Disc Degeneration

P304: Assessment of Lactate Production and Proteoglycans Synthesis by The Intact and Degenerated Intervertebral Disc Cells Under the Influence of Activated Macrophages: In Vitro Study

Liudmila Bardonova1, Evgenii Belykh1, Vadim Byvaltsev1, and Morgan Giers2

1Irkutsk, Russian Federation
2Oregon State University, Corvallis, OR, United States

Introduction: Inflammation is one of the main factors in the development of intervertebral disc (IVD) degeneration. Nevertheless, the cellular mechanisms of the proinflammatory cytokines’ influence on IVD cells remain not fully elucidated. Synthesis of extracellular matrix is an energy-dependent process, which may be affected by the shortage of nutrient supply observed in degenerated IVD. However, the effect of inflammatory mediators on nutrient consumption and metabolic activity of IVD cells is unknown. Using the model of coculture with activated macrophage-like cells, we studied the effects of the inflammatory cytokines on the secretion of glycosaminoglycans (GAG) and production of lactate by the intact and degenerated IVD cells. Material and Methods: Cells obtained from the human annulus fibrosus fibrous ring and the nucleus pulposus (inner core) of intact (Sciencell) and degenerated (Barrow Neurological Institute BioBank) intervertebral discs were used for the experiment. Cells were expanded in monolayer, then trypsinize and resuspend in 1.2% sodium with formation of alginate beads using 102 mM CaCl2. The IVD cells encapsulated in alginate beads (2 × 105 cells/well) were cocultured with or without 60 ng/mL phorbolmyristate acetate-activated macrophage-like THP-1 cells (aTHP-1). Viability, lactate production, glucose consumption and sulfated GAGs (1,9-dimethyl-methylene blue assay) were assessed. The levels of TNF-α, IL-1β, IL-6, IL-8, IL-10, and IL-12p70 were assessed by flow cytometry using microspheres (BD Biosciences, San Jose, CA). Cell morphology in 3D culture was studied using immunocytochemistry: whole beads were fixed and stained with phallolidin for F-actin and DAPI for DNA, and imaged on a laser confocal microscope. All experiments were repeated in triplicate. A main effects ANOVA (analysis of variance) and post hoc Mann-Whitney U tests were performed to compare control and aTHP-1 groups. Results: aTHP cells produced significantly more IL-10, IL-6, IL-1β, and IL-8 (P < .05) compared with control media and nonactivated THP-1 cells. Significant increase of IL-1β, IL-8 levels was observed in all coculture groups compared with controls (P < .05). Proliferative activity (P = .12) and viability (P = .01) of both intact and degenerated annulus fibrosus (AF) and nucleus pulposus (NP) cells significantly decreased in aTHP-1 coculture groups. GAG production was significantly lower in degenerated NP and AF cells when compared with the intact groups, P < .05 for both cell types. Pro-inflammatory cytokines significantly decreased GAG mass/cell in all aTHP-1-coculture groups (pANOVA = 0.003). Significant decrease (P < .05) of lactate production was observed in all aTHP-1-coculture groups of intact and degenerated NP and AF cells compared with control. The imaging study showed smaller cell size and grouping in clusters in the degenerated IVD cells compared with intact. Conclusion: We revealed that pro-inflammatory cytokines have a direct effect on IVD cells in a 3-dimensional culture, reducing the rate of glycolysis, and level of synthetic activity of both intact and degenerated cells of annulus fibrosus and nucleus pulposus, which is an important factor in the progression of IVD degeneration.

P305: Enhanced Recovery Following Interbody Fusion by Transforaminal Endoscopic Techniques

J. N. Alastair Gibson1, Ralf Wagner2, and Bernd Illerhaus3

1Spire Murrayfield Hospital, Edinburgh, UK
2Ligamenta Spine Centre, Frankfurt, Germany
3Elisabeth-Krankenhaus, Recklinghausen, Germany

