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Trauma, infection, complications, diagnostics and imaging

54

CLASSIFICATIONS AND TREATMENT RECOMMENDATIONS FOR THORACOLUMBAR SPINAL INJURIES - A COMPARISON BETWEEN AO MAGERL, TLICS, AND AOSpine

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Introduction: To determine the efficiency or reliability of a new classification system, a direct comparison with existing classification systems should be performed. The aim of the present work is a comparative evaluation of the interobserver reliability of the three international classification systems for thoracolumbar spine injuries (AO Magerl, Thoracolumbar Injury classification score "TLICS", Thoracolumbar AO Spine classification "TL AOSpine") and the determination of modification possibilities with regard to reliability, United Statesbility as well as treatment recommendation of the currently TL AOSpine classification system.

Materials/Method: This is a monocentric, prospective analysis of patients with fractures of the thoracolumbar region. Only cases with traumatic fractures were included, pathological fractures were excluded. The available x-rays, CT and MRT images were classified by 5 spine surgeons with different degrees of experience using the three classification systems AOSpine, AO Magerl and TLICS, and the associated treatment recommendation according to Thoracolumbar AO Spine classification injury score "TL AOS IS", German society for trauma surgery "DGU" and TLICS. For the statistical evaluation, the interobserver reliability according to Cohen's kappa was calculated.

Results: Radiological and clinical data of 100 patients were included. AO Magerl showed moderate Interobserver reliability ($\kappa=0.46$) for morphological classification and substantial agreement ($\kappa=0.71$) for DGU treatment recommendations. TLICS showed fair Interobserver reliability ($\kappa=0.35$) for morphological classification, substantial agreement ($\kappa=0.69$) for treatment recommendations according to TLICS. TL AOS showed substantial Interobserver reliability ($\kappa=0.69$) for morphological classification and a substantial agreement ($\kappa=0.77$) for treatment recommendations (TL AOS IS).

Discussion: In the present study it could be shown that TL AOS is a reliable classification, with superior interobserver reliability compared to AO Magerl and TLICS. The treatment recommendations of TL AOSIS have higher interobserver reliability compared to other treatment recommendations (DGU and TLICS).

Disclosures:

author 1: none; author 2: none

RADIOLOGICAL AND LONG-TERM PATIENT-REPORTED OUTCOME AFTER ANTERIOR COLUMN RECONSTRUCTION OF TRAUMATIC THORACO-LUMBAR BURST FRACTURES USING AN EXPANDABLE VERTEBRAL BODY REPLACEMENT IMPLANT

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Background

Expandable implants for anterior column reconstruction for the surgical treatment of burst fractures have been developed during the last two decades. Data on restoring the bisegmental kyphotic endplate angle (BKA) is rare. The primary goal of this study was to assess the radiological and long-term patient-reported outcome measures (PROM) of traumatic thoracolumbar burst fractures treated with an expandable vertebral body replacement (VBR) implant (Obelisc™, FA Ulrich Medical).

Patients and Methods

A total of 136 patients with traumatic thoraco-lumbar fractures were treated with an expandable VBR implant in a level I trauma center between 2001 and 2015. Radiological data acquisition was completed pre- and postoperatively, after at least six weeks, and approximately two years. In addition to patient data, injury related details, as well as treatment details were assessed. The bi-segmental kyphotic endplate angle (BKA) was measured at each timepoint. Clinical outcome was evaluated using the German Short-Form 36 (SF-36), Oswestry Disability Index (ODI) and the EQ-5D score after at least two years follow-up.

