the telephone call and opinions of the information provided. Where relevant, patients whose symptoms had resolved were removed from the surgical waiting list.

### Results

Our follow-up survey established 82% patient satisfaction with the telephone call and 88% felt they got enough information about surgery. This highlights how communication with this cohort of patients is vital from a psychological perspective. Additionally, following telephone discussion, 43% patients decided they no longer needed surgery and were discharged from the service.

### Conclusion

This project ensures waiting lists only contain patients who are well informed, have appropriate up-to-date assessment of symptoms and who want to proceed with surgery. This will reduce last minute cancellations, optimise post-op recovery. It can hopefully be rolled out to other orthopaedic disciplines.

## Assessment of the Validity Of A generic Temperature Sensor To Monitor Patient Adherence To Cervical Spine Orthosis Wear Time

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### Aim

To evaluate the validity of a generic orthosis temperature sensor to monitor compliance with a cervical orthosis.

### Methods

This observational study involved healthy participants, wearing a cervical orthosis according to a 150 minute protocol (n=8), tested at threshold temperatures of 22-31 degrees, sampling every 15 minutes. University of Sheffield ethical approval reference: 031694. Primary outcome: agreement of temperature sensor with digital camera to determine collar on versus collar off. Secondary outcome: validity of mean wear time.

### Results

The mean temperature whilst collar off was 22 degrees (SD=5.0) and whilst collar on was 28 degrees (SD=4.2). The highest agreement of the 160 data-points was demonstrated at a threshold of 25-27 degrees, which showed moderate agreement between sensor and camera for collar on time and collar off time. (Kappa =0.60, p value <0.001). These analyses are adversely affected by warm-up and cool-down lag. The mean warm-up of 16.8 minutes and cool-down time of 13.2 minutes were similar (p value>0.05), thus negating one another in wear time analysis. Mean detected wear time ranged from 189-90 minutes for thresholds 22-31degrees. A threshold of 25.5 degrees gives optimum correlation between sensor detected wear time and true wear time.

### Conclusion

This novel study demonstrates a widely available temperature sensor can be used to accurately and objectively measure patients’ compliance with cervical orthoses wear time. This has important implications for both clinical practice and research studies such as the forthcoming NIHR DENS study.

## Simple innovation using QI frameworks to deliver sustainable change in documentation practices and standardisation of post-operative care documentation in spinal surgery

Raveen Jayasuriya<sup>1</sup>, Siddharth Komperla<sup>2</sup>, Callum Edmonds<sup>2</sup>, Lucy Amos<sup>1</sup>, Rye Yap<sup>2</sup>, Michael Athanassacopoulos<sup>3</sup>, Edward Bayley<sup>1</sup>, Lee M Breakwell<sup>1</sup>, Ashley Cole<sup>1</sup>, Neil Chiverton<sup>1</sup>, Marcel Ivanov<sup>1</sup>, Shreya Srinivas<sup>1</sup>, James Tomlinson<sup>1</sup>

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### Introduction

Comprehensive post-operative care documentation is essential to reduce information clarification requests, and delays in care.

### Methods

Stage 1: Characterise the problem and engagement through SMART aims, process mapping, driver diagram and stakeholder analysis. MDT consensus to generate evidence-based auditable criteria. Stage 2: Baseline audit to assess current practice Stage 3: Intervention planning by stakeholders. Stage 4: Longitudinal monitoring and iterative refinement.

### Results

Below summarises 5 audit cycles, over 3 years, and includes 283 operative notes. Stage 1: Consensus was achieved on 15 essential criteria for complete documentation, including important negative fields. Stage 2: Baseline audit demonstrated unexpectedly poor documentation: >75% compliance in 4 criteria, and <50% compliance in 10 criteria. Stage 3: A post-operative care template based on the 15 criteria was embedded within the existing IT software. It allowed use of existing operative templates, with a non-overwriting suffix requiring only two mouse clicks. Stage 4: Re-audit at 3 and 12 months showed improved and sustained compliance. At 24 months compliance had declined. Questionnaire of template usage identified problems of criteria response options, and lack of awareness of template by newly appointed staff. Template update improved compliance over the next 6 months (>75% compliance in 11 criteria).

### Conclusions

Simple innovation changed documentation practices by 1) achieving a consensus from stakeholders, 2) a “shock and awe” moment to highlight existing poor documentation, 3) implementing change which fit easily into existing systems, 4) respecting autonomy rather than enforcing change and 5) an iterative process to ensure template was fit for purpose.

## Optimisation and validation of thermal adherence sensors for monitoring spinal orthosis wear-time in a clinical trial

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### Background

Thermal sensors have been used in bracing research as self-reported diaries are inaccurate. Little is known about new low-profile sensors, optimal location within a brace, locational thermal micro-climate and effect of brace lining.

### Aims

Determine an optimal temperature threshold for sensor-measured and true wear time agreement. Identify optimal sensor location. Assess all factors to determine the best sensor option for the Bracing AdoleScent Idiopathic Scoliosis (BASIS) multicentre RCT.

### Methods

Seven Orthotimer and five iButton (DS1925L) sensors were synchronised to record temperature at five-minute intervals. Three healthy participants donned a rigid spinal brace, embedded with both sensors across four anatomical locations (abdomen/axilla/lateral-gluteal/sacral). Universal-coordinated-time wear protocols were performed in/out-doors. Intraclass correlation coefficient (ICC) assessed sensor-measured and true wear time agreement at inputted thresholds 15–36°C.

### Results

Optimal thresholds, determined by largest ICC estimate: Orthotimer: Abdomen=26°C, axilla=27°C, lateral-gluteal=24.5°C, sacral=22.5°C. iButton: Abdomen=26°C, axilla=27°C, lateral-gluteal=23.5°C, sacral=23.5°C. Warm-up time and error at optimal thresholds increased for moulded sensors covered with 6mm lining.

### Conclusion

Location: anterior abdominal wall. Excellent reliability and higher optimal thresholds, less likely to be exceeded by ambient temperature; not a pressure area. Sensor: iButton, longer battery life and larger memory than Orthotimer; allows recording at 10 min intervals for life of brace. Orthotimer only able to record every 30 mins, increasing error between true and measured wear time; Orthotimer needs 6-monthly data download.

### Threshold

26°C is optimal threshold to balance warm-up and cool-down times for accurately measuring wear time. Sensor should not be covered by lining foam as this significantly prolongs warm-up time.



## BASS 2022 Poster Abstracts

## Tumour

### External Validation of the New England Spinal Metastatic Score (NESMS) - A Pilot Feasibility Study for 12-Month Survival in Patients with Metastatic Spinal Cord Compression

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#### Introduction

This pilot study aimed to assess the feasibility of externally validating the New England Spinal Metastasis Score (NESMS) in a cohort of patients presenting with metastatic spinal cord compression. A 2021 multicentre prospective study in the original affluent, metropolitan population showed the NESMS score to be a reliable and superior prognostic tool for 12-month survival for patients presenting with spinal metastasis compared to traditional prognostic spinal metastasis scores.

#### Method

The NESMS score components, and mortality data at 3, 6 and 12 months were collected for 75 patients. All patients, referred between January 2019 and December 2020, were identified via the British Spinal Registry and the "Referback" portal.

#### Results

A substantially different distribution of NESMS scores was observed, compared to the original data, with more high scores and fewer low scores. Twelve-month mortality followed the general trend that a decreasing NESMS score had higher rates of mortality ( $p=0.027$ ): 48% for NESMS 3 vs. 100% for NESMS 0. A similar pattern was observed at 6 months ( $p=0.008$ ) but not 3 months ( $p=0.162$ ). Being operated upon was a significant predictor of improved NESMS score ( $p=0.003$ ) and 12-month mortality ( $p=0.002$ ).

