METHODS: Lifetime radiation exposure associated with specific pediatric craniofacial diagnoses was calculated using standard imaging pathways for these diagnoses and the radiation effective doses (ED) for relevant CT protocols. Eligibility for pediatric protocols is determined by patient size rather than by age. Lifetime risks of radiation-induced cancer incidence (RICI) and fatality (RICF) were calculated using methodology from the Biologic Effect of Ionizing Radiation VII report and are expressed as cases or fatalities/100,000 persons.

RESULTS: A majority of patients evaluated for craniosynostosis repair receive a preoperative cranial protocol CT; some may also receive a postoperative scan. Two-scan protocols give the diagnosis of craniosynostosis a lifetime radiation ED of 1.8 mSv, with a statistical lifetime risk of RICI of 14.7 and RICF of 7.4/100,000 persons. Similarly, pediatric and adult patients with craniofacial trauma undergo a preoperative CT maxillofacial protocol for diagnosis and operative planning, but some additionally undergo a postoperative CT to check reduction and plate placement. Two scans expose patients with craniofacial trauma to a lifetime ED of 0.34 mSv (pediatric) or 1.4 mSv (adults). This exposure is associated with a lifetime risk of RICI of 2.7 and 11.4/100,000 persons and a lifetime risk of RICF of 1.4 and 5.7/100,000 persons in pediatric and adult patients, respectively. In both craniosynostosis and trauma scenarios, lifetime cancer risk is dose-dependently halved by omitting postoperative scans. Further risk may be avoided for conditions with practice patterns that vary by more than 1 scan. For example, a majority of patients with micrognathia presenting for mandibular distraction undergo a preoperative CT. Some patients may also undergo two additional CTs after distractor placement: immediately postoperatively and before distractor removal. Therefore, the lifetime radiation ED associated with micrognathia diagnosis is 2.8 mSv for a 3-scan pathway and 0.9 mSv for 1 scan. Adopting a preoperative-only imaging protocol avoids an additional lifetime risk of RICI of 14.7 and RICF of 7.4/100,000 persons.

CONCLUSIONS: CT scans are often critical for craniofacial operative planning. However, plastic surgeons have not yet adopted a standard of care for craniofacial imaging, which has a dose-dependent oncologic risk that is particularly relevant considering that many surgeons may obtain multiple images when managing these conditions. This is the first study to quantify oncologic risk associated with different imaging pathways for specific craniofacial diagnoses. We encourage open relative risk and benefit discussions with patients and families, as well as critical assessment of the need for routine postoperative scans obtained outside the context of approved research protocols.

Novel Surgical Treatment Algorithm for the Treatment of Temporomandibular Joint Disease

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BACKGROUND/PURPOSE: The treatment of temporomandibular joint (TMJ) disease is highly variable, from nonsurgical management to salvage procedures like joint replacement. Long-term outcomes data are limited, and there is no consensus for an optimal treatment algorithm. A relatively new and minimally invasive treatment includes fat grafting to the TMJ performed with or without open TMJ reconstruction. We aimed to study the safety, efficacy, and indications for this new approach in patients with TMJ disease.

METHODS/DESCRIPTION: A retrospective chart review was performed on all patients who underwent a non-salvage procedure under general anesthesia for the relief of TMJ disease by a single surgeon from 2011 through 2019. Patients with minimum 12-month clinical follow-up were included. Patient demographics, diagnosis, pre- and postoperative symptoms, procedure details, complications, and additional interventions for TMJ disease were recorded. Patients were asked to complete a survey elaborating on their symptoms (TMJ pain on 0–10 Likert scale, other symptoms 0–5 scale) before surgery and at their final follow-up. Wilcoxon signed rank test and repeated-measures analysis of covariance were performed to compare pre- and postoperative symptoms (P < 0.05 for significance).