Results

The radiological follow-up was completed by 117 patients (86%), and 64 patients (54.7%; mean age: 53.2 ± 14.8 years) completed the clinical follow-up (responding group). The mean time between index surgery and completion of the PROM questionnaire was 109.4 ± 44.6 months. Decompression of the spinal canal was performed in n=15 (23.4%) patients, spondylodesis in n=43 (67.2%) patients. Intraoperative reduction of the BKA was 6.6 ± 8.2° among all patients of the respondent group (p < 0.01). A significant loss of reduction of 2.6 ± 4.2° at the first follow-up and of 4.4 ± 6.6° at the second follow-up (Ø 38.5 months post-OP) were seen among all patients (each p < 0.05). The table displays the changes in the BKA of the matched pairs of thoracic and lumbar fractures of the responding group, respectively. At the thoraco-lumbar junction surgery changed the BKA significantly by 5.0 ± 7.9° (p<0.05). Loss of reduction was statistically significant with 2.7 ± 3.5° (p<0.05) until the first follow-up and with 4.0 ± 5.0° (p<0.01) until the second follow-up. Complete bony consolidation was seen in 45 patients (70.3%). The revision rate in the 117 included cases was 5.1% and all revisions (n=6) occurred within the responding group (9.4%). The mean follow-up ODI of the total cohort was 28.4 ± 17.6, the mean EQ-5D VAS reached 57.9 ± 2.5 points. The cohort showed significant lower SF-36 values compared to a healthy reference population for each item (each p < 0.05).

Conclusion

Stabilization of traumatic thoraco-lumbar burst fractures and anterior column reconstruction using an expandable VBR implant is an effective and safe procedure. The initial reduction of the BKA does not consist over time, without effecting the clinical outcome. However, due to the severity of the injury, the quality of life remains inferior to a healthy reference population.

Changes in the bisegmental kyphotic endplate angle				
	Time Points	Mean \pm SD [°]	Range [°]	p
Thoracic spine	Reduction	-7.3 \pm 7.4	-26.7 to 0.67	<0.01
	t0 vs t1	3.2 \pm 4.1	-0.5 to 10.8	<0.05
	t0 vs t2	3.4 \pm 4.3	-0.17 to 12.44	<0.05
	t1 vs t2	1.2 \pm 2.0	-0.63 to 4.4	<0.01
Lumbar spine	Reduction	-6.2 \pm 8.6	-5.9 to 0.3	<0.01
	t0 vs t1	1.5 \pm 2.4	-0.8 to 8.4	<0.01
	t0 vs t2	3.4 \pm 4.4	-0.7 to 16.8	<0.01
	t1 vs t2	1.1 \pm 2.3	-2.7 to 8.0	<0.01

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56

PREDICTORS OF RESIDUAL LOW BACK PAIN AFTER ACUTE OSTEOPOROTIC COMPRESSION FRACTURE: A PROSPECTIVE, MULTICENTER COHORT STUDY

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Purpose: There are, as far as we are aware, no reports that have investigated the risk factors for residual low back pain beyond 6 months after OVFs. The purpose of this study is to characterise a patient population with residual low back pain 48 weeks after acute osteoporotic vertebral fractures (OVFs) and to identify the risk factors associated with residual low back pain in the acute phase, with special focus on patient-reported outcome measures (PROMs) and radiographic assessments.

Methods: This multicenter, prospective cohort study included female patients aged 65-85 years with acute one-level OVFs. Outcome and risk factor analyses were performed by comparing the visual analog scale (VAS) for low back pain score <4 and with low back pain score \geq 4 groups. In the radiographic analysis, the anterior vertebral body compression percentage was measured at 0, 12, and 48 weeks. Magnetic resonance imaging (MRI) was performed at enrollment to confirm the diagnosis. The PROMs included scores on the European Quality of Life-5 Dimensions, VAS for low back pain, and the Japanese Orthopaedic Association Back Pain Evaluation Questionnaire at 0, 12, and 48 weeks.

Results: Of the 228 patients analysed in the present study, 72 (31.6%) complained of residual low back pain at 48 weeks after OVFs. The independent risk factors in the acute phase for persistent pain 48 weeks after OVFs were MRI T2 fluid-intensity image and a high VAS score.

Conclusion: MRI T2 fluid-intensity and a high VAS score in the acute phase were significant risk factors for residual low back pain 48 weeks after OVFs. Patients who have acute OVFs with these risk factors should be carefully monitored for possible development of residual chronic low back pain.

