Original Article

Pediatric nasal septoplasty outcomes

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Background: Corrective nasal surgery has historically been avoided in the pediatric population out of concerns surrounding the potential disruption of nasal growth centers. There is a paucity of data on the rate of complications or revision surgery following septoplasty in this population. As such, the purpose of this study is to review the long-term outcomes of a large cohort of children who underwent nasal septoplasty and to compare outcomes of septoplasty patients under the age of 14 to those 14 years and older.

Methods: A retrospective review was performed on all patients who received nasal septoplasty at our tertiary care pediatric referral center between October 2009 and September 2016. All patients who underwent septoplasty for a deviated nasal septum and were 0–18 years of age at the time of surgery were included in this analysis. Outcomes were compared between patients under the age of 14 to those 14 years and older. Demographic, surgical, and follow-up data were collected including complications and the need for revision surgery.

Results: A total of 194 pediatric patients were identified as meeting inclusion criteria for the study. Mean age for the total cohort was 14.6 years (0–18 years), with a mean of 15.9 years in the older group and 10.6 years in the younger group. Revision septoplasty was performed more frequently in the younger group. However, no significant difference in the rate of complications was seen between the two groups.

Conclusions: To the best of our knowledge, this is the largest retrospective study examining outcomes following septoplasty in pediatric patients. We also specifically examine outcomes of very young septoplasty patients, a population for which limited evidence exists. Further retrospective studies are needed to validate the use of nasal septoplasty in the pediatric population.

Keywords: Nasal septoplasty; pediatric septoplasty; revision septoplasty

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Introduction

Corrective nasal surgery in the pediatric population may be indicated for severe nasal obstruction or posttraumatic deformity (1). However, nasal septoplasty has historically been avoided in children because of concern regarding adverse effects on nasal and facial growth due to the potential disruption of nasal growth centers (2,3). The septal cartilage plays a major role in growth and development of the midface. Specifically, the sphenodorsal zone increases the length and height of the nasal bones, while the sphenospinal zone increases maxilla outgrowth (4,5). As a result, surgeons

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have adopted a cautious attitude towards correction of nasal septal deformities in the pediatric population, often electing to wait until puberty to perform the procedure (3). Based on completion of nasal growth, safe timeframes for nasal surgery have been estimated to be 16 years of age in boys and 14 years of age in girls (5).

More recently, studies have demonstrated that septoplasty can be performed safely in select pediatric patients with little risk of long-term facial deformity (1,6-11). Besides the benefits of enhanced nasal function, improvements in quality-of-life have been reported in the pediatric population (12,13). Authors have used this data to advocate for early corrective surgery to provide harmonious growth and prevent craniofacial sequelae of mouth breathing (5,6). Some studies have suggested that septal surgery is safe in children as young as 6-year-old, and may even be considered in neonates if severe airway obstruction is present (2,4). When the procedure is deemed necessary, a conservative approach to cartilage scoring and resection is thought to avoid disruption of the primary nasal and midface growth centers, and thus prevent the need for revision surgery later in life (5,14).

A majority of the published studies that have shown safety benefit are small, retrospective trials involving fewer than 50 patients (4). As such, the purpose of this study is to review the long-term outcomes of a large cohort of pediatric patients who underwent nasal septoplasty at a tertiary children's hospital. These outcomes of interest include complications and need for revision surgery. To the best of our knowledge, this is the largest retrospective study published in the literature, and the first to compare outcomes of septoplasty patients under the age of 14 to those 14 years and older.

We present the following article in accordance with the STROBE reporting checklist (available at https://dx.doi.org/10.21037/tp-21-359).

Methods

A retrospective chart review was performed, examining medical records for all patients who received nasal septoplasty without adjunctive surgery at Nationwide Children's Hospital in Columbus, Ohio between October 2009 and September 2016. Institution review board approval was obtained prior to study initiation. Patients who were 0 to 18 years of age at the time of surgery and underwent septoplasty for deviated nasal septum were included in the analysis. Patients included those evaluated by otolaryngology or plastic surgery as the primary team involved in the patient's care. Patients undergoing adjunctive procedures, including valve repair, rhinoplasty, and/or inferior turbinate reduction were excluded from the study. Patient characteristics were recorded, including age at the time of surgery, patient sex, surgical indication, complications, and need for revision surgery. If revision surgery was performed, the indication for revision and the time between initial surgery and revision surgery was noted.

