The Predictive Potential of Nutritional and Metabolic Burden: Development of a Novel Validated Metric Predicting Increased Post-Operative Complications in Adult Spinal Deformity Surgery

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INTRODUCTION:

Endocrine and metabolic disease burden has been previously identified to significantly influence patient outcomes, and may play a significant role in predicting increased peri and post-operative complications. Such effects have not been well studied in adult spinal deformity (ASD) surgery.

METHODS: ASD patients ≥ 18 years with baseline (BL) and two-year (2Y) data were included. An internally cross-validated weighted equation using pre-operative laboratory and comorbidity data correlating to peri-operative complications was developed via backstep logistic regression. BMI categorization (normal, over/underweight, obese) was established per USA CDC guidelines. Diabetes classification (normal, prediabetic, diabetic) was stratified per 2010 American Diabetes Associates (ADA) cutoffs. A novel spine surgery-specific metabolic burden score was calculated via Beta-Sullivan adjustment, and Conditional Inference Tree (CIT) determined score threshold for experiencing ≥1 complication. Cohorts were ranked into halves for comparison (LOW vs HIGH). Linear regression assessed correlations between increasing burden score and complications. Means comparison analysis assessed groups differences in BL and post-operative factors.

RESULTS: 201 ASD patients were included (mean age: 58.60±15.4, sex: 48% female, BMI: 29.95±14.31, CCI: 3.75±2.40). Significant demographic, nutritional and metabolic factors were determined to be: age (+1/year), hypertension (+18), peripheral vascular disease (+37), smoking status (+21), anemia (+1), VitD hydroxyl (+1 per ng/mL), hemoglobin (+1 per g/dL), BMI categorization (+13/cat), and diabetes categorization (+4/cat) correlating to occurrence of post-operative complications (model: p<.001). CIT determined scores above 175 correlated with ≥ 1 post-op complication (p<.001). At baseline, LOW patients were more likely to be younger (p=.002), have less total comorbidities (both p<.001), and report lower SF-36 Physical Role scores (p=.037), though groups did not differ by regional or global deformity (p>.05). Surgically, HIGH patients had greater higher ASA grades (p=.021), and were more likely to require PSO (p=.031). Post-operatively, HIGH patients reported significantly worse SF-36 Physical Functioning scores by 2Y (p=.042) than their LOW counterparts. Furthermore, HIGH patients reported higher rates of post-operative cardiac complications (p=.045), and were more likely to require reoperation (p=.024) compared to LOW patients.

DISCUSSION AND CONCLUSION: Nutritional and metabolic related factors play a tremendous impact on the peri- and post-operative course of adult spinal deformity patients undergoing corrective surgery, speaking potentially to a diminished physiology reserve and resilience. Development of a validated novel nutritional and metabolic burden score demonstrated that patients with higher scores are at greater risk of increased post-operative complications and course. As such, surgeons should consider reduction of nutritional and metabolic burden pre-operatively to enhance outcomes and reduce complications in ASD patients.

Variable	Point Values (per unit/cat)
Age (years)	1
BL Hypertension (y/n)	18
BL Peripheral Vascular Disease (y/n)	37
BL Smoker (y/n)	21
BL Anemia (y/n)	1
BL VitD Hydroxy (per ng/mL)	1
BL Hgb (per g/dL)	4
BMI Categorical Increase (0 = Healthy Weight, 1=Over/Underweight, 2=Obese)	13
Diabetes Cat (0=No diabetes or A1C <5.7%, 1=Prediabetic and A1C 5.7-6.5%, 2 = Diabetic and A1C > 6.5%	4
Total	100