do not show a significant decrease in BMI with at least three-fourths of both male and female patients remaining overweight or obese.

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CRANIOMAXILLOFACIAL/HEAD & NECK SESSION 5

Outcomes and Complications of Cranioplasty in the Pediatric Population: A Systematic Review

*Presenter: Amjed Abu-Ghname, MD*

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**BACKGROUND:** Pediatric calvarial reconstruction is challenging given the unique anatomical and growth considerations in this population. Successful cranioplasty reconstruction using autologous and alloplastic materials have been reported, but a head-to-head comparison in outcomes is lacking. The purpose of this study is to address the knowledge gap in cranioplasty outcomes using currently available materials.

**METHODS:** A systematic review was performed using the guidelines outlined in the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA). The electronic literature search included Medline/Pubmed, Scopus and Cochrane Databases to identify papers on pediatric cranioplasty from January 1990 to December 2017. Only pediatric cranioplasty studies with a minimum of 1 year follow up with reported surgical site occurrences and cranioplasty outcomes were included. Surgical site occurrences (SSO) and infections (SSI) data among the different materials were abstracted. Outcome data comparing fresh bone grafts, banked bone flaps, Titanium Mesh (Ti), Polymethyl Methacrylate (PMMA), Polyether Ether Ketone (PEEK), and Hydroxyapatite (HA) were analyzed. Surgical site occurrences included seromas, hematomas, wound dehiscences, skin or flap necrosis, surgical site infections, and bone flap resorptions.

**RESULTS:** A total of 27 studies met the inclusion criteria, encompassing 755 pediatric patients. There were 343 patients that underwent autologous cranioplasty (149 fresh bone grafts and 194 banked bone flaps). Alloplastic reconstruction was performed in 412 patients (211 HA, 110 PMMA, 60 Ti, and 31 PEEK). The mean age ranged from 2.9 to 17.4 years and the follow up time averaged 1 to 10 years. Of all materials evaluated, fresh bone grafts and Ti mesh were associated with the lowest surgical site infections (0.7% and 3.3% respectively; p \(<0.0005\)) and graft failures requiring reoperation (4%, and 3.3% respectively; p \(<0.0001\)). The lowest surgical site occurrence rates were associated with Ti mesh and HA (6.7%, and 9% respectively; p \(<0.0001\)). Banked bone flaps had the highest rates of surgical site occurrences (51%; p \(<0.0001\)) and graft failures (40.2%; p \(<0.0001\)). PEEK implants had the highest rates of surgical site infections (16.1%; p \(<0.0005\)). Graft failure rates for PEEK, PMMA, and HA implants were 19.3%, 16.4%, and 7.1% respectively. Fresh bone grafts had lower rate of resorption (7.4%) compared to banked bone flaps (39.7%; p \(<0.0001\)).

**CONCLUSION:** Based on the available studies reviewed, fresh bone graft reconstruction and titanium mesh demonstrated the lowest surgical site infections and graft failure rates. Banked bone flaps demonstrated the highest overall surgical site occurrences and graft failures. Prospective studies evaluating the efficacy of current cranioplasty materials in the pediatric population are needed.

Patient-Specific Implants for Cranioplasty: Is There an Ideal Implant?

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**INTRODUCTION:** While the ideal synthetic material for cranioplasty remains elusive, the use of prefabricated alloplastic implants has many proposed advantages. Custom implants that fit a patient’s specific defect can reduce operative time and improve contour. Polymethyl-methacrylate (PMMA) has a long history of use for large cranioplasty defects. However, advances in 3D printing have led to an increased popularity of polymer alloplastic materials such as polyether-ketone-ketone (PEKK) implants. No direct comparisons of PMMA and PEKK exist in the literature. We present a retrospective analysis of PMMA and PEKK patient-specific implants at a single institution.

**METHODS:** A retrospective chart review was performed identifying patients undergoing patient-specific implant (PSI) cranioplasty at Northwestern Memorial Hospital between January 2013 and July 2017. Medical records were reviewed for patient characteristics, indications, surgical details, implant type, and post-operative complications. Patients were divided into groups based on cranioplasty type (PMMA vs PEKK). Comparisons between groups were made using the student’s t test and Fisher exact test.

**RESULTS:** 74 patients underwent PSI cranioplasty during the study period. Thirty-five (47.3%) had PMMA implants and 39 (52.7%) had PEEK implants. Patients were 51% male with an average age of 44. There were no differences between groups except for follow up length (17 months vs 7 months, p=0.002). Plastic surgery involvement was more common in patients with a history of infectious complications (46% v 26%). The overall failure rate for PSI cranioplasty was 14.3%. There was no difference in failure rate when comparing PMMA to PEKK (14.7% vs 13.9%, p>0.05). There was no significant difference in complications between PMMA and PEKK (41.0% vs 34.3%, P>0.05). Infection rates were equivalent between groups (17.1% vs 16.7%). Delayed wound healing was also equivalent (8.8% vs 13.9%, p>0.05). When reviewing the 10 failures, 7 occurred in patients with prior infection, 5 in patients with a history of radiation, and 3 with both.

**CONCLUSION:** PMMA and PEKK have similar complication profiles for patient-specific implant cranioplasty. Complication rates remain high for both materials, with wound healing and infectious complications and radiation carrying high risk of implant failure.

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**Purpose:** Correction of craniosynostosis has been well-established to be safe and to have sustainable results in infants. Timing of surgery, however, has remained variable based on surgical training and professional biases. This study sought to evaluate the impact of surgical timing on craniosynostosis management utilizing data from the National Surgical Quality Improvement Program (Pediatric NSQIP).

**METHODS AND MATERIALS:** All available Pediatric NSQIP data through 2016 was acquired and cranioplasty cases were selected using current procedural terminology (CPT) codes 61550, 61552, 61556, 61557, 61558, 61559 and 21175. Cases were split by patient age into four-month age intervals: 0 to <4 months, 4 to <8 months, 8 to <12 months, and 12+ months. Perioperative variables were compared between age groups, including comorbidities, total length of stay (LOS), operative time, American Society of Anesthesiologists (ASA) physical status classification, thirty-day readmissions, thirty-day reoperations, and wound infection rate. Data was analyzed in JMP statistical software (SAS Institute, Cary, NC).

**EXPERIENCE:** A total of 3,926 patients were segregated into age groups based on four-month age intervals.

**RESULTS:** There were significant differences between the age groups by ASA class (p<0.0001) and wound class (p<0.0001). A greater percentage of patients younger than 4 months were ASA class I (24.37%) compared to patients who were older than 12 months (8.92%). Conversely, a greater percentage of patients older than 12 months were ASA classes III and IV (37.38%) compared to patients younger than 4 months (20.90%). The operative time varied significantly by age group (p<0.0001 by chi-square); patients younger than 4 months had a mean operative time of 96.6 minutes, and patients older than 12 months had a mean operative time of 259.7 minutes. The length of stay also varied significantly by age group (p<0.0001). The four age groups had significantly different rates of post-operative