

Abstracts

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P 22**Does a more rigid fusion provoke adjacent segment disease?****A biomechanical analysis**B. Wiedenhöfer¹, M. Akbar¹, C.H. Fürstenberg¹, T.M. Grupp¹, C. Schilling¹¹Orthopädische Universitätsklinik Heidelberg, Sektion Wirbelsäulenchirurgie, Heidelberg

Background: Since the first studies of Nachemson in the 1960s adjacent segment disease is a continuous object of retrospective clinical observations. Rigidity, length of fusion, Stress transfer and augmentation of intradiscal pressure are hypothesized in the adjacent level. Prospective randomized clinical trials to evaluate these observations by evidence based Level 1 data are still lacking. Biomechanical data is poor and partially heterogeneous. This study compares two types of spinal instrumentation of different rigidity on human cadaver spines concerning their influence on the upper adjacent segment (UAS).

Materials and Methods: Six fresh frozen lumbar spines are investigated in a Spine-Simulator based on the principle of the apparatus for creating and monitoring pure, relatively non constraining moments to induce flexion/extension, lateral bending and axial rotation in cadaver spine segments of two or more vertebrae inaugurated by Crawford in 1993. Both the intradiscal pressure (IDP) captured with a miniature pressure sensor and the range of motion (ROM) were measured in the UAS. Lumbar spines without any device, with rigid 360° fusion by an internal fixator and additional ALIF-Cages L3-5 and hybrid fusion with 360° fusion by an internal fixator and additional ALIF-Cage L4/5 and a total disc replacement L3/4 were investigated by the same protocol. Kinematical data is collected by a commercial Ultrasound 3D-Measurement System and evaluated with proprietary software. Statistical analysis was performed using the t-test with $p < 0.05$ and variance analysis.

Results: The mean IDP in the native specimens in flexion/extension was 100 kPa under load of pure moments ± 7.5 Nm (350 kPa with an additional preload of 400 N), in lateral bending 150 kPa (350 kPa) and in axial rotation 100 kPa (350 kPa). The relative pressure data for 360° respectively hybrid fusion in every plane was within a range of 20 % of pressure and therefore not significantly different. The mean ROM in the UAS of the native specimens in flexion/extension was 7.06° under load of pure moments ± 7.5 Nm (5.35° with an additional preload of 400 N), in lateral bending 9.41° (8.71°) and in axial rotation 5.52° (3.82°). The relative ROM data for 360° respectively hybrid fusion in every plane was not significantly different within a range of 10 % of ROM whereas both instrumentations reduced the ROM in the bridged segment significantly in comparison to the native situation as expected.

Discussion: The data shows no significant difference in IDP in the UAS between the 360° bi-segmental instrumentation and native spines on the other. There is no significant difference between the hybrid fusion and the native spines as well as between the hybrid and the 360° fusion. In correlation to the IDP data there was also not a significant different ROM evaluated in the UAS for both instrumentations in comparison to native situation. This is consistent for the measurements with pure moments and with additional preload and in every plane.

Thus the 360° respectively hybrid fusion have not a significant influence on the load of the UAS. Accordingly to this there is not an increased risk for adjacent level disease.

Conclusion: In the biomechanical model the correlation of instrumentation, range of motion and intradiscal pressure in the UAS is not considered as a risk factor for segment degeneration.

P 23**Biomechanical comparison of asymmetric posterior stabilization methods for transforaminal lumbar interbody fusion**P. Schleicher¹, M. Scholz¹, K. Schnake¹, P. Beth², F. Kandziora¹
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Introduction: Beside other advantages, the transforaminal approach for lumbar interbody fusion offers the possibility to reduce surgical trauma by limiting the approach to one side. This requires posterior stabilisation methods which are to be applied without the need to damage contralateral tissues. To compare different posterior stabilisation methods for minimally invasive transforaminal lumbar interbody fusion (TLIF) biomechanically.