In total, 196 patients were identified as meeting inclusion criteria. Two patients were lost to follow-up, and thus were excluded from the analysis. The total cohort of 194 patients was divided into two smaller cohorts, an older cohort consisting of patients between 14 and 18 years old at the time of surgery and a younger cohort consisting of patients under the age of 14 at the time of surgery. The age cutoff was selected based on the average age at completion of the nasofacial growth spurt, which has been shown to be 13.1 in girls and 14.7 in boys (15).

Statistical analysis

Student's *t*-tests were performed to evaluate for differences between the older cohort and younger cohort with P values <0.05 considered as statistically significant.

IRB approval

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the institutional review board (00000568), Nationwide Children's Hospital, and individual consent for this retrospective analysis was waived.

Results

Of the 194 septoplasty patients, 130 (67%) were male, and 64 (33%) were female. Mean age was 14.6 years (0–18 years) for the total cohort, with a mean of 15.9 years in the older cohort and 10.6 years in the younger cohort. Mean follow-up was 629 days (~21 months) after surgery with a range of 4 to 3,101 days. As expected, mean follow-up was significantly longer in the younger cohort compared to the older cohort as these younger patients were followed through puberty to monitor appropriate nasal growth (820 *vs.* 545 days, P=0.01).

Overall, the most common surgical indication was airway obstruction (76%) followed by a documented history of traumatic deformity (12%) and finally, chronic sinusitis (11%). The distribution of age at surgery for the total

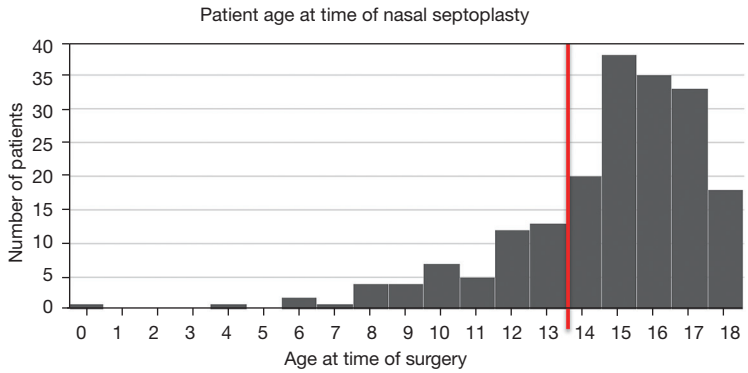

Figure 1 Patient age at time of initial nasal septoplasty.

Table 1 Outcomes for total cohort, patients under 14 years, and patients 14 years or older

Patient details	Total Cohort	Younger Cohort	Older Cohort	P-value
Total number of patients	194	50	144	
Mean age	14.6	10.6	15.9	
Number of patients with revision septoplasty	13 (6.7%)	7 (14.0%)	6 (4.2%)	0.02
Perforation	1 (0.52%)	0 (0.0%)	1 (0.69%)	0.56
Epistaxis	24 (12.4%)	6 (12.0%)	18 (12.5%)	0.93
Septal hematoma	0	0	0	n/a
Mean follow-up (days)	629	820	545	0.01

Statistical analysis was performed to assess differences between patients under 14 years and 14 years or older. Significantly more patients required revision septoplasty in the younger group, which also had a significantly longer follow-up. n/a, not applicable.

cohort is shown in *Figure 1*.

A comparison of outcomes between the older and younger cohorts is summarized in *Table 1*. A higher number of patients were found in the older cohort compared to the younger cohort (144 *vs.* 50). Thirteen patients (6.7%) required revision septoplasty. Seven patients required revision septoplasty in the younger cohort compared to 6 patients in the older cohort. The percentage of patients requiring revision septoplasty in the younger cohort was significantly higher than the percentage of patients requiring revision septoplasty in the older cohort (14.0% *vs.* 4.2%, P=0.02). No significant differences were found when comparing complications of perforation and epistaxis between the younger and older cohorts (P>0.05), and no patient suffered from a septal hematoma complication in the entire cohort.

Of the 7 patients who required revision surgery in the younger cohort, 6 were due to airway obstruction and 1 was due to development of synechiae. In comparison, of the 6 patients who required revision surgery in the older cohort, indications included 3 for airway obstruction, 2 for sinus issues, and 1 for trauma. Mean duration of time from original septoplasty to revision septoplasty was 1,094 days (~36 months) with a range of 119 days to 3,096 days (*Figure 2*).

