Nasal Septal Abscess in Children

Reconstruction With Autologous Cartilage Grafts on Polydioxanone Plate

Dirk J. Menger, MD; Ivar C. Tabink, MD; Gilbert J. Nolst Trenité, MD, PhD

Objective: To assess outgrowth and aesthetics of the nose in children after reconstruction of the cartilaginous nasal septum with autologous cartilage grafts on polydioxanone plate.

Design: Prospective nonrandomized case series.

Setting: University hospital.

Patients: Six patients (5 boys and 1 girl), aged 3 to 11 years, with nasal septal abscess.

Intervention: The nasal septa of 6 children with a history of nasal septal abscess and partial or complete destruction of nasal septal cartilage were reconstructed with autologous cartilage grafts of the auricle or rib fixed on polydioxanone plate.

Main Outcome Measures: Nasal outgrowth was measured by the length of the nose and by the amount of nasal tip projection and was compared with standardized growth curves. Aesthetic outcome variables included nasolabial angle, columellar retraction, and development of saddle nose deformity and were classified as normal, mild, or severe.

Results: The duration of follow-up ranged from 10 to 68 months (mean follow-up, 38 months). Four children had complete loss of the cartilaginous septum. Areas 1 and 2 (caudal parts) had been destroyed in 2 children. Auricular cartilage was used in 5 children; costal cartilage was needed in 1 child. Compared with standardized growth curves, the length of the nose and the amount of nasal tip projection were within 1 SD in all children. None of the children developed saddle nose deformity. One child had mild columellar retraction; 3 children had mild overrotation of the nasal tip.

Conclusion: Total reconstruction of abscess-induced destruction of nasal septal cartilage with autologous cartilage grafts fixed on polydioxanone plate has, so far, resulted in normal development of the nose during follow-up, without expected aesthetic problems.

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costal cartilage are the donor sites of choice for septal re-
strating, packing of the nose, and combinations of these have been described in the literature. The role of an intact cartilaginous septum in the normal development of the nose and midface has generally been underestimated.

To improve normal outgrowth of the nose and maxilla, the nasal septum has been reconstructed with homologous donor cartilage implants.\(^5\)\(^6\)\(^18\) The long-term postoperative results of these studies are conflicting. Huizing\(^7\) reported 2 cases of reconstruction with homologous cartilage resulting in normal outgrowth of the nose and midface. In contrast, Grymer and Bosch\(^6\) studied identical twin boys, one of whom developed a septal abscess that was reconstructed with homologous cartilage. During follow-up, he developed the expected long-term adverse sequelae of the nose and maxilla. This finding is in line with clinical evidence and animal models that have demonstrated replacement of original homologous cartilage grafts with fibrous tissue during follow-up.\(^19\)\(^20\) Homologous cartilage grafts are less suitable for the replacement of structures in the nose with support function such as the nasal septum.

To ensure normal development of the nose in a growing child, the reconstructed nasal septum should be able to grow. It is likely that chondrocytes from the perichondrium fail to migrate toward the matrix of homologous cartilage implants. A clinical example of adverse sequelae that can develop after reconstruction of the nasal septum with irradiated homologous cartilage is shown in Figure 2. At present, autologous cartilage is the implant material of choice, which is consistent with the objectives of optimal long-term postoperative results with limited risk of re-
sorption, infection, or extrusion.\(^21\)\(^22\) Dispensa et al\(^23\) used residual autologous septal cartilage in their technique of “mosaicplasty.” However, most children in our series with a septal abscess had complete or near-complete loss of the cartilaginous septum. In this case, large autologous car-

![Figure 1. Nasal septal abscess in an 11-year-old boy. The photograph was taken 4 weeks after nasal trauma and septal abscess that was treated with oral antibiotics by a general practitioner.](Image 66x579 to 294x747)

