100. Geriatric Co-Management Reduces Peri-Operative Complications and Shortens Duration of Hospital Stay After Lumbar Spine Surgery: A Prospective Single Institutional Experience

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Introduction: Geriatric patients undergoing lumbar spine surgery are at risk for adverse outcomes, such as delirium, and in turn, contribute to the risk of functional decline, nursing home admission, and death. Whether pre- and peri-operative geriatric co-care reduces the incidence of in-hospital complications and length of stay after elective lumbar spine surgery remains unknown.

Methods: A unique model of shared-care for elderly patients undergoing lumbar fusion surgery was implemented at a major academic medical center. The Peri-operative Optimization of Senior Health Program (POSH) was launched with the aim of improving outcomes in elderly patients (>65 years-old) undergoing lumbar spine surgery. In this model, a geriatrician evaluates elderly patients prior to admission, and follows them daily throughout the course of their hospital stay to manage medical complications and coordinate multidisciplinary rehabilitation, with neurosurgical input. We retrospectively review the first 100 cases after the initiation of the POSH-protocol and compared them with the immediately preceding 25 cases to assess the incidence of peri-operative complications and clinical outcomes.

Results: One hundred and twenty-five patients undergoing lumbar decompression and fusion were enrolled in this study. Baseline characteristics were similar between both cohorts. The length of in-hospital stay was 30% lower in the POSH cohort (6.13 vs. 8.72 days, p=0.04). Compared to the non-POSH cohort, the number of steps ambulated on day of discharge was 2-fold higher (1.57 days vs. 2.77 days, p=0.02); and the mobilization was significantly shorter in POSH-cohort compared to the non-POSH cohort (30% lower in the POSH cohort (6.13 vs. 8.72 days). There was a significant correlation between preoperative mJOA and lMC FA (P=0.048). There were no significant correlations between preop mJOA and presence of T2SI. With regards to delta mJOA, significant relationships were discovered with LMC FA at 12 months (p < 0.05); on the contrary, there were no significant relationships associated with NT2SI or presence of T2SI. Combining NT2SI or presence of T2SI to LMC FA in multivariate linear regression analysis also did not improve the predictive value significantly, compared to using LMC FA alone.

Conclusion: In this larger retrospective study of CSM patients, FA at LMC shows to be a better biomarker for determining the disease severity, and both short and long term outcomes compared to T2SI at LMC. Moreover, combined FA and T2SI did not have superiority compared to FA alone in these subgroup of patients.
(hazard ratio, 0.86; 95% confidence interval, 0.44 to 1.68; P=0.66). Postoperative opioid requirements were reduced with intrathecal morphine (P<0.03). Other than a trend towards increased intermittent catheterization in patients assigned to intrathecal morphine (P=0.09), treatment-related side effects did not significantly differ between the groups. The early benefits of intrathecal morphine on postoperative pain were no longer apparent after 48 hours.

**Conclusion:** A single intrathecal injection of 0.2 mg of morphine safely reduces postoperative pain following lumbar fusion. (Funded by the Alberta Spine Foundation; ClinicalTrials.gov number, NCT01053039)

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**Kline Peripheral Nerve Award Presentation**

103. Prediction Algorithm for Surgical Intervention in Neonatal Brachial Plexus Palsy

**Thomas J. Wilson, MD; Kate Chang, Lynda Jun-San Yang, MD, PhD**

**Introduction:** Neonatal brachial plexus palsy (NBPP) results in reduced function of the affected arm with profound ramifications on quality of life. Advances in surgical technique have shown improvements in outcomes for appropriately selected patients. Patient selection, however, remains difficult. Our objective was to develop a decision algorithm that could be applied at the individual patient level, early in life, to reliably predict persistent NBPP that would benefit from surgery.

**Methods:** Retrospective review of NBPP patients was undertaken. Maternal and neonatal factors were entered into the C5.0 statistical package in R. A 60/40 model was employed, whereby 60% of randomized data were used to train the decision tree, while the remaining 40% were used to test the decision tree. The outcome of interest for the decision tree was a severe lesion meeting requirements for surgical candidacy.

**Results:** A decision tree prediction algorithm was generated from the entered variables (Figure 1). Variables utilized in the final decision tree included presence of Horner’s syndrome, presence of a pseudomeningocele, Narakas grade, clavicle fracture at birth, birth weight >9 lbs., and induction or augmentation of labor. Sensitivity of the decision tree was 0.71, specificity 0.96, positive predictive value 0.94, negative predictive value 0.79, and F1 score 0.81.

**Conclusion:** We developed a decision tree prediction algorithm that can be applied shortly after birth to determine surgical candidacy of patients with NBPP, the first of its kind utilizing only maternal and neonatal factors. This conservative decision tree can be used to offer early surgical intervention for appropriate candidates.