Methods: Using an established, custom made spine tester, consisting of a cable and pulley system mounted in a materials testing machine (Zwick 1455, Ulm), threedimensional stiffness testing was performed on 8 fresh frozen human cadaveric lumbar spine motion segments L4/5. The spine tester allowed a pure moment loading in the loading directions extension, flexion, bending and rotation. The following configurations were tested sequentially: (1) native motion segment, (2) TLIF and bilateral pedicle screw (PS) construct, (3) TLIF and ipsilateral PS, (4) TLIF and ipsilateral PS plus contralateral translaminar facet screw (TL), (5) TLIF and ipsilateral PS plus contralateral lumbar facet interference screw (LFIS). The 3D-motion was recorded using an optoelectronic motion analysis system (Qualisys, Savebalden, Sweden, accuracy $< 0.1^\circ$) and angular displacement (ROM), as well as elastic zone were calculated.

Results: In extension, the unilateral ROM (uROM) and elastic zone (EZ) were significantly lower compared to native for bilateral PS and LFIS. There were no significant differences between the different stabilisation methods. In flexion, uROM and EZ were significantly lower compared to the native segment with bilateral PS and TL-screw. The LFIS differed from the native segment in EZ, only. Again, there were no significant differences between the different posterior stabilisation methods. In lateral bending, the EZ of uni- and bilateral PS differed significantly. There were no additional significant differences. In rotation, the stiffness values of bilateral PS were significantly higher compared to native, unilateral PS and to LFIS. The uROM and EZ comparison between ipsi- and bilateral PS showed a tendencial, but no significant difference. There was no evidence, that the TLIF method led to an asymmetric motion behaviour in our study.

Discussion: Bilateral PS augmentation offers more stability than unilateral PS. There was no difference between the other tested methods. All investigated stabilisation methods could achieve at least the stability of the native segment. Since the unilateral PS instrumentation already has proven successful results in a clinical setting, the other methods seem to be suitable as an alternative.

P 24**Uridine monophosphate after nucleotomy: Investigation of pain reduction and quality of life**U. Rückert¹, M. Hedding-Eckerich², G. Lärm¹¹REHA Klinik Damp, Unfallchirurgie und Orthopädie, Damp²Trommsdorff GmbH & Co. KG, Arzneimittel, Med. Wissenschaft II, Alsdorf

Introduction: Dietetic treatment seems to be also useful in conditions that are not particularly known for depending on nutrition, for example lesions of the peripheral nervous system. Regeneration of damaged nerve tissue also depends on adequate supply. As to traumatic nerve lesions, some studies show that nutritional requirement - especially with regard to pyridine nucleotides - is clearly increased. Aim: This prospective and reference-controlled observational study should demonstrate that

patients with painful reduction in movement and functional impairment after nucleotomy benefit of a specific dietetic treatment with uridine monophosphate (UMP) and the neurotropic vitamins B₁₂ and folic acid.

Methods: 83 patients in rehabilitation with painful condition after nucleotomy received a supplementary dietetic food therapy (EBD) with 1 capsule Keltican® forte every day (50 mg UMP + 0.003 mg vitamin B₁₂ + 0.4 mg folic acid) for 3 weeks in addition to customary treatment. Another 40 post-nucleotomic patients with comparable painful condition remained without dietetic therapy during the observational period (control group).

Besides physical examination and labour parameters, main target criteria were used as follows: the visual analogue scale (VAS) for quantification of pain intensity, the standardized short questionnaire QLQ-C 30 for documentation of quality of life, and the global clinical impression (CGI) judged by physician and patients. Study parameters were examined by the onset of the study, after 2 weeks, and at the end of the study.

Results: Demographic data and the gender ratio were comparable between the study group and the control group, and median age was 47 and 48 years, respectively. The intention of pain was significantly reduced in the study group from 90 mm VAS by study onset to 24 mm (visit 2), and finally to 8 mm at study end. Thus, the median reduction was significantly stronger ($p < 0.005$ after 2 weeks, $p < 0.001$ at study end) than in the control group (81, 45, and 30 mm VAS). The absolute reduction in pain was 91% in the study group vs. 63% in the control group. Quality of life, judged as clearly impaired by all the patients at the beginning of the study, was significantly more improved by EBD, the sum score raised by 64% compared to 36% without EBD ($p < 0.001$). CGI (judged by physician) was significantly better in the study group, both after 2 weeks as well as at the end of the study ($p < 0.001$). 89% of EBD-patients were in considerable better state as compared to study onset, in contrast to 40% of controls, only. CGI judged by patients was alike. Acceptance and tolerability of the dietetic treatment was generally assessed as good.

