CLINICAL ANALYSIS OF RADIOLOGIC MEASUREMENT FOR BASILAR INVAGINATION: IS IT POSSIBLE TO PREDICT POSTOPERATIVE OUTCOME BY RADIOLOGIC MEASUREMENT?

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Purpose  To investigate the correlation between two radiologic measurements and clinical outcomes in patients with basilar invagination (BI).

Methods  A retrospective analysis of medical records and radiologic data was performed on patients who underwent posterior atlantoaxial fusion or occipitocervical fusion for basilar invagination from January 2010 to December 2016. Patients under 15-year olds, polytraumatic and infectious pathologies were excluded. 41 patients were enrolled. Modified Ranawat index and Redlund-Johnell method to determine BI were measured at preoperative, postoperative, 3months, the last follow-up. We assessed the clinical outcome of patients with Visual Analogue Scale (VAS), Neck Disability Index (NDI) and Japanese Orthopedic Association (JOA) score. We evaluated the relationship between the change rate of two radiologic measurement and clinical outcomes by correlation test and linear logistic regression analysis during the follow-up.

Results  Mean age of 41 patients was 57.8±16 years. Patients were 23 females and 18 males. Mean follow-up was 41.1±23.2 months. Preoperative mean Modified Ranawat index and Redlund-Johnell method were 24.0±3.9 mm and 29.8±5.8mm. Preoperative mean VAS, NDI and JOA score were 7.0±1.7, 27.8±7.6, and 12.2±4.0. The change rate of Modified Ranawat index and Redlund-Johnell method were 36.4±24.7% and 36.0±20.9% postoperatively, 13.6±11.6% and 13.6±11.2% at 3months, 16.2±19.8% and 17.1±15.0% at last follow-up. The improving rate of JOA score was 59.5±31.2%, 65.3±31.7% and 60.8±34.7%. Only the improving rate of JOA score showed significant linear correlation with Modified Ranawat index postoperatively (p<0.05). We finally described that the improving rate of JOA score was equal to 1.267 times the change rate of Modified Ranawat method plus 40.8.

Conclusion  There were the linear correlation between the change rate of Modified Ranawat index and improving rate of JOA score postoperatively. We could formulate it to the equation. If preoperative Modified Ranawat method and JOA score were evaluated in patient with basilar invagination, we could find the target reduction rate of basilar invagination to obtain expected neurologic recovery by using the above-mentioned equation.
Fig. 1 Normal Probability-Probability plot of regression standardized residual of linear logistic regression test in Modified Ranawat Method at three different points. a The approximated linear correlation between the change rate of Modified Ranawat method and Improving rate of JOA score at postoperative time (p<0.05). b, c The approximated linear trend between the change rate of Modified Ranawat method and Improving rate of JOA score 3 month after surgery and at last follow-up (p>0.05).

Disclosures:
author 1: none; author 2: none; author 3: none
CLINICAL PREDICTORS AND OPTIMAL MANAGEMENT FOR PATIENTS WITH CERVICAL SPINAL CORD INJURY WITHOUT MAJOR BONE INJURY

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Objective Although the number of the patients with cervical spinal cord injury (CSCI) without major bone injury has increased dramatically, treatment with either surgery or conservative measures remains controversial. For these patients, although conservative treatment is basically recommended, we believe that some patients deserve to be treated surgically with the aim of achieving mobility because we experienced cases with an immediate improvement of motor function just after decompression surgery even if the patients have no recovery for several weeks before surgery. The aim of this retrospective study was to identify predictors for clinically-meaningful motor recovery (higher or equal to Frankel D) and candidates most suitable for surgical treatment.

Methods We reviewed 63 patients with CSCI without major bone injury (lower or equal to Frankel C). Of these, 36 patients were treated conservatively, while 27 patients were treated surgically. Neurological examination using modified Frankel grade at admission and 6 months after injury and International Stoke Mandeville Games (ISMG) classification at subacute phase after injury, MRI findings including the extent of spinal cord compression and damage and the type of signal intensity change were assessed. A multiple logistic regression model was used to identify significant predictors of neurological improvement.

Results Thirty-five of 63 patients (55.6%) improved and were able to walk at 6 months after injury. Multivariate analysis identified the extent of spinal cord compression, extent of cord damage and improvement of ISMG grade as significant determinants of clinically-meaningful motor recovery. On the other hand, treatment, type of signal intensity change on MRI, and the presence of OPLL were not associated with such recovery. There was no difference in neurological improvement between the conservative and surgical groups. However, patients with spinal cord compression of $\geq 33.2\%$ (appropriate cut-off was defined as the point on the curve nearest to the upper left corner of the ROC graph) showed better motor recovery at 6 months post-injury after surgery than those treated conservatively. Improvement of ISMG grade at subacute phase correlated significantly with Frankel grade at 6 months post-injury. Surgical timing did not correlate with motor recovery.

Conclusions Conservative treatment is recommended for patients with CSCI without major bone injury. However, we also recommend surgical treatment to achieve mobility for patients (lower or equal to Frankel C) with spinal cord compression of $\geq 33.2\%$ and low ISMG grade at subacute phase. Among such patients, patients with neurological status of Frankel A or B1 on admission and/or extensive spinal cord damage on T2-weighted MRI should be excluded based on data showing lack of neurological improvement after surgery.

Disclosures:
PREDICTIVE VALUES OF MAGNETIC RESONANCE IMAGING FEATURES FOR TRACHEOSTOMY IN TRAUMATIC CERVICAL SPINAL CORD INJURY
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Background: Traumatic cervical spinal cord injury (SCI) may cause respiratory complication that may lead to the need for mechanical ventilation. Magnetic resonance (MR) imaging plays a crucial role in detecting and evaluating spinal trauma.