#### Conclusion

External validation of the NESMS score in our population is feasible, and shows similar significant trends of increasing mortality with decreasing NESMS score. Further validation studies in collaboration with oncologists are now being planned to allow detailed subgroup analysis and validation in a much larger UK-based population.

### Denosumab therapy for Spinal Aneurysmal Bone Cysts with spinal cord compression

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#### Introduction

Current treatment strategies for Spinal Aneurysmal bone cysts (ABCs) involve en bloc surgical resection; intraslesional curettage, with or without bone grafting, with or without instrumentation and spinal fusion; and local adjuvants such as arterial embolization, sclerotherapy or radiotherapy. Surgical morbidity can be significant and recurrence is common. We present a non-invasive alternative treatment option which has not been previously reported in literature in the context of spinal ABCs with spinal cord compression.

#### Methods and Results

We report 2 cases where Denosumab therapy (4 weekly subcutaneous Denosumab injections under outpatient setting) was used in above setting. Case 1 - 9 year old with C3-C5 ABC with asymptomatic spinal cord compression. Treated with Denosumab for 9 months resulting in complete resolution of tumour and pain at 6 months. No tumour recurrence at 12 months. Case 2 - 20 year old with C2-C4 ABC with acute myelopathy which began to resolve within 24hrs after first Denosumab dose and fully resolved after 4 weeks. MRI at 72 hours demonstrated radiological resolution of spinal cord compression. Tumour size reduced to 70% at 6 months with complete resolution of pain. Tumour size remained static at 12 months. There were no adverse effects of Denosumab therapy in both patients.

#### Conclusion

Denosumab therapy may be a useful adjunct to treatment of spinal ABC's with spinal cord compression. Under specific circumstances, it may be considered for the treatment of acute symptomatic spinal cord compression when surgical decompression is high risk. This warrants further investigation.

## Spinal Injuries

### Summary of 10 years experience with robot suit HAL in Germany

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## Introduction

In recent years, robot-assisted systems have increasingly found their way into the care of numerous diseases. Such systems can be used as aids for home use or as remedies, in the form of therapy. In our clinic, the robot suit Hybrid Assistive Limb (HAL) has been used for the therapy of paraplegics since 2012. The HAL uses minimal bioelectrical signals from the patients' remaining motor function and transfers them into movement. Over 180 patients have participated in various studies since.

## Method

Study protocol involves 60 therapy sessions over a 3-month period (5 therapy sessions/week). A therapy session includes up to 30 minutes on the treadmill supervised by a HAL-trained physiotherapist.

## Results

Our published clinical studies initially demonstrated safe use in acute and chronic patients, as well as functional improvements in 10-meter-walk-test, timed-up-and-go test, and 6-minute-walk-test. Furthermore, reduction of neuropathic pain, cortical reorganization, improved bladder and bowel function, and improvement in physiological gait were observed. The most recent published study investigated whether there is a time-dependent threshold between the onset of paraplegia and the start of therapy after which therapy is no longer effective, which was not the case. Thus, HAL therapy appears to be equally effective for both acute and chronic paraplegics.

## Conclusion

Our experience with the HAL shows that effective therapy for paraplegics is possible. Nevertheless, further studies on the long-term effects of the therapy are needed. Furthermore, this therapy is not yet available to a broad mass of patients due to administrative and cost reasons.

## Management of Thoracolumbar Fractures in Patients with Ankylosing Spondylitis: A Systematic Review

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### Introduction

Ankylosing Spondylitic patients are susceptible to spinal fractures despite minor trauma. Due to the absence of consensus on which surgical approach is most efficacious in treating thoracolumbar fractures in AS patients, the focus of this systematic review was to evaluate the efficacy of posterior-only and combined anterior posterior approach in such cohort.

### Methods

Studies published up to 4th of January 2022 were searched on Pubmed / Medline, and Cochrane databases with predetermined terms. Outcomes included Perioperative neurological function (evaluated through ASIA scale), and complication rate. The studies included the final quantitative analysis underwent risk of bias assessment as well as quality of evidence evaluation.

### Results

Ten studies met the inclusion criteria. Most common (1) mechanism of injury was minor trauma (75.7%),  $p < 0.05$ , (2) fracture level was T12 (42.9%). 28.9% of the ThL fracture patients had pre-operative neurological deficit (ASIA Scale). When comparing strategies, combined approach recorded a higher percentage of patients with no change in neurological function (81.8%) versus posterior only approach (66.7%,  $p < 0.05$ ). Although complication rate was higher for posterior only approach (13.6 %) than combined approach (12.5 %), no statistically significant difference was observed,  $p > 0.05$ .

### Conclusion

This systematic review was restricted to the quality of evidence present. Due to a lack of statistical significance in complication rates between both approaches, future randomised controlled trials evaluating different surgical approaches reporting objective measures are needed to form a consensus.

## Compliance With the Cauda Equina Pathway: Results of a Closed-Loop Audit

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The British Association of Spine Surgeons (BASS) and Society of British Neurological Surgeons (SBNS) recommend urgent MRI imaging and operative intervention in patients with suspected CES. Due to the lack of a 24-hour MRI service and the centralisation of neurosurgery to large tertiary centres, there is a need for an evidence-based protocol for the referral of patients presenting with back pain, with red flags to specialist tertiary neurosurgical centres. Our local hospitals SOP outlines steps in the assessment, triage and onward referral of patients presenting with symptoms of acute CES. A closed-loop audit cycle was performed. Recommendations made after the first cycle were actioned prior to re-audit. There was 100% compliance regarding discussions with neurosurgery following MRI and appropriate management following neurosurgical advice. There was a 21.1% increase in appropriate discussions with neurosurgery by A&E, increased accurate documentation of red flags (5% anal tone and 21% perianal sensation). There was a 53% decrease in senior ED doctor referral to neurosurgery, although 100% referrals were discussed with an ED senior prior to referral, and a

20% decrease in compliance regarding neurosurgery plan documentation. In conclusion we were able to improve our compliance with several aspects of the SOP. Since CES requires timely management and early scanning, we recommend a robust protocol at the admitting hospital. This paper presents the protocol at our hospital and the rationale behind it. We discuss what affects our compliance with the SOP and how simple interventions have helped us improve.

## Misc/Other

### Patient Reported Experience of Telephone Consultations for Elective Spine Appointments during COVID

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#### Introduction

The COVID pandemic necessitated a change in the elective outpatient spinal services. We assessed the patient experience and feasibility of telephone consultation post-COVID.

#### Method

Over a two-month period from April to June 2020 on a single spinal surgeons practice a structured telephone interview was performed following new and follow-up telephone consultations. The interview was performed by an independent clerk using a 10 point Patient Reported Experience Measure (CARE Patient Feedback Measure) with a supplementary question (Would you be happy to replace a face to face consultation with a telephone consultation in the future).

#### Results

We recruited 55 patients. 18 (33%) were new patients and 37 (67%) were follow-ups. 5 (28%) new patients and 7(19%) follow-ups would be happy to have telephone consult instead of a face to face consult . 9/22 (41%) new and 18/33 (55%) follow-ups reported a very good or excellent experience in all 10 domains. 4(18%) new patients experienced a lack of interest, 3(14%) a lack of care and compassion with the telephone consult. 9/37(24%) follow-ups experienced a lack of empowering them to take control.