Conclusion: In patients suffering from traumatic nerve damages the treatment with the supplementary dietetic food UMP, vitamin B₁₂, and folic acid is an effective and useful procedure to accelerate the repair mechanism in the peripheral nervous system, in addition to standard therapy. EBD can significantly reduce pain, and improve quality of life as well as clinical global impression.

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Anterior, thoracoscopic-assisted reduction and stabilization of a thoracic burst fracture (T8) in a pregnant woman – A case report

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Introduction: Injuries of the spine in pregnant women are rare. Indications for operative stabilization are highly unstable fractures, incomplete neurological deficits, and unsuccessful conservative treatment. Only posterior stabilization techniques in pregnancy have been published in case reports yet. For the first time, this case report describes an anterior, thoracoscopic-assisted reduction and stabilization of a burst fracture in a pregnant woman.

Material/Methods: An aged 24 woman in the 19th week of gestation suffered from a T5 and T8 fracture due to a motorcycle accident as pillion rider. CT-scan revealed a complete burst fracture (type AO A3.3) of T8 with little, clinical unapparent, narrowing of the spinal canal. Conservative treatment failed, because the patient could not be mobilized despite analgesia with morphine. Operative treatment was performed as an anterior,

thoracoscopic-assisted reduction and stabilization in left lateral position with split intubation. The body of T8 was removed and an ArcoFix plate (Synthes) was used to stabilize and reduce the fracture. Finally, a tricortical iliac bone graft was used for bony fusion. Intraoperative fluoroscopy could be cut down to verification of implant positions.

Results: Postoperative control of the fetus showed normal values. The patient was discharged with paracetamol as residual pain medication. The T8 fracture could be reduced from 20° to 13° kyphosis (segmental standard value 12° [1]). The further clinical and radiological course of the patient was uneventful.

Discussion: Solely anterior, thoracoscopic-assisted reduction and stabilization of an unstable thoracic burst fracture can be recommended if suitable implants are available and good bone stock exists. In the present case of a pregnant woman the operative prone position could be avoided and the intraoperative exposure to radiation was minimized.

Literature: [1] Weber W, Wimmer B. Die klinische und röntgenologische Begutachtung von Wirbelsäulenverletzungen nach dem Segmentprinzip. Unfallchirurg 17 (1991):200-207

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Spondylitis Following Kyphoplasty – Short review and case presentation

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Introduction: Only 10 cases of spondylitis following vertebroplasty have been reported, in a total of nine publications. Up to now, no cases of spondylitis or spondylodiscitis caused by kyphoplasty have been described in the literature.

Material and Methods: A 72-year-old-man with an L1 osteoporotic compression fracture after kyphoplasty developed partial paralysis below L1. This was caused by compression of the myelon following secondary spondylitis with a psoas abscess. The bacterium isolated from a CT-guided aspiration was a group C streptococcus. The psoas abscess was treated by percutaneous drainage, followed by laminectomy and posterior instrumentation with an internal fixator from T11/T12 to L3/L4. A second procedure was performed with a corpectomy at L1, removing the dislocated cement and fusing from T12 to L2 with a titanium cage.

Results: Six weeks after the intervention the patient reached pain-free status with no neurological deficits or signs of infection.

Conclusion: Spondylitis after kyphoplasty is a very rare complication. When patients develop recurrent back pain after kyphoplasty, the rare complication of spondylitis must be considered.

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Traumatic Spinal Injury – What is the Impact of our Efforts? A retrospective analysis of 1052 cases

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Introduction: Every year approximately 1000 people in Germany suffer a traumatic spinal cord injury. Goal of our surgical and rehabilitation efforts is a speedy and qualitatively high occupational and social re-integration. A fundamental requirement is, next to the surgical stabilization of the spine, a close relationship and co-operation of the acute treatment hospital and the spinal rehabilitation unit. This study focuses on the impact that all this measures have on the outcome achieved in our patients. We determined which parameters can positively alter this outcome and which parameter have no significant influence. Furthermore it was evaluated what the central