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**Charles Kuntz Scholar Award Presentations (Abstracts 104–123)**

104. Minimally Effective Dose of Bone Morphogenetic Protein (BMP) in Minimally Invasive (MIS) Lumbar Interbody Fusions 757 Patients in a Dose-finding Statistical Modeling Cohort Study

**Evan Joseph Lytle, DO; Doris Tang, MD; Lisa Govila; Roger F. Gonda, MD; John Nofar, BA; Clifford Michael Housman, DO; Teck-Mun Soo, MD**

**Introduction:** With increasing doses of BMP, the risk of adverse events increases. We seek to demonstrate the minimal effective BMP dose to achieve a fusion in MIS.

**Methods:** From 2009-2014, we reviewed the charts of consecutive patients who underwent MIS lumbar Interbody fusion in a longitudinal cohort study. We excluded patients without radiographic (XR) follow up =3m postop. Dose of BMP/interspace was determined. Fusion was determined by XR evaluated by neuroradiologists. A pilot study was performed to determine the baseline fusion rate in our local population for a sample size with a=0.05 and power=0.8. We used multiple logistic regression with fusion =3m and =6m as the dependent variable and BMP dose per interspace, single vs. multi-level, specific level, postop XR interval, smoking, gender, age as covariates. We satisfied the assumption tests and Wald test was used. The Exp(β) coefficient was used to show change in the odds of fusion for one-unit change in an independent variable when all other independent variables are kept constant. Minimally effective dose of BMP/level was determined by 95% CI between different dose ranges. We considered a p-value of 0.0125 to compensate for multiple comparisons.

**Results:** There were 858 interspaces among 757 unique patient encounters (Table 1). Average dose was 1.08mg/level (Table 2). Gender, dose/level, and single vs. multi-level fusion were significant predictors for fusion =3m postop (Table 3). Dose/level and Single vs. multi-level fusion were significant predictors for fusion =6m postop (Table 4). Overall fusion rate =3m postop was 93.8% (95% CI 0.92-0.95) (Table 5) vs. 93.9% (95% CI 0.92-0.95) (Table 6) at =6m postop.

**Conclusion:** BMP dose/level and single vs. multi-level fusion were significant predictors for fusion =6m postoperatively. We found that the effective fusion rate of 91% (95%CI: 0.87-0.95) was achieved at dose less than 1.05mg (size of XXS) per level.

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105. Vitamin D in Multi-level Anterior Cervical Fusion: Interim Results from a Multi-Center Comparative Effectiveness Study

**Daniel Drazin, MD, MA; Christine Piper; Zachary Rolls Barnard, MD; Lorenzo Rinaldo, MD, PhD; Alexandre Rasoudi, MD; Mohamad Byalon, MD; William E. Krauss, MD; Michelle J. Clarke, MD; Joseph R. O’Brien, MD, MPH; Warren Yu; Edward K. Nomoto, MD; Daniel Norvell; Ray M. Chu, MD; Robert S. Pashman, MD; Eli M. Baron, MD; Terrence T. Kim, MD; J Patrick Johnson, MD, MS**

**Introduction:** Vitamin D deficiency is common in patients presenting for spinal surgery. It has been unclear whether this abnormality affects spinal fusion outcomes.

**Methods:** In a multi-center prospective comparative effectiveness study, we assessed vitamin D levels in patients undergoing multi-level anterior cervical discectomy and fusion. Exclusion criteria included previous cervical spine surgery, posterior approach and bone morphogenetic protein product use. The primary outcome measure was vitamin D level. Participants were classified into two groups based on CDC criteria: normal (>30ng/mL) or subnormal (<29.9ng/mL) level, determined by vitamin D (serum 25-OHD) test. The primary outcome measure was vitamin D level. Participants were classified into two groups based on CDC criteria: normal (>30ng/mL) or subnormal (<29.9ng/mL) level, determined by vitamin D (serum 25-OHD) test. The primary outcome measure was vitamin D level.

**Results:** There were 95 patients enrolled, 42 have had complete follow-up. There were no significant differences in baseline or operative characteristics between the groups. A greater proportion of patients with vitamin D deficiency underwent revision (86%) compared to those with normal levels (17%). This was statistically significant (p=0.007). Mean vitamin D level of revision patients was 25.3 ± 9.0 compared to 35.7 ± 15.5 for non-revision patients. This was statistically significant (p=0.04). There was no statistically significant association between age, BMI, gender, length of stay, or surgical level and the risk for revision. In patients with spondylolisthesis as their primary diagnosis, the revision risk was 50% (n=6) compared to 13% (n=4) for non-spondylolisthesis patients. All 12 revisions occurred in non-smokers. In a multivariable logistic regression model, patients with normal vitamin D levels were at lower odds of undergoing revision. This was statistically significant (odd ratio: 0.4, 95% confidence interval: [0.04, 0.94]).