Purpose of the study: To evaluate the MR imaging features that have a statistically significant association with the need for a tracheostomy in patients with cervical spinal cord injury during the acute stage of injury.

Materials and Methods: This study retrospectively reviewed the clinical data of 130 patients with cervical SCI. We analyzed the factors believed to increase the risk of requiring a tracheostomy, including the severity of SCI, the level of injury as determined by radiological assessment, three quantitative MR imaging parameters, and eleven qualitative MR imaging parameters.

Results: Significant differences between the non-tracheostomy and tracheostomy groups were determined by the following five factors on multivariate analysis: complete SCI (p=0.007), the radiological level of C5 and above (p=0.038), maximum canal compromise (MCC) (p=0.010), lesion length (p=0.022), and osteophyte formation (p=0.015). For the MCC, the cut-off value was 46%, and the risk of requiring a tracheostomy was three times higher at an interval between 50-60% and ten times higher between 60-70%. For lesion length, the cut-off value was 20 mm, and the risk of requiring a tracheostomy was two times higher at an interval between 20-30 mm and fourteen times higher between 40-50 mm.

Conclusion: The ASIA grade A, a radiological injury level of C5 and above, an MCC ≥ 50%, a lesion length ≥ 20 mm, and osteophyte formation at the level of injury were considered to be predictive values for requiring tracheostomy intervention in patients with cervical SCI.
Table 4. Results of multivariate analysis of potential risk factors for tracheostomy (logistic regression method using stepwise forward selection procedure)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Adjusted OR</th>
<th>95% CI</th>
<th>P-value</th>
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<tbody>
<tr>
<td>Severity of SCI</td>
<td></td>
<td></td>
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<tr>
<td>- ASIA B, C, D, or E</td>
<td>1.000</td>
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<tr>
<td>- ASIA A</td>
<td>24.750</td>
<td>2.384-256.974</td>
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<td>Radiological level of injury</td>
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<tr>
<td>- Lower level (C5-C6 intervertebral disc and below)</td>
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<tr>
<td>- Upper level (C5 and above)</td>
<td>25.830</td>
<td>1.296-533.117</td>
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<tr>
<td>Maximum canal compromise</td>
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<td>1.032-1.259</td>
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<td>Maximum spinal cord compression</td>
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<tr>
<td>Lesion length</td>
<td>1.097</td>
<td>1.013-1.187</td>
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<td>Cord transection</td>
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<td>Osteophyte</td>
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<tr>
<td>- No</td>
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<td>28.553</td>
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<td>Fracture and dislocation</td>
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<td>Pneumothorax</td>
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<tr>
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<td>-</td>
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</tbody>
</table>

* Statistically significant differences (p-value < 0.05)

ASIA: American Spinal Injury Association, CI: confidence interval, NS: nonsignificant, OR: odds ratio, SCI: spinal cord injury

Disclosures:
author 1: not indicated; author 2: none; author 3: none; author 4: not indicated; author 5: none
NEUROMONITORING SIGNAL CHANGES IN CERVICAL SPINE SURGERY: WHEN IS IT SIGNIFICANT?
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Introduction: Modern cervical spine surgeries utilise intraoperative neuromonitoring (IONM) in the form of Motor Evoked Potential (MEP), Somatosensory Evoked Potential (SSEP) and Electromyography (EMG). However, with a sensitivity ranging from 0-100% and specificity ranging from 27-100%, there is a need to differentiate between true and false positive signal changes to better supplement intraoperative management.

Methods: A retrospective review of IONM and clinical records of all cervical spine surgeries in 3 hospitals between 2013 and 2017. The procedures were performed by fellowship trained spine surgeons and multimodal IONM was used in all cases. Clinical records were evaluated by 2 clinicians who were not involved in the patients' management. IONM records of MEP and SSEP were reviewed by a trained neurophysiology technologist. Results were grouped into 3 groups. In Group 0, there were unimodal signal drops that were transient and resolved back to baseline by the end of surgery. In Group 1, there were sustained unimodal signal changes while in Group 2, there were sustained drops in both the MEP and SSEP.

Results: 257 cases were reviewed and 207 cases were analysed after exclusions. A total of 52/207 (25.1%) cases had IONM changes. 10/207 (4.3%) of cases were in Group 0, while Group 1 had 35/207 (16.9%) of cases. 7/207 (3.4%) of cases were in Group 2. Group 0 and 1 had no neurological deficits, while in Group 2, 2/7 (28.6%) had neurological deficits. Both MEP and SSEP were 100% sensitive. SSEP had a specificity of 96.6%, while MEP had a lower specificity at 76.6%.

Conclusion: Our study shows that by grouping the signal changes into transient or sustained, and unimodal or bimodal, we are able to better predict which signal drops are significant, thereby allowing for improved intraoperative decision making.

Disclosures:
author 1: employee: Khoo Teck Puat Hospital; author 2: employee: Changi General Hospital; author 3: none
RECRUITMENT OF OTHER REGIONS IN BRAIN FUNCTIONAL CONNECTIVITY NETWORK AFTER LAMINOPLASTY IN PATIENTS WITH CERVICAL MYELOPATHY

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<Introduction>
Cervical decompressive surgery such as laminoplasty is a widely utilized procedure for treating patients with cervical myelopathy (CM). However, we cannot explain the physiological process underlying the postoperative recovery. In the previous results of our group, the functional connectivity of the sensory-motor network and cerebellum was significantly decreased in patients with CM compared with the control, whereas that of the default mode network consisting of medial prefrontal cortex (MPFC) and supplementary motor area (SMA) was significantly increased in patients with CM compared with the control. We hypothesized that these preoperative changes in the cortex in patients with CM would recover after surgery. In the present study, we aimed to investigate the differences between before and after surgery in the functional connectivity using resting-state functional magnetic resonance imaging (rs-fMRI).