#### Conclusion

New and Follow-up patients found the telephone consult a poorer experience compared to a face to face consult. It would not seem feasible to offer telephone consults post-COVID.

### GRASP (Gloucestershire Referral of Acute Spinal Pathologies) GRASP proforma as a Quality improvement tool for Documentation of Acute Spinal Patients

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#### Background

The Management of acute spinal pathologies requires accurate documentation of clinical findings in timely manner. This allows spinal specialists to comprehensively evaluate the clinical presentation and deliver appropriate management. A GRASP proforma was used as a guidance for early documentation of clinical findings in patients presenting with suspected acute spinal pathologies.

#### Methods

A GRASP proforma included; patient demographics, complaints, red flag symptoms, comorbidities, upper and lower limbs myotomes and dermatomes examination, reflexes, rectal examination, upper motor neuron signs, nerve root tension signs, pre and post-void bladder scan. All patients referred with suspected spinal pathology between 5-25 October 2020 (1st cycle), and between 1-19 March 2021 (2nd cycle) were included. The GRASP proforma was used for documentation during second cycle.

#### Results

31 and 35 consecutive records were identified over the first and second cycles respectively. Red flag symptoms documentation dramatically improved for perianal numbness and faecal incontinence from 38% (1st cycle) to 100% (2nd cycle). Admission temperature was recorded in 9.7% of patients (1st cycle) compared to 100% of patients (2nd cycle). Documentation of upper limb motor and sensory function improved 29% (1st cycle) to 77% (2nd cycle). PR examination was recorded in 61% and 100% of patients during first and second cycles respectively.

#### Conclusion

GRASP proforma proved to be an effective quality tool for accurate documentation of acute spinal pathologies which is mandatory to confirm the diagnosis and management plan. The GRASP proforma could be utilised as national guidance for assessing and documenting findings in acute spinal pathologies.



## The 50 Most-cited Articles in Spine Surgery from the United Kingdom

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### Introduction

Spinal surgery is a complex and ever-evolving field. With scientific research becoming a routine part of a clinician's role, there is a need to identify and analyse the most important works that are available for review.

### Purpose

The purpose of this article is to report on the 50 most cited articles in Spine surgery from the United Kingdom and to perform a citation analysis on the most frequently cited articles.

### Materials

The Thomson Reuters Web of Science was used to search citations of all articles relating to Spine surgery from 1950 to 2020 relevant to Spine surgery from the United Kingdom. 50 most cited articles meeting the search criteria were further analysed in terms of journal and year of publication, authorship and region of origin, number of citation and level of evidence.

### Results

There is noticeable gap in the generation of scientific material between England and rest of the United Kingdom with London leading the citation list with 45 papers. Most of the works are in the domain of degenerative lumbar spine pathologies amounting to 44% papers. The trend has been towards clinical research compared to Basic sciences with Observational studies 36% and Case-series being the most frequently published and cited. Total citations received for all the 50 papers was 11266 with a mean of 225.32.

### Conclusion

The most cited works are those from the last two decades. A study like this helps bring to fore the most noticeable work and facilitate a quick review of spine surgery.

## An audit of spinal procedure consenting process at Lister hospital using the BASS three-legged stool approach

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### Background

Informed consent is a vital part of surgical treatment. In 2015, a British Association of Spinal Surgeons (BASS) working group congregated to outline the "three-legged stool" consent

framework for elective spinal surgery. The three components include: 1. Patient information leaflet (PIL) 2. Patient-centred discussion regarding risks and benefits of proposed treatment 3. Surgeon-guided consent form and consent for surgical outcome data to be sent to the British spinal registry (BSR).

### Methods

The BASS framework was used to assess the consenting process for spinal surgery at Lister Hospital. Clinic letters of patients undergoing elective spinal procedures were reviewed in two cohorts: (1) December'18 to May'19 (n=32) and (2) November'19 to April'21 (n=113).

### Results

50.4% of patients received PILs in the 2019-21 cohort compared to 68.8% in 2018-19. Patient centred discussions were also fewer in the 2019-21 cohort (85.0% vs 96.9%). However, more patients signed consent for surgery and BSR in clinic (41.6% 2019-21 vs 21.9% 2018-19). Overall, more patients received all components of the BASS accredited consenting process in 2019-21 (36.6%) compared to 2018-19 (18.8%).

### Conclusion

Despite a reduction in the utilisation of the individual components, a higher proportion of patients received a complete BASS "3-legged stool" framework in the 2019-21 cohort, notwithstanding severe disruptions to surgical services during the COVID-19 pandemic. The study is limited by surgeons' documentation in clinic letters, including where patient-centred discussion may be inferred by the signing of a consent form. With the incorporation of specialised consenting clinics, we hope to further improve our consenting process.

## A Systematic Review of Cluneal Nerve Decompression

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### Background

Cluneal nerve entrapment remains under diagnosed and poorly understood with few studies discussing the efficacy of its surgical release.

### Objective

To conduct a systematic review reporting on the efficacy of cluneal nerve surgical decompression in patients with an established diagnosis who fail conservative treatment.

### Methods

A systematic review of the English language literature dating up until September 2021, was undertaken using search criteria (Cluneal Nerve Entrapment and (decompression Or Release)) and the PRISMA guidelines.

## Results

Of a total of 47 articles, 4 studies met the inclusion criteria (all were level IV evidence) and were analyzed. Overall, 98 patients of mean age 61 years, (range 17-86) underwent cluneal nerve release with a mean follow-up of 25.5 months (6-58 months). There was significant improvement in symptoms post operatively in the 4 studies. No systemic or local complications were encountered during the surgeries. Four articles reported on revision surgery for recurrent symptoms in 8 patients out of 98 with a rate of 8.2%. Of the reoperated patients, 7 had new branches released that were not addressed initially and 1 had neurectomy for an adhered pre-released branch.

## Conclusion

This systematic review demonstrated that cluneal nerve decompression has been performed in a total of 98 patients with significant clinical improvement, zero systemic and local complications and revision rates of 8.2% of the cases. The current literature on cluneal nerve decompression is restricted largely due to a small number of patients and variations in surgical technique.

## Is Modified Frailty Index a Robust Predictor of Perioperative Complications in Spinal Surgery? A Systematic Review

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### Introduction

Risk evaluation through a frailty scale provides a potentially promising device to determine cases susceptible to perioperative complications. Modified frailty index (mFI) is a promising tool for evaluating perioperative complication risks. The purpose of this systematic review was to evaluate the robustness of modified frailty index's predictive abilities regarding perioperative complications in spinal surgery.

### Patients and Methods

Studies published up to and including December 2021 was searched in the Pubmed/Medline, and Cochrane Central Register of Controlled Trials with predetermined terms. Randomised controlled trials, Prospective, and retrospective observational studies reporting mortality rate, Clavien-Dindo IV complications, surgical site infections, and urinary tract infections were included. Included studies underwent a risk of bias and quality of evidence assessment using the GRADE criteria.

### Results

Eighteen studies met the inclusion criteria. Higher mFI index scores revealed to be an independent predictor of thirty day mortality, as 30 day mortality rates increased from 0.8% (mFI 0) to 7.9 % (mFI  $\geq 0.27$ ),  $p < 0.05$ . Clavien-Dindo IV complication rates

increased from 1.9 % (mFI 0) to 14.6 % (mFI  $\geq 0.27$ ),  $p < 0.05$ . A Similar trend was observed in surgical site infections and urinary tract infections, as SSI and UTI rates increased from 2.5% and 10.2 % (mFI 0) to 8.8 % and 22.5 % (mFI  $\geq 0.27$ ),  $p < 0.05$  respectively.

