Risk Factors for Postoperative Complications after Surgical Correction of Craniosynostosis: A Nationwide Analysis of 1357 Intracranial Procedures

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INTRODUCTION: In pediatric craniofacial surgery, accurate risk factor identification is essential for preoperative risk stratification, informed consent, and targeted initiatives to reduce complications and increase perioperative patient safety. To date, our understanding of risk factors for complications after craniosynostosis reconstruction has been limited by small sample size, nonstandard definitions, and/or single-center retrospective data. The objective of this study is to use a large prospective national database to analyze clinical risk factors associated with complications following craniosynostosis reconstruction.

METHODS & MATERIALS: The American College of Surgeons National Surgical Quality Improvement Program-Pediatric (NSQIP-Peds) is a quality improvement registry that collects data on perioperative risk factors and 30-day outcomes from 56 pediatric institutions. Craniosynostosis reconstruction procedures were extracted from the NSQIP-Peds 2012 and 2013 databases by CPT code. The primary outcomes of interest were 30-day postoperative complications. Multivariate logistic regression models were used to examine risk-adjusted predictors of adverse 30-day postoperative outcomes.

RESULTS: 1357 patients underwent surgical correction of craniosynostosis: 1251 (92%) with nonsyndromic craniosynostosis and 106 (8%) with syndromic craniosynostosis. Median age at surgery was 8 months, and 65% were male. Neurological, pulmonary, nutritional, hematological, and cardiac comorbidities were present in 46%, 9%, 4%, 2%, and 1% of patients, respectively. Multiple comorbidities (≥2) were present in 177 (13%) patients. The overall 30-day complication rate was 9.4%, with postoperative bleeding (3.5%, 47 patients) and wound complications (1.4%, 20 patients) most prevalent. Wound complications included 8 superficial surgical site infections (SSIs), 2 deep SSIs, 4 organ space SSIs, and 6 dehiscences. Reintubation (7 patients, 0.5%), venous thrombosis requiring therapy (4 patients, 0.3%), and intracranial hemorrhage (4 patients, 0.3%) were other notable complications. The unplanned readmission rate was 3%, and the unplanned reoperation rate was 2.1%. Independent risk factors for complications included cardiac disease ($p<0.01$), nutritional deficiency ($p<0.01$), increasing ASA class ($p=0.01$), and syndromic craniosynostosis ($p=0.01$). Total operative time was significantly longer in patients experiencing complications (245 minutes) compared to those without complications (197 minutes) ($p=0.01$).

CONCLUSION: This study utilized data from a large prospective multicenter registry to provide a high level of evidence regarding risk factors for perioperative complications after surgical correction of craniosynostosis. These data may aid in preoperative risk stratification, patient counseling, and the development of targeted quality improvement initiatives to minimize complication occurrence.