<Methods>
Nineteen patients (12 men and 7 women; mean age of 69.2 years) with CM such as underwent rs-fMRI before and 6-month after cervical laminoplasty. We adopted seed-based correlation analysis together with amplitude of low-frequency fluctuation. We compared the differences in functional connectivity based on the regions of interests between before and after surgery, using the paired t-test. Neurological function was assessed using the Japanese Orthopaedic Association (JOA) score (full score 17) and the 10-second test before and 6 months after surgery.

<Results>
Neurological examination 6 months after surgery revealed a significant improvement in both the JOA score and the 10 second test (p < 0.001). The significant changes of the functional connectivity after surgery were observed not in the connectivity where significant differences had been observed in the comparison between the CM patients and the control group, but in the connectivity in other regions where no significant difference had been observed in the comparison with the control group. For example, the functional connectivity of the sensory-motor network and supramarginal gyrus was significantly increased (Figure). The functional connectivity of the default mode network and superior frontal was significantly decreased.

<Conclusion>
Contrary to our hypothesis, the preoperative significant differences in the functional connectivity did not significantly changed even after decompression surgery in patients with CM. However, the functional connectivity of other regions was significantly changed. These results may explain that there was recruitment of other cortical regions in brain functional connectivity network to compensate for the damage in the cervical spinal cord.

<Figure Legends>
A. Significant differences in the connectivity pattern of sensory-motor network and cerebellum (CM patients < the control)
B. Significant differences in the connectivity pattern of sensory-motor network and supramarginal gyrus in the CM patients (pre- < post-laminoplasty )
Disclosures:


QF66
CERVICAL SPINAL STENOSIS WITH COEXISTING ROTATOR CUFF TEAR: A NATIONWIDE REVIEW OF RECORDS FROM 2005 TO 2014

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Introduction: Rotator cuff tear (RCT) and cervical spinal stenosis (CSS) are common pathologies found in the elderly population. As the elderly population of America and much of the modernized world becomes a larger representation of the overall population, demographics and incidence of degenerative diseases are expected to change accordingly. Currently, there is a paucity of data available reporting the incidence of CSS amongst patient with a concurrent RCT. CSS and RCT may both present with lateral shoulder pain, weakness or numbness of the upper extremity, making distinguishing between the two conditions as the underlying contributory pathology a challenging endeavor for the diagnosing physician. Additionally, both CSS and RCT may be present on imaging with high incidence in the elderly population without consequence, defined as asymptomatic. Therefore, CSS can often mask an underlying RCT, or vice versa, further complicating diagnosis.

Methods: The Medicare Standard Analytical Files database within the Pearldiver supercomputer (Warsaw, IN, USA) were carefully analyzed to identify all patients with RCT and concomitant CSS from 2005 to 2014. Patients were identified based on international classification of disease 9th edition codes. Annual national trends based on age, gender, body mass index (BMI) and geographic location were assessed. Comparison between annual utilization of open and arthroscopic rotator cuff repair (RCR) were performed.

Results: We identified 86,501 patients with RCT and concomitant CSS. There was a significant
annual increase in number of patients diagnosed with RCT and CSS (p<0.0001). The incidence of CSS in patients with RCT increased from 9% in 2005 to 13% in 2014 (p<0.05). Gender analysis revealed females under 64 years were more likely to demonstrate combined pathology than age-matched males (OR 1.15, 95% CI 1.12 to 1.18) or females > 65 years (OR 1.64, 96% CI 1.61 to 1.67). BMI between 30-40kg/m2 demonstrate the highest incidence (43%, p<0.0001). Arthroscopic RCR management increased by 2% (p=0.03) in RCT-CSS.

Conclusions: The incidence of CSS in patients with rotator cuff tear is significant. Spine surgeons should maintain high clinical suspicion for concurrent RCT pathology in patients with CSS particularly in obese, female patients over 65 years with several medical comorbidities. Further investigation into the influence of these concurrent pathologies on patient outcomes is warranted.

VERTEBRAL BODY LAVAGE REDUCES HEMODYNAMIC RESPONSE TO VERTEBRAL BODY AUGMENTATION

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Introduction: Vertebral body lavage (VBL) prior to percutaneous cement augmentation procedures for acute osteoporotic vertebral compression fractures (VCF) has been demonstrated to reduce the amount of fatty bone marrow displaced into the circulation in animal models, thereby potentially decreasing the risk for cardiovascular complications from fat embolism syndrom. However, no clinical trial has confirmed these findings in humans. We therefore asked whether VBL affects (1) systemic blood pressure, (2) heart rate, and (3) oxygen saturation in patients undergoing percutaneous cement augmentation procedures for acute VCF.

