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MAYFIELD BASIC SCIENCE

100. Cerebrospinal Fluid Drainage and Induced Hypertension Improve spinal cord Perfusion in the Setting of Acute Spinal Cord Injury

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Introduction: Elevation of mean arterial blood pressure (MAP) and cerebrospinal fluid drainage (CSFD) has been used as treatment modalities in patients after acute spinal cord injury (SCI). Currently there is no evidence in support of the routine use of either modality. We sought to determine efficacy of aggressive MAP augmentation combined with lowering of intrathecal pressure (IP) by CSFD to improve spinal cord blood flow (SCBF) after SCI.

Methods: We induced mild spinal cord injury at the T5 level in pigs. The animals were divided evenly between five groups: Control (laminectomy) (n=3); SCI only (n=3); SCI with elevated MAP (SCl+MAP) (n=3); SCI with CSFD and elevated MAP (SCI+MAP+CSFD) (n=3). Elevated MAP and CSFD was initiated 1 hour after SCI. CSF diversion was achieved via lumbar drain. Elevated MAP was achieved by continuous monitoring and recording of IP, SCBF at SCI level and MAP.

Results: The SCBF in SCI group was decreased by 56% after SCI in comparison with baseline. Increase in blood pressure after SCI resulted in a 34% decrease in SCBF, whereas CSFD resulted in a 59% decrease in SCBF. The combination of CSFD and induced hypertension resulted in a 24% increase in SCBF. The SCI group had stable IP throughout experiment. The SCI+MAP group had an average of 5.45 mmHg IP increase after MAP increase 1 hour after SCI.

Conclusions: SCI does not result in increase in IP. Increased MAP in the setting of SCI causes increase in IP, which results in decreased spinal cord perfusion pressure (SCPP). Both elevated MAP and CSFD showed only short-term improvement of SCBF followed by hypoperfusion when implemented independently. The combination of increased MAP and CSFD improves SCBF after SCI.

OUTCOMES AWARD

101. Outcomes After ALIF versus TLIF For Treatment of Symptomatic L5-S1 Spondylolisthesis: A Prospective, Multi-Institutional Comparative Effectiveness Study

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Introduction: Anterior lumbar interbody fusion (ALIF) and transformaminal lumbar interbody fusion (TLIF) procedures achieve lumbar interbody arthrodesis. No recent study has compared improvement in pain and functional disability after both procedures. Whether ALIF or TLIF for treatment of symptomatic L5-S1 spondylolisthesis results in superior post-operative functional outcomes remains unknown. The primary aim of the study was to compare post-operative functional outcomes and complication rates following both surgical approaches.

Methods: A nationwide, multi-institutional, prospective spine outcomes registry was utilized for this study. Enrollment criteria included available demographic, surgical and clinical outcome data. The study included 519 patients with degenerative disc disease or spondylolisthesis at L5-S1; 219 patients underwent ALIF and 300 patients underwent TLIF. Patients completed the Oswestry Disability Index (ODI), MOS Short Form 36 (SF-36), and back and leg pain numerical rating scores before surgery, then at 3, 6, 12, and 24 months after surgery. Clinical outcomes and complication rates were compared between both patient cohorts.

Results: Patients undergoing TLIF experienced higher rates of post-operative complication (ALIF: 12.3%, TLIF: 7.8%, p=0.03); however, the likelihood of visceral/vascular injury was significantly higher in the ALIF cohort (p=0.002). At two years, both ALIF and TLIF patients showed similar 2-year improvement in VAS for back pain (ALIF: 2.96±4.09, TLIF: 2.51±3.73, p=0.15) and leg pain (ALIF: 2.96±4.09, TLIF: 2.75±3.32, p=0.57). ODI (ALIF: 14.63±20.36, TLIF: 14.13±22.45, p=0.79), and SF-36 PCS (ALIF: 6.45±14.15, TLIF: 7.88±17.35, p=0.30) and SF-36 MCS (ALIF: 5.18±20.92, TLIF: 5.24±22.28, p=0.97) were also improved. Notably, patients undergoing ALIF appear to have a more rapid reduction in one-year VAS back and leg pain scores.

Conclusions: For patients with symptomatic L5-S1 spondylolisthesis, ALIF and TLIF have comparable long-term improvement on pain and functional disability. While ALIF was associated with lower post-operative complication rates and more rapid reduction in one-year back pain, leg pain and functional disability, patients undergoing ALIF were more likely to experience intra-operative visceral or vascular injury.

102. Pre-operative Depression, ODI Scores, and EQ-5D Scores are Significant Factors in Patient Satisfaction Following Lumbar Spine Surgery

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Introduction: Objectives of health care reform reducing costs and improving patient outcomes. Of particular interest are spinal surgeries, often performed on chronic back pain patients unresponsive to non-operative care. The patient experience is important and we investigate which factors predict overall patient satisfaction following surgery. The objective of this study is to examine the relationships between patient satisfaction and comorbidities to determine successful candidates for lumbar surgery.

Methods: A total of 96 patients who underwent lumbar spine surgeries at Covenant Medical Center and were included in the National Neurosurgery Quality and Outcomes Database were assessed pre-operatively, and at 3 (96 patients) and 12 months (31 patients) post-operatively using self-assessment tools. The patient’s overall level of satisfaction ODI and EuroQol-5D scores were compiled. Comorbidities including diabetes, smoking, and depression were examined to identify factors predicting patient satisfaction.
post-spinal surgery. Vendors of implants and bone grafts were included as variables.

