A Study of Anthropometric Measures Before and After External Septoplasty in Children

A Preliminary Study

Hamdy El-Hakim, FRCSEd(Orl); William S. Crysdale, MD, FRCSC; Mohammed Abdollel, MSc; Leslie G. Farkas, MD, PhD, DSc, FRCSC

Objective: To test the hypothesis that surgery on the growing nasal septum does not adversely affect nasal and midfacial dimensions.

Design: Paired study.

Setting: Tertiary care center.

Participants: Children treated consecutively during a 4-year period; all had significant nasal obstruction and cosmetic disfigurement secondary to skeletal septal deformities.

Intervention: Nasal septal surgery (using an external approach), in which the quadrilateral cartilage was removed, remodeled, and reinserted as a free graft.

Outcome Measures: Anthropometric linear measurements and indexes of the face and nose preoperatively and postoperatively; nasal dorsum length, nasal height, nasal dorsum index, nasal tip protrusion, columellar length, facial height, face width, upper face height, facial index, nose–upper face height index, and columellar length–nasal tip protrusion index. Continuous measurements were transformed into ordered categories with reference to normative data. Data were analyzed using Wilcoxon signed rank sum test (α level of .05) and by applying the Bonferroni adjustment for multiple testing.

Results: Twenty-six children were studied (12 females and 14 males); age at surgery ranged from 4.5 to 15.5 years (mean age, 9.5 years); average age at postoperative measurement, 12.5 years; mean follow-up, 3.1 years. Only nasal dorsum length (P = .007) and nasal tip protrusion (P = .04) were decreased by a statistically significant level before the Bonferroni adjustment. The change was not considered clinically significant. Thus, relative to age-appropriate norms, the dimensions of the nose and midface and their proportionality did not change after surgery.

Conclusions: Appropriate nasal septal surgery involving excision and subsequent reinsertion of a remodeled segment of the quadrilateral cartilage has no deleterious effects on development of the nose and midface. We question the absolute dogma that nasal surgery in children must always be avoided.


Surgery on the growing nasal septum has always been the epicenter of debates. The sources of such debates are the controversial findings and views found in human and animal studies. As observed by Freng and Haye,1 views based on animal studies vary according to the model implemented (species, surgical procedure, and age of animals). At the same time, interventional clinical studies in humans have failed to provide good evidence for accepted practice. Consequently, blanket statements urging caution are common in the literature, as Gilbert et al2 write:

Because the quadrilateral septal cartilage is the keystone in development of the profile projection of the cartilaginous vault, dare we either chip away at it or even undermine it without fear of subsequent interference with the continuous profile growth of the cartilaginous vault in children?2(p677)

The conclusion of Farrior and Connelly3 after their review of the literature appears fairly balanced, despite the lack of supporting evidence. They recommended that surgery (as conservative as possible) be delayed until nearly full development has taken place, unless marked disturbance in function or distortion exists that also interferes with growth and facial development.

All human studies of pediatric septoplasty will, unavoidably, be confounded by the previous trauma and its effects, making it difficult to attribute to either the sur-
MATERIALS AND METHODS

The database kept by one of us (W.S.C.) holds the medical records of patients who have undergone septoplasty and/or rhinoplasty and were treated during a 13-year period (1986-1999). All patients whose anthropometric measurements were recorded preoperatively were identified. Preoperative anthropometric measurements have been recorded routinely by one of us (W.S.C.) since early 1995. For the purpose of this investigation, we included only those patients whose septoplasty had been performed via the external approach and in whom the free graft technique (previously described) had been used. We considered only those who had undergone the procedure before 16 years of age, as different nasal measurements reach maturation at variable ages (between 14 and 16 years), and these vary further between sexes.

Subsequent to approval by the relevant ethics committee, the patients’ addresses and telephone numbers were retrieved from the Health Records department of The Hospital for Sick Children, Toronto, Ontario. The patients were then contacted by mail and telephone and solicited to attend a specific appointment at the Craniofacial Measurements Laboratory at The Hospital for Sick Children. The consent of parents and children was obtained as appropriate, after explanation of the purpose of the examination.