Introduction: In the past decade, transcervical disc resection and foraminotomy. The foraminotomy approach minimizes damage to the paraspinal muscles and should enhance patient recovery post-surgery. We aimed to evaluate the technical and clinical success of endoscopic disc resection and interbody cage fusion via a transcervical approach. Materials and Methods: Forty patients (mean age 60 ± 10 years, 75 ± 14 kg, 10 males, 30 females) presenting with stenotic symptoms secondary to single-level disc protrusion and degenerative instability (Grade 1 spondylolisthesis) were admitted for surgery. Patients with significant lateral recess in-growth producing a “trefoil” canal were excluded. Median duration of symptoms was 48 months. Surgery was performed in all patients under general anesthesia in the prone position. Transforaminal discectomy removed prolapsed and central disc back to the end-plates. Titanium (Ti6Al4 V) trabecular cages (EndoLIF Oblique cage, joimax GmbH) were then inserted obliquely without graft. The operated level was stabilized further by a percutaneous pedicle screw/rod construct (Percusys joimax, GmbH or similar). Outcomes were collated with hospital stay and re-admission rates compared to those
reported on the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database for patients after posterior lumbar fusion (2005-2010: 1861 and 2011-15: 36,610 patients respectively). Results: Mean surgical time was 128 ± 57 minutes and radiation dose area product 1166 ± 552 GY-cm². There were no intraoperative complications and median hospital stay was 12 hours (range 4-120) compared with ACS-NSQIP of 2.9 ± 1 days. Two cages were inserted at L2/3, 5 at L3/4, 26 at L4/5 and 7 at L5/S1. Most cages were 30 mm × 11 mm × 12 mm size and mean blood loss was 150 mL. Disc height increased with instrumentation from 7.6 ± 1.9 mm to 10.5 ± 1.6 mm anterior, and from 4.9 ± 1.0 to 9.8 ± 1.7 mm posterior (P < .001). Preoperative ODI decreased from 50 ± 17 to 27 ± 20 at 6 months, back pain VAS (0-10) from 7.3 ± 2.2 to 3.3 ± 2.5 (both P < .001) and pain in the most affected leg from 5.9 ± 3.5 to 3.7 ± 3.0 (P < .01). One readmission for cage displacement at 4 months (2.5%) compared with a rate of 5.4% within 30 days on the ACS-NSQIP. Conclusion: Our results indicate that endoscopic interbody fusion via a transforaminal approach is safe and effective. Mean hospital stay was significantly less than that reported for other fusion methods. Randomized studies are still required to determine whether instrumentation and fusion are required over and above transforaminal endoscopic decompression alone.

**P306: Size Does Not Matter: Correlating Disc Size With Disability and Leg Pain**

Sohail Nisar¹, Peter Loughenbury¹, and Robert Dunsmuir¹

¹Leeds General Infirmary, Leeds, UK

Introduction: The size of the herniated disc is commonly mentioned as a factor when deciding if a patient requires surgical intervention. Various studies have suggested the size of the herniated disc should be considered when deciding between operative or conservative management. However, to our knowledge, there are no published studies correlating the size of the herniated disc with severity of symptoms using visual analogue scale (VAS) or Oswestry Disability Index (ODI) scores. Material and Methods: Data was collected prospectively. Patients were asked to complete VAS and ODI scores on the day of surgery. All patient with primary disc herniation were included. Exclusion criteria included recurrent disc herniation or any other associated spinal pathology, for example, fracture, scoliosis, and infection. T2-weighted MRI (magnetic resonance imaging) scans were reviewed on PACS software by the authors. The axial image showing the largest disc protrusion was used for measurements. The size of the disc and canal were measured. The VAS Leg score and ODI score were correlated with the size of the disc using the Pearson correlation coefficient. Interobserver and Intraobserver reliability was assessed using the interclass correlation coefficient (ICC). Results: Forty patients were included in the study. Ages ranged from 20 to 72 years, with an average age of 42 years. A high degree of interobserver reliability was found. The single measure ICC was 0.85 (95% confidence interval [CI] 0.51-0.96 [F = [9.9] = 12.4, P < .001]). A high degree of intraobserver reliability was observed. The single measure ICC was 0.81 (95% CI 0.42-0.95 [F = [9.9] = 9.8, P = .001]).

Conclusion: There were no statistically significant differences between the groups regarding the progression of the ADD and the post-traumatic deformity, but both progressed during the 2-year follow-up. Conclusion: It was concluded that the removal of the synthesis material was not effective in preventing these complications after surgical fusions of the thoracolumbar spine.

**P307: Adjacent Level Degeneration and Post-Traumatic Deformity After Thoracolumbar Fractures**

Marcel Luiz Benato¹, Pedro Grein del Santoro¹, Alyson Laroca Kulcheski¹, Andre Sebben¹, and Xavier Soler I Graells¹

¹Hospital do Trabalhador, Curitiba, Brazil

Introduction: To evaluate thoracolumbar fractures and the complications such as adjacent disc degeneration (ADD) and posttraumatic deformity. Methods: We evaluated 32 patients divided into 2 equal groups, 16 in the case group (removal of the synthesis material), and 16 in the control group (not submitted to removal of the synthesis material), in order to verify if there was difference between the incidence of these complications. Results: There were no statistically significant differences between the groups regarding the progression of the ADD and the post-traumatic deformity, but both progressed during the 2-year follow-up. Conclusion: It was concluded that the removal of the synthesis material was not effective in preventing these complications after surgical fusions of the thoracolumbar spine.

**P308: Basal and Cytokine-Stimulated Biomarker Production by Degenerative Lumbar Discs From Microdiscectomy Versus Interbody Fusion Patients**

Chaityaprak Pundee¹, Naomi N. Lee¹, Jacob S. Kramer¹, Aaron M. Stoker¹, Christina L. Goldstein¹, Don K. Moore¹, Theodore J Choma¹, and James L. Cook¹

¹University of Missouri, Columbia, MO, USA

Introduction: Intervertebral disc (IVD) degeneration is implicated in back pain, a leading cause of a spine-related disability.