### Conclusion

The results of this systematic review provide a strong endorsement for the use of mFI in spinal surgeries. It can be used for screening high-risk cases, optimising surgical tactics, estimating for potential complications, and refinement of postoperative care.

## Is delaying elective spinal surgery associated with increased complexity and complications in the future?

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### Introduction

COVID-19 pandemic has resulted in many elective spinal surgical procedures being postponed. There is little information available on whether such delays may be associated with increased surgical complexity and possible complications. Our aim was to investigate if single level primary microdiscectomies performed after COVID cancellations were associated with increased complexity and complications compared to those performed prior to COVID-19 pandemic.

### Method

A retrospective review of theatre records was carried to identify all patients who had a single level primary microdiscectomy between 1st October 2018 to 1st January 2020 (pre-COVID) and 1st October 2020 to 1st January 2022 (post-COVID). Patients' medical notes and their theatre records were retrospectively reviewed. Operative time was used as an indicator of surgical complexity.

### Results

21 patients underwent microdiscectomy pre-COVID and 19 post-COVID. Median age of patients was 37.9 years (28.5-48.2). 19 patients were female. 26 patients had surgery at L5/S1 level, 11 at L4/5, 2 at L3/4 and 1 at L2/3. Pre-COVID the median operative time was 1 hour and 50 minutes (1:44 – 2:15). Post-COVID the median operative time was 2 hours and 25 minutes (1:40-2:44). There were 3 (15.8 %) cases of dural tear post-COVID and non pre-COVID.

### Conclusion

Our experience demonstrated that following COVID delays single level microdiscectomies took longer, likely due to their increased complexity. Furthermore, we witnessed increased incidence of dural tears. Despite the small sample size, our findings should be kept in mind when considering postponing future elective spinal procedures.

## Lumbar degenerative

### Does the addition of fusion or interspinous process device improve outcomes in the decompression of lumbar stenosis with degenerative spondylolisthesis? A systematic review and meta-analysis

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#### Objective

This study's primary objective was to investigate the efficacy of the addition of fusion or interspinous process device (IPD) to decompressive surgery in the treatment of lumbar stenosis in the presence of spondylolisthesis. Outcomes of interest included both patient-rated measures of pain and function and perioperative measures of blood loss, operation duration, hospital stay, and reoperation.

#### Methods

Electronic searches of five online databases were performed, with included studies limited to randomised-controlled trials (RCTs) comparing decompression alone (DA) with decompression with fusion (DF) or IPD for patient-rated or perioperative outcomes. Patient-rated data were reported as part of the systematic review, while meta-analyses were performed for perioperative outcomes using the DerSimonian and Laird random-effects model. Heterogeneity was assessed using the Q and I<sup>2</sup> statistics, while forest plots were developed for visual interpretation.

#### Results

A total of 13 articles met the review's eligibility criteria. Overall, no statistically significant differences were found in the efficacy of fusion or IPD over DA in patient-rated outcomes. Meta-analysis of perioperative outcomes revealed fusion to result in greater blood loss, operation duration and length of stay in hospital. Use of IPD led to slightly reduced operation times, but greater risk of reoperation compared to DA.

#### Conclusion

Currently there is no evidence for the addition of fusion or IPD to decompressive surgery for patient-rated or perioperative outcomes. Indeed, both alternatives potentially lead to greater costs and risk of complications, and therefore, a stronger evidence base for their use should be established before they are promoted as routine options.

### The clinical utility of repeating MRI scans within 12 months in the management of Lumbosacral Degenerative Disc Disease

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#### Background

MRI is the gold standard investigation for lumbosacral degenerative disc disease. However, controversy exists regarding the clinical value of repeating an MRI scan within 12 months when a patient presents with recurring symptoms. This study measures rates of radiological change in a real-world cohort to guide clinicians when deciding to repeat a scan.

#### Methods

All patients over a ten-year window in one general hospital who underwent two lumbosacral MRI scans for degenerative disc disease within twelve months of each other were included in the study. Level of main vertebral pathology was recorded, along with location of a disc prolapse. Time intervals between the two scans were calculated, these were collated into 30-day intervals for analysis. The repeat scans were categorized into three groups: no change, radiological improvement, and radiological deterioration. Patients who had emergency intervention due to a radiological change on MRI scan were recorded.

#### Results

481 patients were included for analysis. 390 (81%) showed no change in MRI findings, 18 (3.7%) had improvements in their repeat scans and 73 (15.3%) demonstrated deterioration. From the 73 patients with a radiological deterioration, 3 patients (0.62% of total) required urgent surgical intervention.

#### Conclusions

Though there is no alternative to detailed clinical assessment in determining whether a repeat MRI scan is indicated, the findings demonstrate that repeating MRI within 12 months for patients with lumbosacral degenerative disc disease has a low chance of altering the management plan. Over the 10-year period, only three patients required an urgent change to their clinical management.

### Complications after lumbar discectomy: a systematic review

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The lumbar discectomy procedure is performed with a variety of surgical techniques including open (OD), microscope assisted (MD), micro endoscopic (MED) and full endoscopic (FED) approaches. The minimally invasive approaches offer theoretical advantages including less pain, minimal blood loss, reduced length of stay and earlier return to work. Herein we produce an up-to-date comparative systematic review of the literature on the incidence of complications from the various techniques. The authors conducted a database search and included RCTs and prospective cohort studies published after 1997 comparing complication rates with OD, MD, MED, and FED. Mean complication rates for each technique were calculated by dividing the total number of each complication by the total number of patients included in the studies which reported that specific complication. Of the 1095 articles retrieved from Medline, 35 met the inclusion criteria. OD, MD, MED and FED were associated with; recurrent lumbar disc hernias in 4.1%, 5.1%, 3.9% and 3.5% respectively; re-operations in 5.2%, 7.5%, 4.9% and 4% respectively; wound complications in 3.5%, 3.5%, 1.2% and 2% respectively; durotomy in 6.6%, 2.3%, 4.4% and 1.1% respectively; neurological complications in 1.8%, 2.8%, 4.5% and 4.9% respectively. Nerve root injury was reported in 0.3% for MD, 0.8% for MED and 1.2% for FED. This up-to-date systematic review of complications after various techniques of lumbar discectomy (including a large pool of patients who had MIS) confirms previous findings of low and comparable rates.

## Patient and clinical outcomes of expandable interbody cages in transforaminal lumbar interbody fusion: A Systematic Review

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Spinal fusion is a common and important procedure for a variety of spinal disorders. The use of expandable interbody cages in Transforaminal Lumbar Interbody Fusions (TLIF) offers several theoretical advantages compared to static cages including reduced migration, expulsion and dural or neural traction injuries. However, whether interbody cages transfer an improvement in clinical outcomes compared to static cages remains unclear. We conduct a systematic review of patient related and clinical outcomes from expandable interbody cages in TLIF procedures. A systematic review adherent to PRISMA guidelines, was conducted on the Medline and EMBASE databases. We included prospective and retrospective studies reporting clinical and patient related outcomes from expandable interbody cages in TLIF procedures. Six studies (207 patients) were included in the

final analysis. Combined mean VAS leg (5.8 to 1.6) and back scores (6.6 to 2.5) significantly improved from baseline to last follow up. ODI scores had a mean reduction from baseline of 18.07. Expandable cages showed disc height improvement (mean 4.82mm) however, fusion rates varied from 50-96%. Return to theatre occurred in 3.9% of cases. Complications were reported in 9.7% of cases and included dural tears, infections, haematomas and radiculopathies. Expandable cages were found to markedly reduce pain, improve functionality, restore disc space and achieve successful fusion rates. However, there is a paucity of data directly comparing expandable interbody cages to static cages. This review emphasises the need for high quality comparative studies between static and expandable to determine if the significantly increased cost with the former cage is justified.