![Figure 2. Adverse sequelae after reconstruction of the nasal septum with irradiated homologous cartilage. A, Frontal view of a 16-year-old boy with an underdeveloped nose and midface due to nasal septal abscess at the age of 2 years. Multiple nasal septal reconstructions were performed elsewhere with the use of homologous donor cartilage. Despite these reconstructions, the nose is short with a broad bony pyramid. B, Lateral view of the same patient. Because of the absence of the cartilaginous septum, the bony and cartilaginous dorsum was underdeveloped, and the columna was retracted with upward rotation of the nasal tip, causing an overlarge nasolabial angle (103°). The length of the nose was 4.1 cm (less than \(-2\ SD\)), and the amount of nasal tip projection was 1.7 cm (\(-2\ SD\)); both are too small for age and sex.](Image 318x585 to 545x747)

**METHODS**

**PATIENTS**

Between June 5, 2001, and April 19, 2006, we performed rhinoplasty surgery on 6 children (5 boys and 1 girl) with partial or complete loss of the cartilaginous nasal septum. All children had a history of nasal trauma, septal hematoma, and septal abscess. Initially, 2 of these children were treated by a general practitioner for blockage of the nasal passage and fever that had developed a few days after the nasal trauma. Inferior turbinate hypertrophy or fever of unknown origin was assumed, so these children were treated with topical decongestants or systemic antibiotics. By the time of the initial visit at our department, these children still had a swollen nasal septum with complete or near-complete loss of the cartilaginous septum on palpation. Clinically, these children had a normal nasal profile with marginal flattening and broadening of the supratip area and slight columellar retraction. In 2 other children, nasal abscess had been diagnosed and drained elsewhere, including treatment with antibiotics, before being seen at our department. Temporary reconstruction with irradiated homologous rib cartilage (Tutoplast; Tutogen Medical GmbH, Neunkirchen am Brand, Germany) to prevent adhesions between the mucoperichondrium layers was performed elsewhere in the 2 other children. These children were seen at our department for reconstruction of the nasal septum with autologous cartilage grafts.

**SURGICAL TECHNIQUE**

In all children, reconstruction of the nasal septum was performed using general anesthesia through an open rhinoplasty using a broken columellar incision. After opening the submucosal space, cultures were taken for microbiologic examination, and the abscess was drained. Only 2 children still had a...
Figure 3. Perioperative view of a 5-year-old girl with complete loss of the cartilaginous septum. This photograph was taken 2 weeks after septal abscess that was treated with oral antibiotics by a general practitioner. The external approach provides maximal exposure of the nasal septum for optimal reconstruction and does not interfere with the normal outgrowth of the nose.

purulent collection between the mucosal layers. At this phase, the diameter of absent septal cartilage was estimated to ensure total reconstruction of the septum (Figure 3). If the amount of cartilage needed for reconstruction was large, costal cartilage from the seventh rib was harvested on the right side (Figure 4A). Auricular conchal cartilage was used when the quantity needed was less than 1 auricular concha (Figure 5A).

The next step was reconstruction of the nasal septum. Cartilage grafts were stabilized and fixed (using polyglactin 4-0 sutures). The next step was to fixate the implant with the use of soluble mattress sutures (Figures 4C and 5C). An internal nose dressing was applied for 1 or 2 days. Systemic broad-spectrum antibiotics (a combination of amoxicillin [50 mg/kg] and clavulanic acid [5 mg/kg], every 6 hours) were administered during 7 days. Depending on culture results, the antibiotic regimen is changed if necessary.

EVALUATION OF NASAL GROWTH

To evaluate the development of nasal growth, we compared the length of the nose and the amount of nasal tip projection in our children with standardized growth charts for central Europe. These growth charts were based on measurements of 2500 healthy individuals in Switzerland aged 0 to 97 years. All measurements of the length of the nose and the amount of nasal tip projection (nasal protrusion) were performed in accord with the recommendations by Zankl et al. In addition to measuring the length of the nose and the amount of nasal tip projection, we evaluated columellar retraction and the development of saddle nose deformity. These variables were analyzed and classified as normal, mild, or severe (Table 1). Finally, we measured the nasolabial angle and classified the angle as normal (<100° for boys and <115° for girls), mildly overrotated (>100° for boys and >115° for girls), or overrotated (>115° for boys and >130° for girls). Midfacial growth was not considered because cephalometrics were not performed during follow-up.