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MINIMALLY INVASIVE MANAGEMENT OF THORACIC SPONDYLODISCITIS IN ELDERLY PATIENTS; THORACOSCOPIC DEBRIDEMENT AND FUSION COMBINED WITH POSTERIOR PERCUTANEOUS FIXATION

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Spondylodiscitis affects the thoracic region in about 20 % of spine infections. Old patients with multiple comorbidities are more vulnerable and have more complicated clinical progression. The tremendous improvements in surgical technique, instrumentation, blood management, and cord monitoring are yielding good results posterior-only surgeries. However -as in pyogenic spondylitis- often the problem is situated anterior and only for reason of access the posterior column needs to be destabilized to various degrees. Above that due to demographic changes the patients requiring solutions are increasingly old. So, solutions requiring proximal resection of 1 or 2 ribs on both sides and resections of one or two vertebrae often are not applicable.

Materials and methods

From 2005 until 2016 a total of 225 patients were managed through anterior thoracoscopic debridement and fusion in prone position combined with a posterior percutaneous fixation for the treatment of thoracic spondylodiscitis, 92 of them were older than 65 years and are the material of this study. Preoperative clinical and laboratory investigations, operative profile, and postoperative follow up were analyzed

Results

There were 54 males and 38 females with a mean age of 74.12 years (66 to 88). The presentation was a pain in all patients, fever in 64 (65%), neurological deficits in 27 (29.3%) 7 of them was complete, and sepsis with cardiovascular instability in 12 patients (13%). Pre-operative mean VAS was 7.4 and ODI was 26.4. Blood culture was positive in 22 patients (24%), the mean pre-operative CRP was 142.5 (48 to 458) and the mean WBC was 14.6 (range 4.5 to 24.7). Preoperative antibiotics were used in 20 patients (22%) for 2-4 weeks. In 47 patients (51%) an epidural abscess was found and in 15 (16.3%) there was spondylodiscitis in the cervical or lumbar region.

The mean operation time was 226 minutes (120 to 310) and the mean blood loss was 685 ml (100-2500). Thoracoscopy was done from the right side in 50% of the cases. In 20 cases a corpectomy was necessary due to osteolysis. There were no intra-operative complications. Staph. aureus was the most common organism in 35 patients followed by staph. Epidermis. in 74 patients antibiotic therapy was for 12 weeks, in 18 patients for 8 weeks (negative microbiological results). After 2 weeks the CRP falls to a mean of 36 and WBC to 7.5. After a mean follow up of 38 months (6 to 132) there was no recurrence of infection and reoperation was necessary only in 5 patients due to adjacent segment infection in 3 patients and 2 patients due to screw loosening. In the last postoperative follow up the mean VAS was 3.2 and ODI was 10.8

Conclusions

Thoracoscopic debridement and fusion in prone position, combined with percutaneous fixation is a safe and effective approach for the management of thoracic spondylodiscitis in elderly patients. The prone position allows the combined anterior and posterior approach without the need of patients repositioning during surgery

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PREDICTIVE FACTORS OF MECHANICAL COMPLICATIONS IN ADULT SPINAL DEFORMITY SURGERY WITH MINIMUM TWO-YEAR FOLLOW-UP

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Introduction

Decrease mechanical complications (MC) after adult deformity surgery is challenging and prevention measures are still unknown. The objective of this study was to identify prognostic factors of mechanical complications in adult spinal deformity surgery with minimum two-year follow-up

Materials and Methods:

We performed a retrospective review of 51 patients who underwent correction surgery from thoracic to pelvis (> 5levels) for adult spinal deformity with minimum two-year follow-up. Mean age was 71.7±6.2 year with 12 males and 39 females. MC included proximal junctional kyphosis (PJK), rod breakage (RB) and implant-related complications such as screw pull-out or hook dislodgement. The potentially explanatory variables included age, gender, fused levels, use of multiple rods, 3 column osteotomy (3CO), lateral lumbar interbody fusion (LIF) and anterior longitudinal ligament (ALL) rupture. Radiographic parameters included thoracic kyphosis (TK), lumbar lordosis (LL), pelvic incidence (PI), pelvic tilt (PT), and sagittal vertical axis (SVA). Postoperative global alignment and proportion (GAP) score were measured in all patients. Cox proportional-hazard model was used to identify the predictive factors of MC.