Methods: In a retrospective comparative study, 145 consecutive patients undergoing percutaneous cement augmentation procedures for acute VCF (mean age 74 ± 12 (42 - 96) years; 70% female; 475 levels treated) were enrolled. Patients undergoing vertebral body lavage prior to cement application were allocated to the ‘lavage group’ (n=61 patients; 203 spinal levels treated), and patients without prior VBL to the ‘control group’ (n=84 patients, 271 spinal levels treated). Mean arterial blood pressure (MAP), heart rate, and oxygen saturation were monitored immediately prior and three minutes after cement injection. Logistic regression analysis was performed with ΔMAP≥10mmHg before and after cement injection as the dependent output variable and vertebral body lavage, age, gender, number of cemented vertebra, level of cement augmentation (thoracic, thoracolumbar, lumbar), number of fractured vertebra, type of augmentation performed (vertebroplasty, kyphoplasty, stentoplasty), cement leakage (vascular and out of fracture gaps), increase of heart rate ≥ 10/min as independent variables.

Results: MAP decreased by mean 3±7.3 (range, 0-30; [confidence interval, 0.5-6.7]) mmHg before and after cement injection in the ‘lavage group’ and 9±10.5 (range, -3 to 35; [CI, 7-11]) mmHg in the control group (p<0.001). There were no differences in terms of heart rate and oxygen saturation before and after cement application either within each group or between the two groups. Multivariate logistic regression analyses revealed VBL as the only factor influencing MAP (adjusted odds ratio: 3.49, p=0.03).

Conclusion: Vertebral body lavage before PMMA application results in a significant reduction of MAP decrease, most probably by reduction of the embolic load. Its use for removing intravertebral fat prior to cement injection is an easy and cheap method to prevent potentially life-threatening complications in patients with impaired cardiopulmonary function.
Disclosures:

Figure 1. Vertebral body image is achieved by pedicular access with two Jamshidi needles into the vertebral body. One of the syringes connected to the Jamshidi needles is filled with 10ml NaCl solution (left syringes). Negative pressure is applied with the second empty syringe thereby aspirating the NaCl solution through the vertebral body (closed system). This procedure is repeated three times. Positive pressure on syringe filled with NaCl solution has to be avoided to prevent dislocation of bone marrow and fat into the circulation.
MIDTERM CLINICAL RESULTS OF TEMPORARY SHORT-SEGMENT FIXATION WITHOUT AUGMENTATION FOR THORACOLUMBAR BURST FRACTURES
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Dept of Orthopaedic Surgery, Osaka, Japan

Introduction:
Short-segment posterior instrumentation for thoracolumbar burst fractures provides superior correction of kyphosis by indirect reduction technique. We have reported the clinical results of temporary short-segment fixation without augmentation. In the report, fractured vertebra was well reduced and maintained regardless of load-sharing score, whereas correction loss was observed at adjacent disc level mainly after implant removal. However, midterm results with these patients are not clear. The aim of this study is to investigate midterm clinical results of temporary short-segment fixation.

Methods:
Subjects comprised 35 patients with thoracolumbar burst fracture (T11-L2) who underwent surgery by ligamentotaxis procedure using Schanz screws without augmentation between 2006 and 2012 in our institution. Of these 35 patients, 12 patients who had been followed at least 5 years were included in the study. There were 8 males and 4 females and their mean age at surgery was 41 years (range 20-66). Implants were removed approximately 1 year after surgery after confirming union of the fracture. Mean follow up period was 7.1 years (range 5-9). We have measured local vertebral body angle (VBA) and kyphotic angle (KA), which was measured between the superior endplate of the intact vertebra cephalad to the fracture and the inferior endplate of the intact vertebra caudad to the fracture before surgery, just after surgery, approximately 1 year after initial surgery, around 2 months after implant removal, and at the final follow-up examination in standing lateral roentgenograms. In addition, range of motion (ROM) at KA was measured by lateral dynamic roentgenograms. Fracture severity and back pain were also evaluated according to load-sharing classification and Denis pain scale, respectively.

Results:
The mean load-sharing score was 7.4 points. VBA was corrected 9.9° after initial surgery and the maintenance of the reduced vertebra was successful during the follow-up period. Therefore, we had no patients with instrumentation failure by vertebral collapse. In contrast, KA was corrected 11° after initial surgery and 10° loss of correction was observed only two months after implant removal. However, no deterioration in KA was found after that. Although motion segment was preserved (mean ROM at KA: 6.7°), 7 patients (58%) had fusion with cranial adjacent intact vertebra. None had back pain deterioration because of implant removal and had interruptions in their activities of daily life or work during the follow-up period.

Conclusion:
Kyphosis recurrence was observed at disc adjacent to the injured vertebra in the early period after implant removal in temporary short-segment fixation. However, the kyphotic change didn't progress further after that and caused no deterioration of back pain. Motion segment was preserved after implant removal, but fractured vertebra had fused with cranial adjacent intact vertebra in nearly 60% of the patients.

Disclosures:
author 1: none; author 2: none
LONG-TERM FOLLOW-UP RESULTS IN PATIENTS WITH THORACOLUMBAR UNSTABLE BURST FRACTURE TREATED WITH TEMPORARY POSTERIOR INSTRUMENTATION WITHOUT FUSION AND IMPLANT REMOVAL SURGERY - FOLLOW-UP RESULTS FOR AT LEAST TEN YEARS -

Sangbong Ko
Dept of Orthopaedic Surgery, Daegu, Korea

Background context: Intersegmental fusion is not necessarily needed in treatment of thoracolumbar burst fracture requiring surgery.

Purpose: The purpose of this study is to report the results of long-term follow-up for at least ten years in patients with unstable thoracolumbar burst fracture requiring surgery in which fractured segment was healed after temporary posterior instrumentation without fusion and subsequently implants were removed.

Study Design/Setting: Retrospective Cohort Study. Among patients hospitalized with unstable thoracolumbar burst fracture from 1 March 2004 to 31 January 2007, those in which union of fractured vertebra was observed after surgery and then implants were removed within an average of 12.2 months (8-15 months), and who could be followed up for at least ten years, were enrolled.