The ages at which septal abscess developed ranged from 3 to 11 years (mean age, 8 years). Four children had complete loss of the cartilaginous septum; in 2 children, only areas 1 and 2 (caudal parts) of the nasal septum were resorbed (Table 2). In 5 children, auricular conchal cartilage was adequate for total reconstruction, whereas costal cartilage was required in 1 child. Follow-up ranged from 10 to 68 months (mean follow-up, 38 months). Two children still had a purulent collection between the mucopeichondrium layers during surgery. In these children, microbiologic cultures were positive for H influenzae and Streptococcus milleri. None of the children developed postoperative infections or other complications. Compared with standardized growth curves, the length of the nose and the amount of nasal tip projection were within 1 SD in all children (Table 1 and Figure 6). None of the children developed saddle nose deformity; mild columellar retraction was noted in 1 child (patient 3 in Tables 1 and 2). The nasolabial angle was normal in 3 children; mild overrotation was observed in 3 children. Outgrowth of the nose was normal in all the children, without signs of underdevelopment or development of saddle nose deformity.

COMMENT

Septal hematomas and abscesses require prompt drainage and inspection and may necessitate reconstruction of the nasal septum. Frequently, there is no loss of septal cartilage. In such cases, adequate drainage and administration of antibiotics will be sufficient for a good long-term postoperative result without adverse sequelae such as underdevelopment or development of severe saddle nose deformity. The normal nasal septum has 2 major growing centers, which are thicker (3 mm) than the surrounding cartilage (0.75 mm). These include the sphenodorsal zone, which regulates the length and height of the nose, and the sphenospinal zone (basal), which stimulates the development of the anterior nasal spine and the maxilla. Smaller defects in the thinner anterior central part of the cartilaginous septum, located between the major growing centers, do not seem to interfere with nasal growth. Nevertheless, reconstruction of such small defects should be considered to avoid the development of septal perforation.

In children with complete or near-complete destruction of septal cartilage, reconstruction of the nasal sep-
tum is required. The fact that the operative field is infected with microorganisms does not detract from this statement. After careful rinsing of the subperichondrial space with large quantities of an isotonic sodium chloride solution, the risk of infection in the cartilage implant is low, especially after intravenous or oral administration of broad-spectrum antibiotics. In our case series, autologous cartilage grafts attached to polydioxanone plate for reconstruction of the nasal septum after septal abscess showed normal development of the length of the nose and the amount of nasal tip projection, both in accord with standardized growth curves of the nose. Little is known about the type of growth in the cartilage grafts. We do not know whether new chondrocytes derive from the perichondrium (appositional growth) or from within the lacuna of the graft (interstitial growth). Furthermore, it is not fully understood whether the histologic properties of the original implants change in time toward a hyaline type of cartilage. It is anticipated that future animal studies will answer these kinds of questions.

We are aware that our series of 6 children is small. Nevertheless, to our knowledge, it is the largest docu-

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Follow-up, mo</th>
<th>Age, y</th>
<th>Length of Nose, cm²</th>
<th>Tip Projection, cm²</th>
<th>Saddle Deformity</th>
<th>Columellar Retraction</th>
<th>Nasolabial Angle</th>
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<tbody>
<tr>
<td>1</td>
<td>62</td>
<td>8</td>
<td>3.8 (-1 SD)</td>
<td>1.5 (Mean)</td>
<td>No</td>
<td>No</td>
<td>98° (Normal)</td>
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<tr>
<td>2</td>
<td>12</td>
<td>6</td>
<td>3.4 (-1 SD)</td>
<td>1.6 (1 SD)</td>
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<td>No</td>
<td>116° (Mildly overrotated)</td>
</tr>
<tr>
<td>3</td>
<td>68</td>
<td>14</td>
<td>4.5 (-1 SD)</td>
<td>1.9 (Mean)</td>
<td>No</td>
<td>Mild</td>
<td>110° (Mildly overrotated)</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>12</td>
<td>4.7 (Mean)</td>
<td>2 (1 SD)</td>
<td>No</td>
<td>No</td>
<td>110° (Mildly overrotated)</td>
</tr>
<tr>
<td>5</td>
<td>54</td>
<td>15</td>
<td>4.8 (-1 SD)</td>
<td>2.1 (1 SD)</td>
<td>No</td>
<td>No</td>
<td>88° (Normal)</td>
</tr>
<tr>
<td>6</td>
<td>24</td>
<td>13</td>
<td>4.8 (Mean)</td>
<td>1.9 (Mean)</td>
<td>No</td>
<td>No</td>
<td>85° (Normal)</td>
</tr>
</tbody>
</table>