## Repeat Presentations of Pseudo Cauda Equina Syndrome

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### Introduction

Cauda Equina Syndrome (CES) is a surgical emergency and a daunting medicolegal challenge. Poor clinical specificity leads to high rate of negative (normal) MRI scans, adding additional burden on the emergency services. Often such patients have subsequent re-presentations with CES-like symptoms. The study aims to assess the re-presenting patients after a first normal MRI; to identify incidence, clinical risk factors, comparative MRI-findings and predictive factors for development of TrueCES.

### Methods

Retrospective review of prospectively-gathered data, of patients aged 18-65 years, with a normal MRI, between January 2018-December 2021; with re-presentation within One-year; documented records and bladder scan results. Patients with TrueCES or abnormal MRI pathology were excluded. Statistics were done using SPSSv16.0, and Fischer-Exact-test for comparative assessment.

### Results

922 patients were referred for ?CES, of which 56 had TrueCES on MRI; 356 excluded; leaving 510 patients with normal MRI on first/initial presentation. Of these, 43 patients (8.4%) re-presented in One-year (mean interval 152 days), and further 7 presented a third time (mean interval 126 days). Their mean age was 38.63 years, with a female predominance (33:10). There was no significant difference in clinical symptoms, gender, bladder scans between first and second/third presentations. No patient showed TrueCES on re-presentation MRI, all demonstrated exact same normal MRI findings as initial presentation.

## Conclusion

Re-presentation of Pseudo-CES symptoms was common after initial presentation with normal MRI with incidence of 8.4%. There were no significant clinical or MRI differences between the two presentations and none developed TrueCES on re-presentation MRI. Such re-presenting patients should be evaluated for functional/non-organic causes, to appropriately channel further treatment.

## Indirect decompression of severe lumbar canal stenosis with low grade spondylolisthesis achieved by XLIF with percutaneous posterior instrumentation

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## Background

Extreme Lateral Interbody Fusion was traditionally described as a procedure to achieve interbody fusion and was contraindicated in severe central canal stenosis (1). We report the clinical and radiological results of a series of patients with severe central and lateral recess stenosis managed by indirect decompression achieved with XLIF and percutaneous posterior stabilization alone.

## Purpose

To assess the clinical and radiological outcomes of indirect decompression in patients with severe central canal stenosis following XLIF with percutaneous posterior stabilization  
Methodology: Retrospective analysis of prospectively collected pre and post-operative VAS and COMI scores in a series of 7 patients undergoing XLIF. Evaluation of change in canal diameter on axial MRI scan and correlation with clinical findings.

## Results

The mean pre op leg pain VAS was 8.8 which improved to 4.6 at 1 year and 3.6 at 2 years follow up. The mean pre op COMI score was 8.5 which improved to 4.3 at 1 year and 2.3 at 2 years follow up. The mean post operative canal diameter was 152.6mm<sup>2</sup>, which was almost a 250% improvement over the pre operative mean diameter of 64mm<sup>2</sup>. None of the patients in this series required a direct decompressive procedure.

## Conclusion

XLIF with percutaneous posterior stabilization is effective in indirectly decompressing the spinal canal even in cases with severe lumbar canal stenosis and results in good patient reported outcomes.

## Lumbar Spine Extradural Cysts Evaluation and Treatment: A Narrative Review

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## Objectives

The main objective was to describe the different types and characteristics of lumbar spine extradural cysts along with a description of their optimal treatment options with focus on endoscopic technique.

## Methods

We searched Pubmed, EMBASE, Medline and Google Scholar for articles published between 1967 and 2020 using the key words “Spinal Cyst”, “Extradural Cyst” and “Lumbar Cyst”. The various anatomical and histological types of the extradural cysts with their presentations, etiologies, imaging and optimal treatment with focus on endoscopic techniques were reviewed from the articles.

## Results

Lumbar spinal cysts are relatively rare pathologies that might cause radicular symptoms similar to lumbar disc herniation. Spinal extradural cysts are classified either histologically based on the cyst lining tissues (synovial cysts or non-synovial, ganglion cysts) or anatomically, based on the structure of origin (Epidural cysts, Ligamentum flavum cysts, discal cysts, Post-discectomy pseudocysts, Posterior longitudinal ligament cysts, facet cysts). Surgical excision is recommended treatment of symptomatic cysts with endoscopic techniques being a viable option.

## Conclusion

Extradural lumbar cysts can be identified based on their histological structure or depending on their structure of origin. Regardless of their classification they could all give similar clinical findings and the optimal treatment would be surgical excision with endoscopic technique being a viable option with satisfactory outcome.

## Intradural

### A Systematic Review analysing Management of Incidental Dural Tears in Open versus Endoscopic Spine Surgeries

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#### Introduction

Incidental durotomy is a frequent complication in lumbar spinal surgeries, prevalence ranging from 1-17% in open procedures. Without management, it can progress to severe complications such as cerebrospinal fluid (CSF) leakage, pseudomeningocele, epidural abscess, necessitating additional surgeries. The aim of this review was to analyse the occurrence and management of dural tears in open and endoscopic spinal surgeries.

#### Methods

A systematic literature search was conducted using Pubmed/Medline, Cochrane databases on June 2021. The inclusion criteria were defined to include studies analysing dural tear repair in open and endoscopic spinal surgeries. The outcomes included the dural tear rate, location, dural tear repair strategy, direct repair involving suture versus indirect measures including glue, patch, tear repair failure, and revision surgery rate.

#### Results

Fourteen studies (3 open, and 11 endoscopic) met the inclusion criteria. Dural tear rate was higher in open (7.2%) versus endoscopic (4%) spine surgeries. In terms of DT location, root shoulder was found to be the most common location (39%) in open surgeries, while ipsilateral tears (57.2%) were most commonly found in endoscopic cases. When comparing repair strategies, indirect repair was far more common (47.3% vs 33.7%) than direct repair in open surgeries, and a similar trend was observed in endoscopic spine surgeries (75.8% vs 20%).

#### Conclusion

Although indirect repair strategies were far more commonly used in open and endoscopic spine surgeries, no statistically significant differences were found between the efficacy of both strategies. Future studies are needed to achieve a consensus.

## Innovation

### The Use of Mesenchymal Stem Cells to Treat Degenerative Disc Disease: A Systematic Review of Animal and Human studies

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#### Objective

This review aims to critically appraise and narratively synthesise evidence from animal and human studies on the use of mesenchymal stem cells (MSCs) to treat degenerative disc disease (DDD).

#### Methods

A systematic search of PubMed, Embase, Science Direct and Cochrane Central Register of Controlled Trials databases as well as ClinicalTrials.org, to January 2020, was carried out using predetermined search terms. Bibliographies of published narrative and systematic reviews were also screened. The quality of eligible studies was assessed, and study characteristics and data were tabulated for analysis.

#### Results

From 1680 potentially relevant citations, twenty studies met the inclusion criteria—sixteen studies focused on animal models and four studies involved human participants. 10/16 animal studies reported favourable radiological outcomes. All studies that incorporated histology (11/16) demonstrated improved histological outcomes. In terms of molecular outcomes, 10/16 studies reported matrix restoration. Data across the four human studies suggested improvement in pain and function relative to baseline; however, a majority of changes were not deemed to be statistically significant. Safety data was sparse with 19/20 studies reporting no adverse events.

