J.A.N.E. Award Presentation
100 Predictors of the Best Outcomes Following Minimally Invasive Surgery for Grade 1 Lumbar Spondylolisthesis
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Introduction: The factors driving the best outcomes following minimally invasive surgery (MIS) for grade 1 lumbar spondylolisthesis are not clearly elucidated. This study investigates the factors that drive the best 24-month patient reported outcomes (PRO) following MIS lumbar spondylolisthesis surgery.

Methods: 310 patients from the Quality Outcomes Database (QOD) Lumbar Spondylolisthesis Module underwent surgery for degenerative grade 1 lumbar spondylolisthesis utilizing MIS techniques. Surgeries were classified as MIS if any of the following were involved: MIS laminectomy, MIS pedicle screws, MIS interbody grafts, or percutaneous screws. Baseline and 24-month follow-up parameters were collected. PROs included the Oswestry Disability Index (ODI), numeric rating scale (NRS) Back Pain, NRS Leg Pain, EuroQoL-5D (EQ-5D) Questionnaire, and North American Spine Society (NASS) Satisfaction Questionnaire. Multivariate models were constructed.

Results: The cohort included 233 (75.2%) fusions and 77 (24.8%) decompression only procedures. The mean age was 64.0±11.3 years. The cohort demonstrated significant improvement in ODI, NRS back pain, NRS leg pain, and EQ-5D at 24 months (p<0.001, all comparisons relative to baseline). In multivariate analyses, aside from baseline PRO values, only three factors were significantly associated with multiple PRO change scores: employment, independent ambulation at presentation, and the addition of fusion to surgery. Employment was associated with superior postoperative ODI (OR=0.002;95%CI[0.0002-0.28];p=0.01), NRS back pain (OR=0.39;95%CI [0.19-0.78];p=0.008), and NASS satisfaction (OR=0.36;95%CI[0.18-0.68];p=0.002). Independent ambulation was associated with superior NRS leg pain (OR=0.34;95%CI[0.12-0.91];p=0.03) and EQ-5D (OR=1.11;95%CI[1.04-1.18];p<0.001). The addition of a fusion was associated with superior NRS back pain (OR=0.41;95%CI [0.17-0.93];p=0.03) and NASS satisfaction (OR=0.35;95%CI[0.17-0.73];p=0.005). Education was also associated with superior outcomes for a single outcome, ODI (OR=0.002;95%CI[0.0002-0.13];p=0.004).

Conclusion: Multiple factors influence outcomes following lumbar spondylolisthesis surgery. For MIS, preoperative active employment, higher education, independent ambulation at presentation, and fusion surgery were significant predictors of superior outcomes across the domains of disability, back pain, leg pain, quality of life, and satisfaction.

Mayfield Basic Science Award Presentation
101 Transplantation of Neural Precursors Derived from Spinal Progenitor Cells Improves Functional Recovery from Spinal Cord Injury by Reduced Inflammation via Inhibition of the Nuclear Factor Kappa-B Pathway in a Rat Model of Spinal Cord Injury
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Introduction: Traumatic spinal cord injury (SCI) triggers a chain of events that hinders recovery characterized by an inflammatory cascade leading to necrotic cell death at the core injury site with astrogliosis and apoptotic cell death in surrounding areas. Activation of the nuclear factor-kappa-B (NF-kB) signaling pathway is associated with inflammation in SCI. Here, we elucidate the activation pattern of NF-kB in SCI while investigating the effect of transplantation of spinal neural precursors (SPC-01) on its activity, related astrogliosis, and functional recovery in a rat model.

Methods: Using a balloon compression rat model of SCI, injury was induced at T8 and SPC-01 cells or saline was injected into the lesion 7-days post-injury. Rats were followed for functional recovery (Basso, Beattie, Bresnahan BBB, Rotarod, Plantar Thermal Noceiception, and Flat Beam tests) and sacrificed to retrieve spinal cord sections at multiple time points. The course of SPC-01 cells was determined by immunofluorescence response to stem cell and neuronal markers. NF-kB activity, phosphorylated-p65, secretory levels of cytokines (e.g. TNF-alpha), extent of glial scaring, white and gray matter preservation, and cavity size were determined.
Results: Functional recovery was enhanced in SPC-01-treated rats as confirmed by BBB score. A bimodal activation pattern of the NF-kB signaling pathway was seen, with peaks at 3- and 28-days. Transplantation of SPC-01 cells resulted in significant downregulation of TNF-alpha at 10- and 14-days and inhibition of NF-kB activity at 28 days after SCI, mainly in gray matter. Transplanted rats exhibited gray matter preservation and reduced glial scar and cavity size.