Discussion

We present long-term outcomes for the largest cohort of pediatric nasal septoplasty patients to date. Upon review of the literature, the next largest study discovered was a retrospective review that included 157 patients between 4 and 16 years of age (6). In this study, we included 194 patients with an age range of 0–18 years. Only three prospective studies were discovered; one involved examination of acoustic rhinometries of 26 pediatric septoplasty patients (9), and two examined quality of life outcomes with 35 and 28 patients included in each study (13).

Our data indicates that septoplasty performed in patients

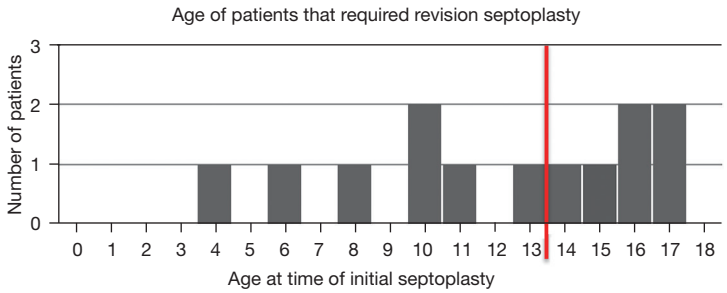

Figure 2 Number of patients requiring revision surgeries per age.

under the age of 14 years is associated with a higher rate of revision septoplasty when compared to those performed in children 14 years and older. In our cohort, 14% of children under 14 required a revision septoplasty. This is in contrast with the findings of a recent retrospective review of 43 preadolescent children (defined as males <16 years, females <14 years) who received septoplasty that found that 0 of these patients required revision procedures (1). Other published studies report similarly favorable long-term outcomes in this population (4,5). Similarly, a review of pediatric nasal surgery has demonstrated that conservative and limited nasal surgery with careful preservation of septal structure may be safely performed in the pediatric population with little long-term impact on nasofacial growth (16). Although pediatric septoplasty may have significant benefit, our results suggest that septoplasty performed in patients under the age of 14 years carries a significant risk for the need for revision surgery.

There were no significant differences in the rates of perforation or epistaxis. However, epistaxis was reported during the follow-up period in approximately 12% of patients in both groups, as well as in the total cohort. Postoperative epistaxis was defined as the presence of bleeding greater than expected post-operatively that was identified in the medical record in any medical encounter during the follow-up period. As only one patient suffered a septal perforation and no septal hematomas were seen in the total cohort, it is difficult to draw a meaningful relationship between the incidence of these complications and patient age. Although the number of revision surgeries carries more clinical weight, it is important to note the lack of differences in complications between groups as this is an important contribution to quality of life.

In our cohort, a large majority of surgical indications were classified as "airway obstruction" compared to trauma and sinus issues. In reality, some patients with surgical indications classified as "airway obstruction" likely had remote history of trauma earlier in childhood that was not documented. This would correlate with surgical indications reported in a study of 54 pediatric corrective nasal surgery patients in which the most common indications listed for surgery were posttraumatic deformities (67%) and airway obstruction (89%) with 28% reporting severe nasal obstruction without documented trauma (1).

Limitations of this study include those inherent to retrospective analyses and potential variances in the younger and older study groups. In addition, long-term quality of life outcomes were not measured. While the age demarcation in this study was chosen based on the pubertal transition, significant variation in anatomy and growth may be seen between patients within the younger group. To address these differences, further research may seek to include further stratification by age. Additional research may aim to include a multivariate analysis of long-term surgical and quality of life outcomes stratified by type of septoplasty, surgical indication, or severity of septal deviation.

Conclusions

To the best of our knowledge, this is the largest retrospective study examining septoplasty outcomes in the pediatric population. Septoplasty patients under the age of 14 years require more revision surgeries compared to older patients. These results contrast with the increasingly popular notion that pediatric nasal septoplasty can be performed safely at a young age without negative consequences. Future prospective studies are required to further elucidate the long-term effects of pediatric nasal septoplasty.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://dx.doi.org/10.21037/tp-21-359

Data Sharing Statement: Available at https://dx.doi.org/10.21037/tp-21-359

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://dx.doi.org/10.21037/tp-21-359). CAE is a consultant for Smith and Nephew. The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the institutional review board (00000568), Nationwide Children's Hospital, and individual consent for this retrospective analysis was waived.

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