Result:

Mechanical complications (MC) occurred in 30 patients (59%) and a total of 31% of all patients required reoperation (Figure 1). PJK was found in 33% (reoperation rate 29%) and RB was found in 31% (reoperation rate 69%). Higher rate of MC was observed in 3CO (10% vs 37%, P=0.048). Preoperative SVA (113mm vs 144mm, P=0.044) and postoperative GAP score (4.4 vs 6.3, P=0.026) were significantly higher in the MC group. The GAP score is an independent prognostic factor associated with MC (Hazard ratio 1.357, 95%CI 1.072-1.718, P=0.011). ROC analysis revealed that a cut-off point of 8 points showed appropriate values.

Conclusion:

MC occurred in 59% and 31% of all patients required reoperation. The GAP score is an independent prognostic factor associated with MC. The goal of proportional sagittal alignment may decrease the prevalence of MC.

Mechanical Complications

Type of Mechanical Complications	Total % (n)	Revision n (%)
PJK	33% (17 cases)	5 cases (29%)
Rod breakage	31% (16 cases)	11 cases (69%)
Hook dislodgement	6% (3 cases)	2 case (67%)
Screw pullout	2% (1 case)	1 case (100%)
Total	59% (30 pts, 37 cases)	31% (16 pts, 19 cases)

Disclosures:

author 1: none; author 2: none; author 3: none; author 4: none

SACROILIAC JOINT FUSION: REVIEW OF ADVERSE EVENTS AND STRATEGIES TO IMPROVE PATIENT SAFETY

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Introduction

There is growing acceptance of sacroiliac joint fusion as a means to address pain that does not respond to conservative therapy. The approach to the SIJ is made difficult by its oblique position within the narrow structure of the anterior column and its proximity to major neurovascular structure within and adjacent to the target bony structures, which are subject to developmental and anatomic variation. Bone quality is variable, subject to inflammatory, degenerative and hormonal effects. Further, the target pain-generating lesions, whether osseous or neural remain theoretical and unproven. Though results of some methods of stabilization are encouraging, overall results are imperfect and to some degree unpredictable, with unfortunate incidences of incomplete pain relief, postoperative neurologic-suggestive pain, mechanical pain, or combinations, sometimes addressable by revision and sometimes resistant to revision attempts. To improve outcomes after sacroiliac fusion surgery, complications must be studied in light of the anatomy and physiology and understood.

Methods

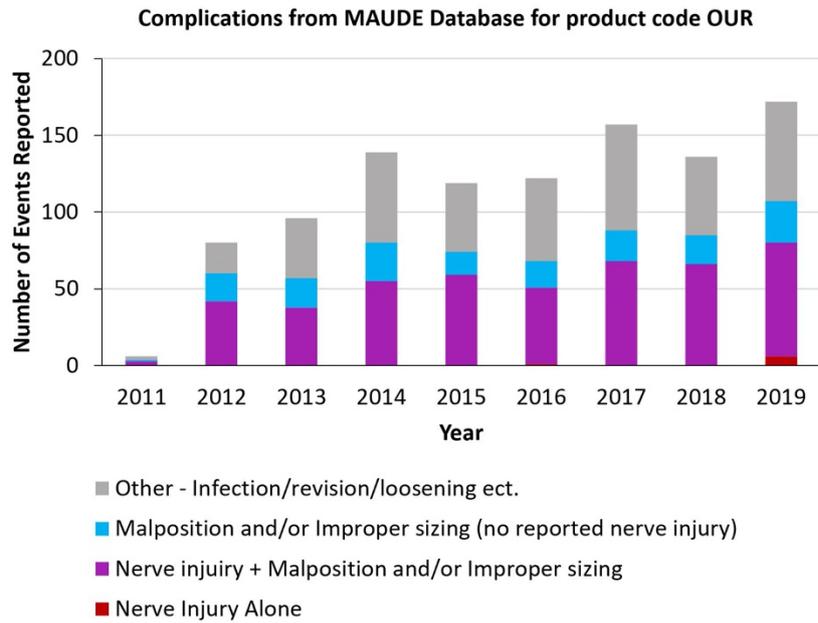
In this study we used the FDA Manufacturers and User Facility Device Experience (MAUDE) database to review the complications that have been reported for product category OUR -smooth or threaded metallic bone fixation fastener used for sacroiliac joint fusion over the past 10 years. Complications were further categorized using event data and compared year by year.