Conclusion: We demonstrate immunomodulatory properties of SPC-01 cells based on inhibition of the canonical NF-kB pathway. This effect occurs prior to maturation of SPC-01 cells, implying that the observed results are due to paracrine mechanisms rather than cell replacement. Reduced inflammation may result in tissue sparing, reduced glial scar, and improved functional recovery.

Mayfield Clinical Science Award Presentation

102 Fusion and Opioid-sparing with the Use of Ketorolac in Posterior Thoracolumbar Spinal Fusions: A Prospective Double-blinded Randomized Placebo-Controlled Trial

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Introduction: Use of Ketorolac in spinal fusion is limited due to the risk of pseudarthrosis. Recent literature suggested that such an effect could be type- and dose-related. We sought to demonstrate that Ketorolac use was safe with significant opioid-sparing effect and non-inferior fusion rate.

Methods: This is a prospective, double-blinded, randomized placebo-controlled trial designed according to the 2013 SPIRIT Guidelines. It is a two-arm parallel design with a 1:1 randomization. Over a two-year period under 6 surgeons at two sites, consecutive patients who underwent elective 1-3 level minimally invasive thoracolumbar fusion were screened for inclusion/exclusion. Patients with fusion confounders were excluded. A centralized treatment allocation mechanism and Excel-generated block randomization were used. Patients received a 48-hour scheduled treatment of intravenous Ketorolac (15mg IV Q6H) or saline. We implemented a standardized analgesia regimen using a standardized order set. The primary outcome was fusion rate as evaluated XR/CT using the Suk criteria at 6/12 months. Univariate analysis was used by a blinded neuroradiologist. T

Results: Sixty-nine patients were analyzed. Patient characteristics and operative data were comparable between the groups except EBL (Tables 1&2). No significant difference in fusion was found at 6-month (Table 3). There was a significant reduction in total/48-hour MME and length of stay for the Ketorolac group (Table 4). The only complication was a superficial hematoma in a ketorolac-assigned patient requiring evacuation.

Conclusion: Ketorolac demonstrated safety, a significant reduction in postoperative opioid use and length of stay when used as part of a multi-modal analgesics regimen after thoracolumbar fusion.

103 Long Term Costs of Maximum Non-Operative Treatments in Patients with Symptomatic Lumbar Stenosis or Spondylolisthesis that Ultimately Required Surgery: A Five Year Costs Analysis

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Introduction: The costs and utilization of long-term maximal non-operative therapy (MNT) can be substantial, and in the current era of bundled payments, the duration of conservative therapy trials should be reassessed. The purpose of this study is to characterize the utilization and costs of MNTs prior to spinal fusion surgery in patients with symptomatic lumbar stenosis or spondylolisthesis.

Methods: A large insurance database was queried for patients with symptomatic lumbar stenosis or spondylolisthesis undergoing index lumbar decompression and fusion procedures between 2007 and 2016. This database consists of 20.9 million covered lives and includes private/commercially insured and Medicare Advantage beneficiaries. Only patients with lumbar stenosis or spondylolisthesis and those continuously active within the insurance system for at least 5 years prior to the index operation were eligible.

Results: A total of 4,133 out of 497,822 (0.8%) eligible patients underwent 1, 2, or 3-level posterior lumbar instrumented fusion. 20.8% of patients were smokers, 44.5% had type II DM, and 38.2% were obese (BMI > 30 kg/m2). Patient maximal non-operative therapy (MNT) utilization was as follows: 66.7% used NSAIDs, 84.4% used opioids, 58.6% used muscle relaxants, 65.5% received LESI, 66.6% attended 21.1% presented to the ED, and 24.9% received chiropractic treatments. The total direct cost associated with all MNT prior to index spinal fusion was $9,000,968; LESI comprised the largest portion of the total cost of MNT ($4,094,646, 45.5%), followed by NSAIDS ($1,624,217, 18.0%) and opioid costs ($1,279,219, 14.2%). At the patient level, an average of $4,010 per patient utilizing therapy was spent on MNT prior to index lumbar surgery.