Methods: At the last follow-up, we confirmed the reduction status of fractured vertebra and the progress of kyphotic deformity in plain radiographs, measured the Oswestry Disability Index (ODI) to evaluate functional outcome of the spine, and investigated the Short Form 36 (SF-36) to evaluate overall quality of life in the patients.

Results: The follow-up period after implant removal surgery was 151 months (120-168) on average. The local kyphotic angle (LKA) was 26.89±6.08 degrees (range: 17-45) at the time of injury, and 10.11±2.22 (range: 6-14) at the last follow-up. Thus, the fractured vertebra was significantly reduced and then maintained (p<0.05). The anterior body height ratio (ABHR) was 0.54±0.16, and 0.89±0.05 at the last follow-up. Similarly, it showed that fractured vertebra was significantly reduced and maintained (p<0.05). At the last follow-up, the motion angle of vertebral interbody by Cobb’s angle, ODI, and Physical Component Summary (PCS) and Mental Component Summary (MCS) of SF-36 averaged 9.84±3.03 degrees, 7.95±7.38, 77.50±16.61, and 79.21±13.32, respectively.

Conclusion: In patients with unstable thoracolumbar burst fracture, fractured vertebra was healed after temporary posterior instrumentation without fusion and subsequently implants were removed. We conducted a long-term follow-up for at least ten years and found that they had minimum disability and their quality of life represented almost 80% of normal persons. Accordingly, temporary posterior instrumentation without fusion and implant removal surgery can be one of the alternative treatments useful for unstable thoracolumbar burst fracture, instead of the traditional posterior instrumentation and fusion.

Disclosures:
author 1: none
THE RADIOLOGICAL EVALUATION DOES NOT REFLECT THE CLINICAL OUTCOME AFTER SURGERY IN UNSTABLE THORACOLUMBAR AND LUMBAR TYPE A FRACTURES WITHOUT NEUROLOGICAL SYMPTOMS.
A COMPARATIVE STUDY OF TWO COHORTS TREATED BY OPEN OR PERCUTANEOUS SURGERY
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Hospital Ramón y Cajal, Madrid, Spain; Hospital Infanta Cristina, Badajoz, Spain; University Hospital Madrid Norte Sabchinarro, Madrid, Spain; Valencia Catholic University, Valencia, Spain.

Background/Introduction:
In recent years, transpedicular percutaneous fixation systems (TPF) have become a common treatment of thoracolumbar fractures thanks to the clinical advantages described in relation to open fusion. To date, no studies have analyzed clinical outcomes in terms of return to work.

Purpose of the study:
To compare the clinical and radiological outcome of two cohorts of unstable thoracolumbar and lumbar fractures treated by open posterior fixation (OPF) with bone graft or TPF without grafting.

Material and Methods:
This prospective study of cohorts included 136 patients (91 men and 45 women) with unstable thoracolumbar and lumbar compression fractures (type A2, A3, and A4) without neurological symptoms, who underwent open surgery (n = 85) or percutaneous fixation (n = 51) between 2010 and 2015. A conventional radiological study was performed in the preoperative, immediate postoperative period and after 1 and 2 years of follow-up. Six radiological parameters were measured: fracture angle, kyphotic deformity, sagittal index, percentage of compression, degree of displacement and angle of deformation. Clinical outcomes were evaluated by VAS and ODI scores at 1-year and 2-year follow-up. The period to return to work and the type of work was also recorded.

Results:
In both groups, all radiological parameters showed a significant improvement immediately after surgery (p <0.001). The percentages of correction were significantly higher in the cases operated by open surgery: fracture angle (p <0.001), kyphotic deformity (p <0.001), vertebral compression (p <0.001) and correction of displacement (p <0.001). Furthermore, cases operated by TPF experienced a greater percentage of loss of correction at 2-years follow-up, being notable in the fracture displacement (p < 0.001), the deformity angle (p <0.001), the kyphotic deformity (p <0.001) and in the sagittal index (p <0.001). Besides this greater loss of correction, TPF cases showed better VAS (p<0.001) and ODI scores (p<0.001) at final follow-up. The percentage of patients returning to the same heavy work position was higher in the TPF group (p<0.001) and in a shorter period of time (p<0.001).

Conclusion:
Patients undergoing percutaneous surgery after a thoracolumbar fracture experienced in a greater loss of the radiological correction obtained immediately after surgery as compared to cases operated by open surgery with grafting. However, the loss of correction does not reflect the clinical outcomes that were significantly better in patients undergoing percutaneous surgery without grafting. It would be useful to further evaluate if these radiological changes could have a long-term clinical significance.

Disclosures:
BONE SCINTIGRAPHY WITH SPECT CT IN PAEDIATRIC PATIENTS WITH BACK PAIN: THE EXPERIENCE OF A TERTIARY PAEDIATRIC REFERRAL CENTRE
Kelechi Eseonu, Uche Oduoza, Lorenzo Biassoni, Ramesh Nadarajah
Spinal Orthopaedic Department, Great Ormond Street Hospital, London

Aim: A retrospective review on the added clinical value of bone scan with SPECT/CT in children and adolescents with back pain.

Materials and Methods: 107 consecutive paediatric and adolescent patients (37 males, 70 females, age range 5-17, median age 15) after referral to the spinal surgery clinic of a tertiary paediatric teaching hospital between November 2009 and February 2017 were included. All patients had spinal x-ray and MRI (except 9 patients, who had CT) and bone scan with planar whole body images (and spot views of the area of pain) and SPECT/CT, centred on the area of pain.