The measurements were performed by one of us (L.G.F.) according to a standard technique with the use of sliding and spreading calipers, and proportions were calculated using standard formulae. The anthropometric linear measurements used are illustrated in Figure 1, and the indexes were calculated from their values. Although the linear measurements are individual dimensions in their own right, the indexes or proportions demonstrate the harmony between these dimensions. Together, they indicate some aspects of nasal and facial growth.

The variables used as outcome measures (many of which are illustrated in Figure 1) were as follows:

- Nasal dorsum length
- Nasal height
- Nasal tip protrusion
- Salellar length–nasal tip protrusion index or (sn to c’)/(sn to prn), ie, the relationship between the columnellar length (sn to apex of columnella [c’]) and the nasal tip protrusion (sn to prn)
- Facial height
- Face width
- Facial index or (n to gn)/(zy to zy), ie, the relationship between the facial height (n to gnation [gn]) and the face width (distance from one zygion [zy] to the other)
- Upper face height
- Nose–upper face height index or (n to sn)/(n to sto), ie, the relationship between the nasal height (n to sn) and the upper face height (n to sto).

All measurements were in millimeters.

The linear measurements and indexes before and after surgery were transformed into 1 of 5 possible ordered categories (−2, −1, 0, 1, and 2). These indicate whether the measured variable is subnormal, borderline small, optimal, borderline large, or supernormal, respectively, as compared with documented norms of North American whites. An optimal measurement or proportion is within 1 SD from the mean, whereas borderline (small or large) values lie within 2 SDs. Abnormally large or small measurements are those values beyond 2 SDs from the mean.

The Wilcoxon signed rank test was applied to the paired differences between each of the ordered measurements to determine whether they changed after surgery. A Bonferroni adjustment for multiple testing was performed (k × P), and the interpretation of our results was based on the adjusted P values. Ninety-five percent confidence intervals were computed for the medians of the paired differences.

The spreadsheet from the computerized database (created using Microsoft Excel software [Microsoft Corporation, Redmond, Wash]) contains records of 295 patients who were operated on between January 1, 1986, and December 31, 1999, in The Hospital for Sick Children. We identified 40 patients who qualified for the entry criteria. Eight patients could not be contacted with the available addresses or telephone numbers, and we had no access to their new locations. The remaining 32 were contacted by mail and telephone and were invited for follow-up. Only 1 parent declined initially, and another 5 patients failed to attend.

The study patients were treated between March 1, 1995, and December 31, 1999. Their follow-up ranged from 10 months to 5.4 years (mean, 3.1 years). Twelve were females and 14 were males, with an age range (at operation) from 4.5 to 15.5 years (mean age, 9.5 years).
Eight patients had isolated cleft lip and/or palate and 1 had Crouzon syndrome; 16 had previously undergone septoplasty. The patients fell into 4 different ethnic groups: most (n=14) were whites of European descent, 7 were East Indians, 4 were whites of Middle Eastern descent, and 1 was West Indian.

Altogether, 26 rhinoplasty maneuvers were performed in addition to the free-graft septoplasty in all the patients: 14 dorsal grafts, 4 columellar struts, 4 dome sutures, 2 lower lateral cartilage trimmings, and 2 tip grafts. None of the patients underwent an osteotomy. Only 2 postoperative complications had been recorded: 1 vestibular granuloma that required resection and 1 postoperative epistaxis that required packing for control.

The variables for all patients were available for analysis, with 3 exceptions. One measurement for the columnellar length was not documented. Also, in both the columnellar length–nasal tip protrusion index and nose–upper face height index, there were no available norms for children younger than 5 years, which led to the omission of 1 patient who was aged 4 1/2 years at the time of surgery.

The details of the paired analysis are presented in Table 2 and Table 3. They demonstrate that only 2 of the differences between the medians were statistically significant before the Bonferroni adjustment (the nasal dorsum length [P = .007] and nasal tip protrusion [P = .04]). After adjustment (multiplication by the number of variables, ie, 11), this significance was lost. Two more important observations support this notion. First, if the confidence intervals are examined, it will be observed that they all encompass the 0; ie, no difference between medians, indicating that the significance of the P values is not supported. Second, the median differences are either 0 or 0.5; in other words, the change is less than 1 ordered category, which cannot be clinically significant. Also, none of the indexes changed significantly, since they represent proportionality measures between individual linear dimensions.