#### Conclusions

The overall strength of evidence for the efficacy and safety of MSCs for DDD was low due to inconsistencies in methodological design and outcome parameters, small sample sizes and lack of comparator interventions. Robust animal models that can more closely replicate the human condition and high-quality comparative studies are now needed to assess whether MSCs can truly enhance the armaments at the disposal of the clinician in the treatment of DDD.



## The Antero-Posterior Positioning of Visco-Elastic Cervical Disc Prosthesis Does Not Alter the Outcomes

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While first generation articulated disc prostheses had an ideal positioning schematically as posterior as possible, because of their geometrically determined center of rotation, the dogma may change for visco-elastic implants, whose center of rotation is free. Our hypothesis was to check if the antero-posterior positioning of the implants may influence the clinical outcomes at follow-up. Data has been compiled from 35 consecutive patients with single-level CP-ESP disc prosthesis (Spine Innovation, France). There were 20 women and 15 men, aged 31 to 62 years-old. The average follow-up was 25.9 months (15 to 38). The population was retrospectively divided in two groups : anterior / posterior depending on the relative position of the middle of the prosthesis to the middle of the inferior endplate on the lateral radiograph. Recorded outcomes were clinical and radiological: Neck Disability Index (NDI), visual analog scale for neck and radicular pain (VASn and VASr), flexion-extension range of motion (ROM) and McAfee's classification for heterotopic ossifications (HO). The average NDI was 33.1% preop, dropping to 12.3% at LFU (-63%). The average VASn and VASr were 8.6 and 7.3 preop, dropping to 2.9 and 2.6 at LFU. At LFU, the average flexion / extension ROM was 6.8° and the HO were : grade 0: 7, grade 1: 14, grade 2: 9 and grade 3: 2 (NA: 3). No significant difference between the anterior group (n=21) and the posterior group (n=14). The antero-posterior positioning of viscoelastic TDR do not significantly influence the clinical or radiological outcomes at follow up.

## Giant thoracic meningocele in patients with Neurofibromatosis type 1: A review of literature with illustration of a novel surgical challenge, and insights from histology

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### Background

69% of thoracic meningoceles are associated with Neurofibromatosis type 1 (NF1). Pathology is debated between being a saccular protrusion of dysplastic meninges through a vertebral defect, or a forme fruste of neurofibroma, with no pathological evidence to the later. Treatment is usually

conservative, however surgical intervention is sometimes indicated. Surgical options include thoracotomy, endoscopic plication of the cyst, or CSF diversion. After excision of the meningocele, watertight closure of the dura is difficult and meningoceles often reform, so dural reinforcement is indicated.

### Objective

A literature review on thoracic meningocele in NF1 patients, including an illustrative case discussing the surgical challenges with giant meningoceles.

### Case presentation

An NF1 presented with dyspnoea due to enlargement of the known thoracic meningocele. The meningocele was successfully excised via thoracotomy in a challenging surgery with a novel surgical technique and unique insight on histology.

### Results

10 cases of giant meningoceles in NF1 patients have been reported in literature, surgery was performed in 9 of them. 1 patient died, and there was recurrence or no change in 6 them. Histology in our illustrative case showed diffuse population of schwann cells. Also, Buttress plates achieved reinforced dural closure with no recurrence.

### Conclusion

Our study concluded that in large thoracic meningocele(s) surgery via thoracotomy is advised versus CSF diversion, and dural reinforcement with buttress plates proved to be successful. Our study also concluded that meningoceles in NF1 patients is likely a forme fruste of neurofibroma, or a giant cystic neurofibroma rather than due to dysplastic dura.

## Infection

### Is there evidence of poor diabetic control in patients who have Spondylodiscitis?

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### Study design

A local analysis of spinal databases to determine if there is association of poor community control of HBA1c in spondylodiscitis patients with diabetes.

### Objective

To identify the patients presenting with discitis that have diabetes as a risk factor and to identify HBA1c levels from the community and the type of diabetic control in these patients prior to the presentation of discitis.

### Methods

The study identified 31 patients over a one-year period. 26 (15 male, 11 female) met the inclusion criteria and 10 of these had discitis and diabetes. A retrospective notes review was conducted, and analysis was performed using Microsoft excel.

### Results

The study found that 38.4% of patients with discitis had diabetes, out of these patients 70% had poorly controlled diabetes. It also found that diabetes did not necessarily result in poor outcomes. Overall males were more likely than females to have both discitis and diabetes.

### Conclusions

The study demonstrated the importance of observing the relationship between discitis and diabetes. It showed that there is evidence of poor community control of HBA1c, linked to patients that present with discitis. It highlights that this is a complex problem which has multifactorial logistics and that interventions would be required at all levels of care.

## Analysis of morbidity and mortality in elderly population with non-iatrogenic spine infection (NISI)

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### Background

Non iatrogenic spine infection (including spondylodiscitis) in the elderly is not well reported on in the literature despite a rising incidence. We analysed the outcome of NISI in the elderly in terms of morbidity and mortality and the associated risk factors.

### Methods

Patients aged 65 years or above diagnosed and treated for NISI between Sep-2014 to Dec-2020 were retrospectively analysed from a prospective database. Their morbidity and associated risk factors were evaluated.

### Results

There were 67 patients included (44.3% of all NISI treated in that time period). The age of patients varied from 66 to 93 years (median age 74 years). 7 patients (10.4%) required surgical drainage and 11 patients (16.5%) required radiological intervention/drainage. The 30 day mortality rate was 13.4% (9 out of 67) with 66% of the deaths (6 out of 9) occurring during that inpatient episode and the remainder after the 30-day period due to other causes. 10.4% (7 out of 67 patients) were readmitted with the same pathology requiring further management. The average hospital stay was 39 days (range: 2-139 days). The most frequently occurring organisms isolated were Staphylococcus

aureus and Coagulase-negative Staphylococci. The mean ASA grade was found to be 3. A Logistic Regression Analysis for readmission was carried out against 21 comorbidities. No statistical significance was identified for any particular comorbidity (P value is 0.503).

### Conclusion

Spondylodiscitis in elderly is associated with high incidence of mortality and morbidity.

## Deformity

### Use of intra-operative internal distraction for the application of Magnetically Controlled Growth Rods –Maximizing correction in the rigid immature spine during index surgery

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### Level and type of study

Retrospective clinical study, level 4.

### Objective

Operative treatment of early onset scoliosis with (Magnetically Controlled Growing Rod) MCGR in moderate to severe curves poses a challenge due to the limited amount of force and length available with the implant. The purpose of this study was to assess the use of the intra-operative internal spine distraction using Harrington Outrigger, before definitive implantation of MCGR, with regards to initial correction, maintenance of correction, truncal balance, and complication rates.

### Patients and Methods

All patients of EOS included in the study were treated with the application of MCGR using the Intra-operative internal distractor technique. Patients were followed up for a minimum of 2 years. Radiological evaluation of change in Cobb's angle, Thoracic Kyphosis, lumbar lordosis, T1-S1 length, T1-T12 length, Sagittal balance were done in all patients.

### Results

The mean age of the operated patients was 8 years  $\pm$ 1.7, Range (4-10 years). The Mean post-operative Cobb's angle was 35.8°. The mean correction of major Cobb's angle was 34.6°. The Percentage correction achieved in post-operative Cobb's angle was about 51%. Mean improvement in post-operative kyphosis was 18.6°. The average gain in immediate post-operative spinal length (T1-S1) and Thoracic height (T1-T12) was 46.7mm and 41mm, respectively.

## Conclusion

Large and rigid curves in EOS can achieve a significant correction of Cobb's angle and coronal imbalance during the index operation, by the use of intra-operative internal distraction at the time of MCGR insertion.

## Neuromonitoring Electrode Hyper-sensitive Reaction Prior to Scoliosis Correction Surgery: A Case Report

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### Introduction

Neuro-physiological monitoring is routinely employed during scoliosis correction surgery to facilitate interval stimulation and signal strength assessment. We present a unique case where patient developed hyper-sensitivity reaction on insertion of neuro-monitoring electrodes prior to initiation of posterior correction of scoliosis.

### Material

14-year-old female patient was booked for a posterior scoliosis correction surgery. After the patient was placed under a general anaesthetic, the neurophysiologist started inserting sub-dermal stainless-steel probes. Within the first 10 minutes of the first two probes being inserted into patient's left leg and thigh there was a characteristic wheal and flare reaction noticed. Further insertions were withheld and reaction site marked. In view of ongoing hypersensitive reaction to the ION electrode, it was decided to abandon the procedure. After removal of the probes, the reaction settled. Patient was haemodynamically stable throughout.

### Discussion

On evaluating alternatives to stainless-steel electrodes for undertaking it was identified that Platinum-Iridium subdermal lead are, although 5-times more expensive, a valid option with the added benefit of having better magnetic resonance imaging compatibility.

### Conclusion

Although rare, allergic reaction can occur after insertion of metallic electrodes which should be borne in mind whilst undertaking elective major spinal surgery where ignorance can lead to catastrophic eventuality to develop over the many hours as the surgery is being undertaken.

## Retrospective Evaluation of Fusion and Spinal Alignment Following Deformity Correction Using I-Factor Peptide Enhanced Bone Graft

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### Introduction

Correction of Adult Spinal Deformity usually involves long segment posterior pedicular fixation and fusion from T10 to pelvis. Anchorage to the sacrum and iliac wings with 360 degree circumferential fusion at the lumbosacral junction eliminates non union. I-Factor, a composite bone graft substitute made of anorganic bone matrix (ABM) and bioactive P-35 peptide provides osteoconductive properties. There have been no studies till date to evaluate the long fusion rates associated with a peptide enhanced bone graft. This retrospective study strives to evaluate the rate of fusion and maintenance of spinal alignment following adult spinal deformity correction using i-Factor as a bone graft substitute.

### Methods

Study group consisted of 35 cases treated with i-Factor and autograft during the corrective surgical procedure with minimum 2 year follow up. X-ray and CT scan were pseudo anonymised and sent to an external core lab vendor (RAYLYTIC GmbH, Petersstraße 32-34, 04109 Leipzig, Germany) for assessment of fusion rates and restoration of spino-pelvic parameters.

### Results

Pelvic parameters - Sacral slope, lumbar lordosis, Pelvic tilt, Pelvic Incidence were restored to normal levels. The bone integration of the cage was evaluated by the absence of radiolucent lines at the circumferential interface between the device and the adjacent bone, and evidence of bridging trabecular bone within the cages. At 18 months post surgery, 20/35 (57.14%) achieved fusion.

### Conclusion

By using i-factor we could achieve fusion rates comparable to that in literature. Being a retrospective study there weren't protocols in terms of timing of imaging to assess fusion.

## Surgical outcomes and complication profiles of surgery for Neuromuscular Scoliosis

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### Introduction

Corrective spinal surgery for neuromuscular scoliosis is associated with high rates of surgical and medical complications due to intrinsic low physiological reserve, multiple comorbidities and the magnitude of the surgical intervention to correct the spinal deformity and pelvic obliquity. The objective of this study is to determine the current complication rates and surgical corrective outcomes of a cohort of patients in a tertiary referral centre.

### Methods

A retrospective cohort analysis of patients who underwent surgery for neuromuscular scoliosis between 2016 and 2020 was performed. Early (<90 days) postoperative complications were recorded and pre and post-operative Cobb angle and pelvic obliquity were recorded and compared.

### Results

A total of 49 patients with an average follow up of 26 months were included. There were 7 (14%) cases of intraoperative complications, 26 patients (53%) had post-operative medical complications and 3 (6%) early spinal wound infections. 4 patients died during the follow-up period. The average operating time was 428 minutes and the average estimated blood loss was 1337ml. There wasn't any correlation between early infections and GMFCS, intraoperative complications, need for tracheostomy, pelvis fixation, feeding route or severity of pre op curve. The rate of correction was more than 50% of the pre-operative curve.

### Conclusion

Our results demonstrate an overall low infection rate in these patients with comparable overall medical complication profiles relative to other publications. Patient selection is important to ensure improved perceived quality of life in these group of patients and this can only be achieved via a multidisciplinary approach.

## Case series of cervical cord infarction following Thoracic/Thoraco-Lumbar scoliosis correction

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### Study Design

Retrospective case series of 6 cases, Multi-centre study

### Objectives

Summary of the 6 cases scoliosis correction patients complicated with CCI with the relevant clinical features based on a BSS members survey results. Summary of background Data (CCI) with neurological deficit following posterior scoliosis correction is widely under-reported complication. In the literature only 4 reported cases. This complication has a devastating effect for the patients, surgeons and the NHS. The aim is to highlight this complication, the possible theories that can contribute to it, early identification of the complication.

We propose a post-operative protocol for neural monitoring, highlight the possible remedial actions, but most importantly determine measures taken to minimise the risk of developing the pathology.

### Methods

We are reporting 6 cases of scoliosis correction patients complicated with CCI with the relevant clinical features based on a BSS members survey results.

### Results

In all 6 cases there were neither hardware failure/ Misplacement nor gross intraoperative IOM, There was one case with hypotensive event and all presented with delayed neurological deterioration (2-48 Hours). 4 cases Metalwork were altered. 2 cases showed recovery to pre op level.

### Conclusion

Cervical cord infarction can be a complication of Thoracic and Thoraco/Lumbar scoliosis correction, and widely under reported. Careful study of MRI, intra-operative neck positioning, maintenance of MAP, post-operative neurological monitoring for 48-72 hours are emphasised, low threshold for post-operative MRI and careful consideration of return to theatre, could all be points that are actions that can make the difference in preventing permanent quadriplegia.

## Distal Single-Level Asymmetric Unilateral Concavity TLIF to Save a Distal Level in AIS with Structural Lumbar curves (Lenke 3-6): A Technical Report & Pilot Study

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### Introduction

Preservation of motion segments when extending fusions into the lumbar spine in structural lumbar AIS curves (Lenke 3-6) can be challenging. We describe a novel technique with single-level distal lumbar asymmetric concavity TLIF accompanying the conventional posterior AIS correction to shorten distal-fusion and preserve a distal motion segment.

### Methodology

An asymmetric unilateral single-level lumbar concavity TLIF is performed, at the distal end, proximal to the Stable-Vertebra (SV) or Last-Touched-Vertebra (LTV), at or distal to the Lumbar-Apex (LAV), with concave disc distraction and transforaminal cage insertion to 'jack up' the vertebral height; with conventional AIS correction. The technique was piloted in 3 posterior AIS corrections.

## Results

Patients were aged 13,13 & 14 years: 2 Lenke Type 4 and one Type 6 curves. LIV was L3 in all cases with TLIF at L2-3. Mean cage height was 9.3cm, leaving 4, 3 & 3 distal mobile segments respectively. Mean pre-operative & postoperative PT,MT & TL/L upright curves measured: 29.3o/10.6o, 65o/17o and 56o/21.9o respectively. The postop residual lumbar curvature distal to LIV measured 14.6o; Lumbar-Apical-Translation improved from 4.2cm to 2.3cm; EV-Ground Tilt improved from 23.6o to 10.8o and the postop LIV-Ground Tilt measured 6.2o. Operative duration was 350mins with blood loss 633.3mls, without any complications. Radiographic shoulder balance was attained post-op.

## Conclusion

Single-level distal asymmetric concavity TLIF seems an effective technique to save a distal fusion-level in AIS with structural lumbar curves, with minimal change in surgical morbidity allowing preservation of an additional lumbar motion segment in the adolescent population. Larger sample size and follow-up is required.

# Commissioning, Governance & Patient Pathways

## Day-case Lumbar Discectomy & Decompression Can We do More?

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### Introduction

Lumbar discectomy and lumbar decompression are procedures which can be undertaken as day cases. Despite this, these patients frequently stay overnight and impact on bed pressures. We undertook a single centre review of our lumbar discectomy & decompression management.

### Method

A retrospective review of all elective lumbar discectomies or lumbar decompressions (up to two levels), at a single district general hospital, over a nineteen-month period were reviewed. All emergency cases were excluded.

### Results

215 procedures were completed, 35 undertaken in the day surgery centre and 180 within the main hospital. All day surgery centre patients and 49% main hospital patients went home the same day. Of the 91 patients who stayed overnight 50 went home the next day, with no indication for their overnight stay. All of these patients were eligible for treatment in the day surgery centre.

## Discussion

Overall, we identified 123 unnecessary hospital 'bed days' in our cohort. If these were prevented by undertaking these procedures as day cases the total cost saving would be '£95,325'

## Conclusion

A significant cost saving and reduction in bed days can be achieved by undertaking a greater portion of lumbar discectomies and lumbar decompressions as day case procedures.

## A retrospective audit of referrals to the Orthopaedics department for suspected Cauda Equina Syndrome

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### Introduction

Cauda Equina Syndrome (CES) is a surgical emergency with delayed diagnosis and management potentially leading to permanent dysfunction. Currently, there is no formal pathway at Buckinghamshire Healthcare NHS Trust (BHT) for Emergency Department (ED) and GP referrals with service pressures potentially resulting in a delayed Orthopaedic review. This audit explores current practice at BHT and its compliance with the British Association of Spine Surgeons (BASS) guidelines.

### Method

Retrospective data was collected for patients referred between March-October 2020. We collected data on demographic and referral variables, symptoms, initial review, specialist review as well as investigations including bladder scan, MRI and tertiary referral.

### Results

76 patients were referred with suspected CES during the study period of which 4 (5.3%) were found to have MRI findings consistent with CES. There was poor and inconsistent documentation. 37.9% of patients were referred within 1 hour of assessment. 58% had pre- and postvoid bladder scans. 60.5% of patients had an MRI scan requested after 6 hours of ED registration.

### Conclusion

This initial cycle highlights the need for a clear referral pathway in line with BASS guidelines on CES. We also found that current Trust policy only permits the Orthopaedics team to request MRI scans for suspected CES which is subject to time to referral and time of specialist review. We are in the process of developing a dedicated pathway to streamline the process, facilitate improved documentation and prospectively audit this against BASS guidance in the future.

## Perceptions of telehealth usability and satisfaction with telehealth within spinal surgery outpatients during COVID-19

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### Introduction

Maintaining high-quality patient care during COVID-19 necessitated a rapid rise in the use of telemedicine in order to communicate with patients remotely. We aimed to determine spinal surgery patient's attitudes towards telehealth.

### Design

We performed a prospective cross-sectional study.

### Subjects

We interviewed 87 patients with spinal disease who had attended a virtual neurosurgical outpatient appointment at our institute.

### Methods

Using the validated Telehealth Usability Questionnaire, we investigated patients' attitudes towards telehealth in terms of usefulness, ease, effectiveness, reliability and satisfaction. Survey items were reported on a Likert scale and data interpreted using descriptive and statistical analysis.

### Results

87% of participants expressed a favourable impression of telehealth (patient's score 3 or above) with ease of use being the highest scoring domain (89%) and reliability the lowest (74%). The lowest scoring question was 'I think the visits provided over the telehealth system are the same as in-person visits', with only 38% patients agreeing. There was no association between scores and age or gender. Patients who attended video appointments (46 patients) were significantly more positive towards telehealth, across all domains, than those who attended audio-only consultations (41 patients).

### Conclusions

Our studied population was generally satisfied with telehealth as a means to receive appointments. However, patients did not feel that telemedicine appointments were 'the same' as in-person visits. Telehealth should not replace face-to-face outpatient services, but may represent a viable adjunct in specific circumstances, including post-operative reviews not requiring physical examination; these should be video-based where possible.

## Cervical degenerative

### 3-level ACDF with stand-alone cages; our preliminary experience & early outcomes

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### Objectives

The aim of this review is to share our experience with 3-level ACDFs and to propagate its use as a safe and effective procedure for degenerative cervical spinal stenosis.

### Design

A retrospective analysis of prospectively collected data.

### Methods

We conducted a retrospective review for 6 patients who underwent elective 3-level ACDF with stand-alone cages at our institution by a single surgeon between 2017-2021. All patients had standard anterior approach to Cervical spine (right sided). We evaluated clinical and radiological outcomes for these patients at various stages of follow up.

### Results

Mean hospitalisation was 4.3 days, which was excellent considering all our patients stayed in high dependency unit post surgery. VAS score of neck and arm improved from 5.98, 6.16 to 3 & 2.56 respectively. Average Neck Disability Index score improved from 62.8 to 24.8. Odom criteria was excellent in 1, good in 3, satisfactory in 1 revealing good post op results. 4 of the post op X rays showed fusion, 2 had very little follow up to assess fusion. Overall, average lordosis post operatively, was 12.9 degrees. Subsidence was observed at 4 levels in all patients put together, but none were symptomatic.

### Conclusions

Stand-alone cages for multi level ACDFs have excellent short term results clinically and radiologically. Subsidence of cages has a higher incidence with stand alone cages, but little clinical relevance. Randomised control trials are recommended in high volume centres with longer period of follow up.



## One Hundred Top Cited Articles in Cervical Myelopathy: A Bibliographic Analysis

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### Introduction

The aim of this study was to identify the most highly cited articles relating to cervical myelopathy and to analyse the most influential articles. Over the past several decades, a lot of research has been conducted regarding the subject of cervical myelopathy. Although there are a large number of articles on this topic, this is the first bibliometric analysis.

### Methods

A selection of search terms and keywords were inputted into the 'Dimensions' database and the most highly cited articles in cervical myelopathy were selected from high impact factor journals. The top 100 articles were analysed for year of publication, authorship, publishing journals, institution and country of origin, subject matter, article type and level of evidence.

### Results

The 100 most cited articles in the topic of cervical myelopathy were published from 1956-2015. The number of citations ranged from 121 times for the 100th paper to 541 times for the top paper in a total of 20 journals. The most common topic was operative technique while the journals which contributed the most articles were the Spine Journal and the Journal of Neurosurgery. There was very little Level 1 and Level 2 evidence in the top 100 cited articles.

### Conclusion

Our study provided an extensive list of the most historically significant articles regarding cervical myelopathy, acknowledging the key contributions made to the advancement of this field.



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