Results

Since 2011, there are 1039 adverse event reports in the MAUDE database. The first year with adverse events was 2010 with 6 document events. The events grew year by year to 172 events by the year 2019. The largest category of events, regardless of year was injury due to implant malposition. The second largest category of adverse events was implant malposition without nerve injury. Other significant complications include fracture, and bleeding.

Discussion

Despite advancements in the field of sacroiliac fusion surgery, the incidence of complications is discouraging and does not seem to be abating. The absolute incidence is concerning but the calculation of the actual rate of incidence is made difficult by the absence of some commercial information, such as actual number of implants actually placed (or attempted) in the US, from which the MAUDE data is derived. Complications include malposition of implants, nerve impingement, fracture, displacement of implants. In many cases, these results, seem resistant to surgical planning, intraoperative precautions and imaging. Other worrisome events also occur (not directly referable to the implants themselves) which include failure of relief, new neurologic deficits, and new extraaxial pain. Treatment may be made difficult by irretrievable implants. The large number of neurovascular complications suggests that the relationships of the implants to the neurovascular anatomy may not be well understood. More study is required.



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DEVELOPMENT OF A MODEL TO PREDICT THE LIKELIHOOD OF INCURRING A COMPLICATION IN PATIENTS UNDERGOING SURGERY FOR DEGENERATIVE DISORDERS OF THE LUMBAR SPINE

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Introduction

Previous studies have identified several factors influencing the likelihood of incurring a complication during spine surgery for degenerative disorders of the lumbar spine. These include previous spine surgery, age, comorbidity, complexity of the surgery, BMI, smoking, and others. The aim of this study was to identify predictors from a large international spine registry data base and to develop a multivariable model to predict the probability for complications perioperatively.

Methods

The data were extracted from EUROSPINE's International Spine Tango Registry. Medical history and surgical details had been documented using the Tango surgery form, as had surgical and general medical complications arising between admission and discharge. Separate prediction models were built for surgical and general complications. Predictors were age, gender, previous spine surgeries at the same level, additional pathologies, BMI, smoking status, morbidity and Mirza-score. For model development, all predictors were evaluated simultaneously in a multiple logistic regression approach. A complete-case approach was taken. The discriminative ability was addressed as area under the receiver operating characteristic curve (AUC), and 95% confidence interval.

Results

Data were available for 68'111 patients operated between Jan. 2012 and Dec. 2017. 43'461 were patients with degenerative lumbar disorders, aged 18 to 95 years, and 23'873 of them were available for complete case analysis. A general medical complication was reported in 766/23'873 (3.2%) patients, most commonly postoperative kidney/urinary problems (202; 0.8%) and a surgical complication in 2559/23'873 (10.7%), most commonly dural tear (1653; 6.9%). The most important predictor for surgical complication was previous surgery at the same level (odds ratio 1.96; 95% CI 1.76 -2.18, p-value < 0.001). For general complications it was the ASA-Score (ASA-2 odds ratio 1.59; 95% CI 1.21 -2.14; p-value = 0.001, ASA-3 odds ratio 3.09; 95% CI 2.27 -4.25; p-value < 0.001, ASA-3 odds ratio 5.80; 95% CI 3.03 -10.59; p-value < 0.001) The AUC for the model was 0.74 (95% CI: 0.72-0.75) for general complications and 0.63 (95% CI: 0.62-0.64) for surgical complications.