CT settings were adjusted to minimise the radiation burden (50 mAs, 80kVp under 8 years, 24 mAs, 110 kVp over 8 years). A Siemens Symbia T2 SPECT/CT gamma camera was used. All bone scintigraphies were reviewed by two consultant nuclear medicine specialists. Reports of x-rays, MRI (and CT) scans were available from the Radiology Information System. Details on patients’ presentation and follow up were available from the clinical documents database. The decision on whether SPECT/CT added clinical value was made in a combined review session with the consultant spinal surgeon.

Results: SPECT CT reported relevant positive findings in 53% of cases (57 of 107) and relevant negative findings in a further 16% (17/107). In those cases where SPECT CT scan reported positive findings, a likely pain generator corresponding to the clinical history was identified in 86% of cases (49 of 57). Of those with positive findings, SPECT CT added clinical value, important for patients’ management, in 36 of 57 (63%) cases.

SPECT CT identified the pain generator mechanical stress from facet or sacroiliac joints in 32 of 57 (56%). It showed that the MRI abnormalities (mild disc herniation, Shmorl’s nodules, hydromelia, Tarlov cyst) were not the cause of pain in 4 cases and identified loose metalwork in 9 patients with spinal metal work not previously diagnosed on MRI or plain radiograph. 8 cases of spondylolysis SPECT/CT showed a cold pars defect, thus prompting pars fusion with bone grafting. The mean effective dose equivalent from the limited CT associated to the SPECT was 0.37 mSv +/-0.22 mSv (0.15 - 0.98 mSv).

Conclusion: These results suggest that a prospective evaluation of the role of SPECT/CT in paediatric patients with orthopaedic back pain is justified in a selected patient population. The CT component of the SPECT CT study, whilst producing bone images of diagnostic quality, gave a particularly low radiation dose.

RADIOLOGICAL AND CLINICAL EVALUATION OF THE USE OF LOW AND HIGH DENSITY SCREW SYSTEMS IN SCHEUERMANN KYPHOSIS

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Dept of Orthopedics & Traumatology, Adana, Turkey

Introduction: The use of low and high-density screw systems in spinal deformity surgery remains controversial.

Aim: To determine how implant density affects clinical and radiological outcome in the treatment of Scheuermann Kyphosis.

Study Design: A retrospective multicenter study

Patient Sample & Outcome Measures: 149 Scheuermann kyphosis diagnosed patients who underwent posterior one stage correction surgery with a minimum follow up of 24 months. Radiographic outcomes included preoperative and 2 year postoperative sagittal cobb measurements, Risser stage and curve flexibility. We also assessed SRS-22 outcome measures before surgery and at the 2 year postoperative time point.

Methods: Bivariate analysis was conducted between implant density and the following factors: percent correction of the kyphotic curve, number of osteotomy levels and other sagittal parameters. The correlation between curve flexibility and percent correction of the kyphotic curve was determined. Patients were divided into two groups: the low-density (LD) group defined by implant density below the mean number of screws for the kyphotic apex (less than 1.3 screws per level) and the high density (HD) group defined by implant density above the mean number for the kyphotic apex (more than 1.3 screws per level). Independent sample t tests were used to compare demographic data as well as radiographic and clinical outcomes at baseline and at follow-up between the two groups. Whole spine x-rays obtained before surgery, 1 months after surgery, and at the latest 2 year follow-up were analyzed. The following parameters were measured: thoracic kyphosis (TK), lumbar lordosis (LL), sagittal vertical axis (SVA). The development of PJK was considered the primary end point of the study.

Results: It was found that all the study groups were homogeneously distributed in the preoperative evaluations such as age, sex, duration of complaint, flexibility and riser stages. When the technical details of the surgical procedure were examined, the number of fused vertebrae (11.6 ± 1.1, 12.1 ± 1.7, p: 0.017), number of pedicle screws (15.4 ± 3.5, 23.5 ± 3.7, p: 0.0001) and osteotomy levels (2.8 ± 1.6; 3.9±1.9, p: 0.0001), statistically significant differences were found between low and high density screw groups (p <0.05). When the radiological evaluations were taken into consideration, there was no statistically significant difference between the values of T2-T12, T5-T12, T10-L2, and L1-S1 Cobb angle between the early postop and the 2-year follow up between the low and high density groups.
Conclusion: Both radiologic and clinically similar results and limited number of complications were seen in both low and high density groups. It has been supported that the clinically same results can be obtained with less implant use in patients planned for Scheuermann kyphosis surgery.

Clinical and radiological measurements of patients according to screw density and time period