*Parentheses indicate comparison with standardized growth curves.
Table 2. Reconstruction of the Cartilaginous Nasal Septum

<table>
<thead>
<tr>
<th>Patient No./Sex</th>
<th>Age at Onset, y</th>
<th>Previous Therapy</th>
<th>Length of Defect/Height of Defect, mm</th>
<th>Area Defect</th>
<th>Cartilage Graft</th>
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<tr>
<td>1/M</td>
<td>3</td>
<td>Antibiotics and drainage</td>
<td>23/15</td>
<td>Total</td>
<td>Auricular</td>
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<td>5</td>
<td>Antibiotics</td>
<td>30/20</td>
<td>Total</td>
<td>Auricular</td>
</tr>
<tr>
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<td>8</td>
<td>Antibiotics, drainage, and septal reconstruction with irradiated homologous costal cartilage</td>
<td>32/20</td>
<td>Total</td>
<td>Auricular</td>
</tr>
<tr>
<td>4/M</td>
<td>11</td>
<td>Antibiotics</td>
<td>36/25</td>
<td>Total</td>
<td>Costal</td>
</tr>
<tr>
<td>5/M</td>
<td>11</td>
<td>Antibiotics, drainage, and septal reconstruction with irradiated homologous costal cartilage</td>
<td>20/25</td>
<td>1, 2</td>
<td>Auricular</td>
</tr>
<tr>
<td>6/M</td>
<td>11</td>
<td>Antibiotics and drainage</td>
<td>20/25</td>
<td>1, 2</td>
<td>Auricular</td>
</tr>
</tbody>
</table>

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* aTutoplast (Tutogen Medical GmbH, Neunkirchen am Brand, Germany).

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Correspondence: Dirk J. Menger, MD, Center for Facial Plastic and Reconstructive Surgery, Department of Otorhinolaryngology–Head and Neck Surgery, Academic Medical Center, Meibergdreef 9, 1105 AZ Amsterdam, the Netherlands (D.J.Menger@amc.uva.nl).

Author Contributions: Drs Menger and Nolst Trenité had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Menger and Tabink. Acquisition of data: Menger. Analysis and interpretation of data: Menger and Nolst Trenité. Drafting of the manuscript: Menger. Critical revision of the manuscript for important intellectual content: Tabink and Nolst Trenité. Administrative, technical, and material support: Tabink. Study supervision: Menger and Nolst Trenité. Financial Disclosure: None reported.

In the growing child, reconstruction of partially or completely destructed septal cartilage is essential for normal development of the nose and maxilla. To achieve a successful long-term functional and aesthetic postoperative result, the implant material should provide sufficient support function and should be able to grow between the mucoperichondrium layers. Autologous cartilage grafts of the auricle or rib are, so far, the implant materials of choice in line with current medical practice to achieve these goals. The ideal solution would be to restore the septum with a single large cartilaginous implant instead of multiple smaller grafts. For this reason, the autologous cartilage grafts were affixed to polydioxanone plate, which ensured good tissue-to-tissue approximation of the individual grafts. The nasal septa of 6 children were reconstructed using this technique. This approach has, so far, resulted in normal development of the nose during follow-up in all children.

are promising and, in our view, represent the best alternative for children with complete loss of nasal septal cartilage. Follow-up will be continued during the pubertal growth spurt until our patients are 18 years of age.