Results: The frequency of post-operative patient satisfaction was compared to pre-operative comorbidities including depression, smoking, diabetes, obesity (BMI>30), morbid obesity (BMI>40), and vendor of implants and bone grafts. The only comorbidity that was statistically linked with patient satisfaction at 3 months following surgery was depression, with nearly 62% of dissatisfied patients and only 35% of satisfied patients identifying themselves as having “Depression Disorder” pre-operatively. We found that patients having both the EQ-5D and EQ-5D scores showed greater improvements in their scores at 3 months following surgery, with statistically significant correlative relationships. Additionally, ODI scores at 3 months were not significantly different than scores at 12 months, suggesting 3 month ODI scores can predict longer-term patient-reported outcomes.

Conclusions: Pre-operative depression, ODI and EQ-5D scores are significantly associated with patient satisfaction at 3 months post-surgery and patient satisfaction remains stable comparing 3 and 12-month results.

103. Two Year Prospective, Multicenter Analysis of Consecutive Adult Spinal Deformity (ASD) Patients Demonstrates Higher Fusion Grade, Lower Implant Failures and Greater Improvement in SRS-22r Scores for Patients Treated with Recombinant Human Bone Morpho

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Introduction: Theoretical advantages of BMP use include high fusion rates and improved outcomes, however little data exists evaluating fusion grade, complications and health related quality of life (HRQOL) for ASD patients treated with BMP. Purpose: evaluate fusion grade, complications and HRQOL associated with BMP vs. no BMP use in a prospective, multicenter, consecutive ASD cohort, minimum 2 year follow-up.

Methods: Multicenter, prospective analysis of consecutive ASD patients receiving BMP (BMP) or no BMP (NOBMP). Inclusion criteria: ASD, age = 18 years, spinal fusion= 4 levels, complete demographic and radiographic data, and minimum two-year follow up. ASD: scoliosis =20 degrees, sagittal vertical axis =5cm, pelvic tilt =25 degrees, or thoracic kyphosis > 60 degrees. Spine fusion evaluated using Lenke grade, complications noted, baseline and 2 year postoperative HRQOL (SRS-22r, SF-36, ODI) analyzed.

Results: 141 of 189 patients had complete two year data (75% follow-up); mean follow up 35.8 months (range 24.1-47.9). BMP (n=110; mean BMP doses: posterolateral= 2.6mg/level, interbody= 5.3 mg/level) and NOBMP (n=31) had similar preop deformity, baseline HRQOL, and total posterior fusion levels (BMP=11.6, NOBMP=12.9). BMP was older (56 vs. 49 years), had more anteroposterior surgery (25 vs. 6.5%), and fewer pedicle subtraction osteotomy/most cases (0.12 vs. 0.3), than NOBMP, respectively (p<0.05). BMP had more minor complications (61% vs. 29%) and fewer pedicle subtractions (0.12 vs. 0.3), than NOBMP, respectively (p<0.05). BMP had greater HRQOL improvement at 2 year follow up than NOBMP. Research is needed evaluating long term complications and outcomes.

Conclusions: BMP use in ASD, at reported BMP dose/level, demonstrated higher fusion grade, fewer implant failures, similar major complications, and greater HRQOL improvement at 2 year follow up than NOBMP. Research is needed evaluating long term complications and outcomes.

104. Punctured Intervertebral Discs

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Introduction: Open defects compromise the ability of the annulus fibrosus (AF) to contain nuclear tissue in the disc space, and therefore increase the likelihood of rehydration. [1, 2] We evaluated whether high-density collagen (HDC) gel can prevent nuclear tissue extrusion and subsequent degenerative changes to intervertebral discs in a rat tail spine.

Methods: Forty athymic rats were punctured with an 18-gauge needle at C3/4 in the caudal spine. Uncrosslinked high-density collagen (HDC) (n=6) or HDC cross-linked with 0.25mM (n=9), 0.5mM (n=8), or 0.75mM (n=8) Riboflavin (RF) was injected into the puncture defect of 31 rats. Nine rats were punctured and left untreated. 7T MRIs were obtained at 1, 2, 5, 12, and 18 week time points to evaluate NP size and degeneration grade. We developed an algorithm based on T2 Relaxation Time measurements to assess NP size by number of MRI voxels that composed it. Lateral X-rays were taken to measure disc heights. Histological analyses were performed to study degenerative changes, and repair of annular defects. Stress-relaxation and frequency sweep tests measured ability of punctured discs to pressurize and their damping quality.

Results: After 18 weeks, untreated discs showed signs of terminal degenerative changes on MRI, histological sections, and biomechanical tests. No NP tissue remained in the disc space. In contrast, discs treated with 0.5 and 0.75mM cross-linked collagen retained 70% of NP and 80% of disc height with minimal degenerative changes on histological section. Biomechanical tests revealed similar damping and pressurization qualities as in healthy discs. Increased RF concentration significantly correlated with NP size and disc height. On histological section, discs treated with cross-linked collagen showed formation of a fibrous cap which repaired the defect. This fibrous cap was formed from host fibroblasts which infiltrated and reorganized injected collagen gel.

Conclusions: HDC can repair annular defects in rat IVDs and maintain their biomechanical properties.

105. Adjacent Segment Degeneration Incidence Reduced after Total Disc Replacement Compared with Anterior Discectomy and Fusion for Treatment of One and Two Level Cervical Degenerative Disc Disease: 4-Year Results from an FDA IDE Clinical Trial

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Introduction: Maintaining motion at the treated segment to reduce adjacent segment degeneration is a primary reason for the development of recently approved total disc arthroplasty (TDR) devices. Long-term data comparing these devices with ACDF is limited. The purpose of this study is to compare the effect of one and two-level ACDF to one and two-level TDR on the integrity of adjacent segments.

Methods: Patients (575 total; 1 level = 164 TDR, 81 ACDF; 2 level = 225 TDR, 105 ACDF) included in this study were participating in the FDA IDE clinical trial of the Mobi-C Cervical Artificial