Our study documents that these children did not exhibit clinically significant retardation of growth after external approach septoplasty using quadrilateral cartilage as a free graft. This extrapolation derives from the categorization of the postoperative anthropometric measurements in relation to documented norms for North American whites, which was not significantly different from the preoperative status. However, there is an observed trend for the noses operated on to shorten, as noted in the results of 2 variables.

This is the first longitudinal clinical study on pediatric septoplasty, to our knowledge, to use objective mea-

![Image](http://archotol.jamanetwork.com/pdfaccess.ashx?url=/data/journals/otol/11857/ on 06/17/2017)
sures in a paired design. With individual patients acting as their own controls, the confounding effect of the heterogeneity of the sample (ie, inclusion of patients with craniofacial abnormalities and various ethnic origins) is overcome. Objections may be raised that the norms used as their own controls, the confounding effect of the heterogeneity of the sample (ie, inclusion of patients with craniofacial abnormalities and various ethnic origins) is overcome. Objections may be raised that the norms used are those based on North American whites. However, since we used the order of the categorization to facilitate analysis rather than its implications with regard to normality (as Bejar et al did), the issue has less bearing on the final conclusions. The current study has its shortcomings. We are aware that the sample size is a limiting factor. Also, the measurements had been taken at different points in time after surgery for individual subjects.

At this stage, and since the study contributes significantly to the debate on pediatric septoplasty, it is appropriate to review the results of work performed in animals. Experimental reports are divided to some extent. Destructive procedures on the nasal septum, including resection of the mucoperichondrium in addition to the cartilage, were found to result in significant deformity and growth retardation in rodents. Others have reproduced the same results in the same species, even though they preserved the mucoperichondrium. On the other hand, procedures preserving the mucoperichondrium, especially those with reimplantation of resected cartilage, produced fewer adverse results.

In most of the studies cited, and where histological examination had been performed, evidence of cartilage regeneration and survival after autotransplantation had been documented. After noting these facts and the occurrence of duplications and deviations after the use of autografts, Nolst Trenite and colleagues stated that possible adjustments in operative techniques to achieve a better connection between parts of septal cartilage with a prolonged fixation of the septum in the midline might be required for successful pediatric septoplasty.

Finally, it is pertinent to examine some of the literature that deals with patterns of growth of the nasal septal cartilage. In this context, Van Loosen and coworkers had shown in 1996 and 1997 that the growth of the nasal septum decelerates remarkably after age 2 years and that it reaches a plateau by age 36 years. They also postulated that the septal cartilage reaches adult size by age 2 years and that further growth occurs courtesy of the bony perpendicular plate. They did not document any particular spurts of growth at any ages. Recent work from Brazil adds that there is histological evidence of a reduction in the rate of growth of the quadrilateral cartilage by age 5 years and that deceleration starts by age 8 years.

The philosophy of the intervention used in this group of patients respects these issues. This intervention is based on a conservative technique that emphasizes precision in the preparation of a carefully sized and shaped graft and in its method of fixation. Equally important are the patient choice and the indication for surgery. The age limit has never fallen below 6 years, except for one of the patients in this series who had documented sleep apnea due to nasal airway obstruction that was subsequently relieved by surgery. The indication for this type of surgery is severe nasal obstruction associated with external deformity. In particular, septal deformities anterior to the anterior nasal spine are the specific abnormality addressed by this technique. These patients are always scrutinized for causes of obstruction other than the septum.

In conclusion, we believe that, where indicated, reconstructive septal surgery does not cause significant growth retardation in children. Achievement of these results will only be possible by using a technique that preserves the integrity of the mucoperichondrium and restores skeletal continuity (by using refashioned quadrilateral cartilage as free graft) as much as possible, along with meticulous fixation of the reconstructed septum. This is not an open invitation for septal surgery in any deviated pediatric nasal septum or by an inexperienced surgeon.

©2001 American Medical Association. All rights reserved.
REFERENCES