Conclusion

In general, complications were relatively rare. Surgical complications could be predicted with less discriminative ability than general complications. We found that reoperations at the same level were a predominant predictive factor for surgical complications.

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THE EFFECT OF CURVE LOCATION ON THE SEVERITY INDEX FOR ADOLESCENT IDIOPATHIC SCOLIOSIS

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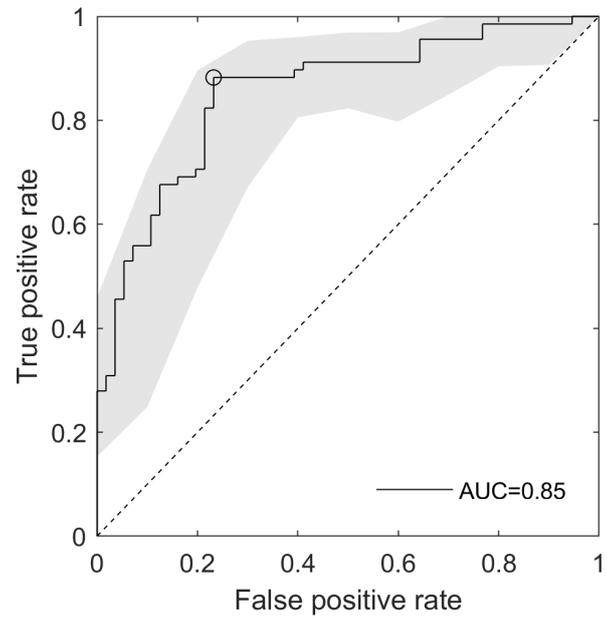
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Early treatment of adolescent idiopathic scoliosis (AIS) is more effective than late, but this requires determining early which patients will progress. A severity index was recently proposed to detect progressive AIS at the first exam. In the present work, a larger cohort was included to further validate the index and to determine the effects of curve location on its predictions.

This was a multicentric, prospective and retrospective study, with inclusions from six clinical centres in four different countries. AIS patients were included with a Cobb angle between 10° and 25°, age > 10 years and Risser sign < 3. They underwent biplanar radiography and 3D reconstruction of the spine, which allowed to compute the severity index. An index < 0.4 predicts a stable curve, while > 0.6 a progressive one; no prediction is made for values in-between. Patients were followed until decision of treatment („progressive“ patients) or until they reached skeletal maturity without progression („stable patients“, with Risser ≥ 3, Cobb angle ≤ 25°). Patients were grouped by major curve location: thoracic (T, apex above T12), thoracolumbar (TL, apex in T12 or L1) or lumbar (L, apex below L2). Receiver operator curve (ROC) and area under the ROC (AUC) were computed.

159 patients were included. Among those patients with Risser 2 (N=30), only 4 progressed. Hence, Risser 2 patients were excluded due to their low risk of progression in this cohort. The remaining patients (N=129, age 12±1 years, Risser<2) were 59 stable and 70 progressive. 55 patients had T curves, 31 TL and 43 L. The index correctly classified 83 % of patients as stable or progressive, with a sensitivity of 88% and a specificity of 77 %. No prediction was made for 5 patients (4%, index between 0.4 and 0.6). Figure 1 shows the ROC; AUC was 0.85. For T and L patients, sensitivity-specificity were 94%-76% and 94%-74%, respectively. Only 31 patients had TL curves, and 76% of them were correctly classified.

In this multicentric cohort of 129 patients, the severity index correctly classified 83% of patients as stable or progressive, at their first exam. The severity index represents a novel tool to aid the clinician and the patient in the modulation of the follow up and, for progressive patients, their decision for brace treatment.



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