<table>
<thead>
<tr>
<th></th>
<th>Preop Low</th>
<th>Preop High</th>
<th>Postop 1st m Low</th>
<th>Postop 1st m High</th>
<th>Postop 2 yrs Low</th>
<th>Postop 2 yrs High</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
<td>Median</td>
<td>Median (Min-Max)</td>
<td>Median (Min-Max)</td>
<td>Median (Min-Max)</td>
<td>Median (Min-Max)</td>
<td></td>
</tr>
<tr>
<td>SRS22 Sub Total</td>
<td>3.3(3.1-4.5)</td>
<td>2.9(2.2-2.3)</td>
<td>4.2(3.4-9)</td>
<td>4.1(2.5-4.8)</td>
<td>0.603</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRS22 Function</td>
<td>3.8(2.6-5)</td>
<td>4(2.4-5)</td>
<td>4.3(2-5)</td>
<td>4.2(2.6-5)</td>
<td>0.465</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRS22 Pain</td>
<td>3.6(2.2-4.8)</td>
<td>3(0.8-4.8)</td>
<td>4.2(2.3-5)</td>
<td>3.8(1.6-4.8)</td>
<td>0.082</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRS22 Self Image</td>
<td>3.2(1.3-4.4)</td>
<td>2.6(1.4-5)</td>
<td>4.2(1.5)</td>
<td>4.2(2.2-5)</td>
<td>0.021</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRS22 Mental Health</td>
<td>3.8(2.5-6)</td>
<td>3.2(1.4-5)</td>
<td>4.6(1.5-5)</td>
<td>4.2(2.6-5)</td>
<td>0.508</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobb T2-T12</td>
<td>79(70-101)</td>
<td>79(35-103)</td>
<td>48(22-77)</td>
<td>46(25-73)</td>
<td>48(35-77)</td>
<td>49(0-74)</td>
<td>0.290</td>
</tr>
<tr>
<td>Cobb T5-T12</td>
<td>65(34-89)</td>
<td>67(30-93)</td>
<td>40(13-59)</td>
<td>35(7-58)</td>
<td>38(17-60)</td>
<td>36(7-56)</td>
<td>0.469</td>
</tr>
<tr>
<td>Cobb T10-L2</td>
<td>17(1-65)</td>
<td>21(-7-63)</td>
<td>10(2-31)</td>
<td>10(-20-32)</td>
<td>8(0-39)</td>
<td>10(-15-45)</td>
<td>0.091</td>
</tr>
<tr>
<td>Cobb LL(L1-L1)</td>
<td>59(35-92)</td>
<td>67(85-108)</td>
<td>48(29-67)</td>
<td>41(68-91)</td>
<td>48(27-75)</td>
<td>40(-59-82)</td>
<td>0.073</td>
</tr>
</tbody>
</table>

Disclosures:
3D VALIDATION OF THE NEW SAGITTAL CLASSIFICATION FOR AIS
Mareille Post, Stephane Verdun, Pierre Roussouly, Kariman Abelin-Genevois
Dept of Spine surgery, Centre Medico Chirurgical des Massues Croix Rouge Francaise, Lyon, France Dept of Medical Research, Institut Catholique de Lille, France

Title
3D Validation of the new sagittal classification for AIS

Summary
New sagittal classification differentiating three patterns in AIS has been tested by 3D radiographic analysis. Concordance was high for spino pelvic parameters and thoracic kyphosis especially T4T12 angle. T10L2 was the most variable parameter. However 91% of the cases were similarly classified in the sagittal classification by 2D and 3D analysis. This comparative analysis validates the use of the new sagittal classification in both 2D and 3D. However 3D analysis is more accurate to define sagittal alignment when Cobb > 55°.

Hypothesis
New 2D sagittal classification of AIS validation based on 3D analysis of the spine.

Introduction and purpose of the study
In order to improve surgical planning of sagittal correction in AIS, we proposed a new sagittal classification (presented SRS meeting 2017). The main criticism is related to the fact that 2D lateral view results from the projection of the 3D deformity. Therefore, there is a need to validate the new sagittal classification using 3D radiograph analyzing software.

Materials and method
We performed a radiographic analysis in a cohort of 94 AIS patients (mean age 15,5 years) candidate for surgery with biplanar stereoradiography (prospective data). 2D measurements were performed with data management software and provided frontal and sagittal spinopelvic parameters (T1-T12, T4-T12, T10-L2, L1-S1, PI, SS, PT). Utilizing 3D radiograph analyzing software, a 3D model of the spine was constructed, providing 3D calculated frontal (cobb angle, apical rotation) and sagittal parameters. Each case was categorized according to Lenke and sagittal classification.

Results
According to Lenke, 72% of these patients were type 1/2, 13% type 3 and 15% type 5/6. Concordance between 2D and 3D parameters was high for spino pelvic parameters and thoracic angles. Mean error for thoracic kyphosis was 3° for T1T12 and 1° for T4T12. Mean error for L1S1 was 5°. We found more variation for T10L2 angle when Cobb angle > 55 and/or rotation > 21 degrees. However 91% of the cases were similarly classified in the sagittal classification in 2D and 3D.

Conclusion
This comparative analysis validates the use of the new sagittal classification in both 2D and 3D. 3D
analysis emphasizes the clinical relevance of the new sagittal classification and helps to define more accurately the sagittal pattern in AIS. 2D analysis may underestimate thoraco lumbar junction behavior especially when lordotic. However the position of the inflexion point may help on 2D analysis to differentiate type 1 (normal kyphosis) from type 3 (cervico thoracic kyphosis). Type 2 (thoracic hypokyphosis) are well-characterized by either 2D and 3D analysis.

Disclosures:
THE INFLUENCE OF OBESITY ON LOW BACK PAIN IN ELDERLY INDIVIDUALS CONSIDERATIONS BASED ON MEDICAL EXAMINATION OF LOCAL RESIDENTS: THE GAINA STUDY
Shinji Tanishima, Hiroshi Hagino, Hiromi Matsumoto, Hideki Nagashima
Dept of Orthopedic Surgery, Tottori-University, Japan

[Introduction] During the treatment for low back pain, it is common for patients and physicians to consider reducing the patients' body weight. However, reportedly, body mass index (BMI) is not related to back pain; there is no obvious basis for the relationship between low back pain and obesity.

[Purpose] In this study, we report the relationship between obesity and low back pain based on a medical examination of elderly local residents.