RESULTS: Forty patients were included in the study, 71% female, mean age 34 (range, 10–65) years, mean clinical follow-up 4.3 (range, 1.6–9.0) years. The prevalence of procedures that patients underwent was 90% TMJ fat injection, 90% masticatory Botox injection, 80% Kenalog injection, 36% open TMJ arthroplasty, and 3% concurrent orthognathic surgery. Twenty-six (65%) patients completed the pre- and postoperative surveys. Overall, there was a statistically significant improvement in mean Likert scores at final follow-up versus preoperatively for: trismus (0.46 versus 1.63; P = 0.003),
clicking/popping (1.29 versus 3.17; \(P = 0.001\)), grinding/clenching (0.29 versus 1.58; \(P = 0.007\)), headache (1.27 versus 2.67; \(P = 0.003\)), TMJ pain (2.17 versus 6.71; \(P < 0.001\)), difficulty eating (1.21 versus 3.50; \(P = 0.001\)), difficulty chewing (1.63 versus 4.06; \(P = 0.001\)), and muscle soreness (2.12 versus 3.25; \(P = 0.007\)) but not for facial asymmetry (0.73 versus 1.21; \(P = 0.112\)). Only 3% of patients experienced worsened symptoms at final follow-up. No patients experienced any major or minor complications during the study period. Patients who exhibited preoperative trismus (50%) were more likely to undergo open TMJ surgery compared with those who did not (62% versus 38%; \(P = 0.206\)). Preoperative mean Likert scores were otherwise similar for patients who underwent fat/botox injection versus open TMJ surgery. Patients who underwent open TMJ surgery versus a more conservative approach demonstrated similar mean reduction in Likert scores for trismus (1.13 versus 1.23; \(P = 0.894\)), headache (1.70 versus 1.08; \(P = 0.419\)), muscle soreness (1.34 versus 0.91; \(P = 0.554\)), difficulty chewing (2.70 versus 2.62; \(P = 0.516\)), difficulty swallowing (2.50 versus 2.08; \(P = 0.630\)), grind/clenching (1.00 versus 0.75; \(P = 0.670\)), facial asymmetry (0.83 versus 0.13; \(P = 0.251\)), and TMJ pain (5.67 versus 3.42; \(P = 0.064\)); a significant decrease was only noted for click/popping (2.58 versus 1.16; \(P = 0.048\)).

CONCLUSIONS: A combination of TMJ fat grafting, masticatory Botox injection, Kenalog injection, open TMJ arthroplasty, and possible concurrent orthognathic surgery can provide much needed improvement for patients with TMJ disease, while postponing the need for salvage operations like joint replacement. A comprehensive treatment algorithm is presented and discussed.

Optimizing Transfusion-Related Postoperative Outcomes in Craniosynostosis Repair

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BACKGROUND: As cranial vault reconstruction for craniosynostosis is associated with significant blood loss and transfusions, managing intraoperative and postoperative hematologic status is a significant challenge for both plastic surgeons and anesthesiologists. Factors contributing to these challenges include young patient age with low total blood volume (TBV), as well as the difficulty of quantifying intraoperative estimated blood loss (EBL) in real time. However, optimizing intraoperative transfusion management for these cases is critical: blood products are independently associated with an increased risk of overall mortality, postoperative complications, multiorgan failure, and prolonged intensive care unit (ICU) stays. This study aims to evaluate how intraoperative fluid management, including blood transfusion, affects incidence of postoperative complications, and respiratory morbidity.

METHODS: We conducted a retrospective review of prospectively collected data from October 2012 to November 2019 using the Pediatric Craniofacial Surgery Perioperative Registry at Johns Hopkins Hospital. Pediatric patients (<18 years) undergoing open craniosynostosis repair were included. Endoscopic strip craniectomies were excluded. Outcomes of interest included postoperative complication incidence, intraoperative and postoperative respiratory complications, and hospital length of stay (LOS).

RESULTS: Sixty-one patients were included with a median age of 1.2 years (SD = 3.3); 36% were female, 54% Caucasian, and median ASA score was 2. Mean ICU and total hospital LOS were 3.3 and 6 days, respectively. Intraoperatively, mean EBL was 494 ml (SD = 403) and mean EBL/TBV was 0.55 (SD = 0.42). Patients were given an average of 1,412-ml crystalloid fluids for a mean crystalloid/EBL ratio of 5.1:1. On average, 646-ml blood products were given (mean 75% TBV). When controlling for ASA, odds of any postoperative complication were increased over 14-fold by intraoperatively transfusing >85% TBV in blood products compared with <85% (\(P = 0.028\)). Increasing %TBV transfused was significantly associated with increased incidence of intraoperative or postoperative respiratory complications, with an odds ratio of 5.2 (\(P = 0.049\)). Total and ICU LOS were increased as intraoperatively transfusing >85% TBV in blood products compared with <85% (\(P = 0.028\)). 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