[Method] We participated in the medical examination of the town in 2014 and targeted 121 individuals (males, 43; females, 78; average age, 72.4 years) who also participated in the medical examination in 2017. The percentage of body fat was measured, and obesity was defined as body fat percentage of ≥25% and >30% in males and females, respectively. Participants were divided into two groups: normal (87 participants) and obese (34 participants). Back pain and lumbar function were evaluated using the visual analog scale (VAS) and Oswestry Disability Index (ODI) at the time of medical examination, and the attitude was measured and evaluated using the kyphosis index.

[Results] The complaint rate of low back pain in 2014 was 58.6% (51/87) and 50.0% (17/34) in the normal and obese groups, respectively, with no significant difference between the groups. The ODI and VAS scores were 10.0 ± 1.2 and 17.2 ± 2.6 in the normal group and 10.6 ± 1.9 and 12.4 ± 3.0 in the obese group, respectively, and there were no significant differences between the two groups in terms of both VAS and ODI scores. The kyphosis index was 10.9 ± 0.3 in the normal group and 9.5 ± 0.6 in the obese group, and the round back was strong in the normal group (P = 0.03). There were no significant differences in the VAS and ODI scores between 2014 and 2017, and there was no difference in the complaint rate of back pain in the normal and obese groups. The kyphosis index showed no significant change in the normal group (from 10.9 ± 0.3 to 10.4 ± 0.8), but it was significantly deteriorated in the obese group (9.5 ± 0.6 to 10.9 ± 0.8; P < 0.001). Furthermore, 10 of 87 individuals who were normal in 2014 had become obese in 2017. However, both VAS and ODI scores did not show significant deterioration in these 10 cases from 2014 to 2017.

[Discussion] The complaint rate of low back pain in obese individuals was not particularly high, and functional impairment was not noticeable. Based on these findings, it can be said that obesity is not directly related to low back pain in elderly individuals. However, the posture clearly deteriorates over the years in the obese population, which may affect back pain in the long term.

[Conclusion] Obesity is not a risk factor for back pain. However, Obesity influences the attitude.

Disclosures:
TIME FOR ONE MORE QUESTION?
A SIMPLE "YELLOW FLAG" TOOL TO ASSESS PSYCHOLOGICAL FACTORS IN PATIENTS UNDERGOING SPINE SURGERY

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Schulthess Klinik, Zürich, Switzerland

Introduction
Depression, anxiety, catastrophising thoughts, and fear-avoidance beliefs are key "yellow flags" predicting a poor outcome in patients being treated for spinal disorders. Many clinicians have difficulty assessing or detecting yellow flags and they rarely "formally" screen for them. This may be the result of the complexity of existing instruments and time constraints in the consultation. A brief assessment tool would allow for the rapid evaluation of yellow flags on a more systematic basis. We aimed to develop such a tool to add to the baseline Spine Tango Patient Self-Assessment form that currently evaluates each of the key outcome domains with a single item using the Core Outcome Measures Index (COMI).

Methods
First, we performed a secondary analysis of large datasets containing spine patients' individual item scores for 4 established questionnaires: ZUNG depression scale (N=399); Anxiety Scale of Hospital Anxiety and Depression Scale (N=308); Pain Catastrophising Scale (N=766); and the Fear Avoidance Beliefs Questionnaire (N=736). We used published methods to select the single item that best represented each full questionnaire whilst also making sense as a stand-alone item. These were then presented as one question with 4 items, all using the same 5-point response option (Fig 1), and answered by 1'768 patients before surgery; patients also completed a baseline COMI, to evaluate construct validity of the flag question, and a 12-month follow-up (FU) COMI, to assess its predictive ability. Reliability was assessed in 21 patients who completed the flag question twice, 6±7 days apart.

Results
The flag items showed strong correlations with the scores for the full questionnaires from which they were extracted: 0.71 (depression), 0.81 (catastrophising), 0.77 (anxiety), 0.83 (fear avoidance beliefs). The intraclass correlation coefficients for test-retest reliability were 0.63-0.89 for each of the 4 items and 0.86 for the set, considered "good". Internal consistency (Cronbach's α) of the 4 items was 0.79. Correlations between each item and preoperative COMI ranged from 0.27 (anxiety) to 0.39 (depression), p<0.0001. Multiple regression revealed that baseline COMI, age, sex, ASA status and the 4 flag items explained 15% variance in COMI at 12 months' FU, with catastrophising and anxiety each being significant predictors (p<0.001) of the outcome.

Discussion
The items selected for the flags question were similar to those in the brief "STarTBack screening tool" used in primary care to identify patients needing targeted treatment to prevent back pain chronicity. The flags question proved to be a simple, practicable, reliable and valid tool for assessing key psychological attributes in patients undergoing spine surgery. Its brevity makes it a useful addition to the COMI in the Spine Tango patient self-assessment of baseline status prior to treatment and may assist in improving the accuracy of outcome predictions in our current predictor models.
Fig. 1. The new question added to the Tango Patient Self-Assessment form, preoperatively (subsections: 8a, catastrophising; 8b, depression; 8c, anxiety; 8d, fear avoidance beliefs).

The following list contains statements from people with back problems. Some of these statements may also reflect your own thoughts/feelings. Please tick the box that best describes the extent to which each statement reflects your own thoughts/feelings at the moment.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Not at all</th>
<th>To a slight degree</th>
<th>To a moderate degree</th>
<th>To a great degree</th>
<th>Totally</th>
</tr>
</thead>
<tbody>
<tr>
<td>8a It’s terrible and I think it’s never going to get any better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8b I feel down-hearted, blue and sad.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8c Worrying thoughts go through my mind.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8d Physical activity might harm my back.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Disclosures: