Ear reconstruction following severe complications of otoplasty

F. Firmin*, C. Sanger, G. O’Toole

Clinique Georges Bizet, Rue Georges Bizet, 75116 Paris, France

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KEYWORDS
Otoplasty; Prominent ears; Severe complications

Summary
Background: Correction of prominent ears is one of the most common operations performed in congenital deformity. Many appropriate corrective techniques have been described. While rare, severe complications destroying ear contours can occur and their correction should follow the established principles of ear reconstruction.

Methods: A retrospective review of the notes of all patients who presented to Clinique George Bizet (1981–2007) in Paris, for correction of complications after undergoing prominent ear surgery at another facility, was performed. Each patient’s age, gender, diagnosis, number of previous operations and final outcome were noted as available. Patients were included in this study if they had undergone one or more operations for prominent ears, leading to severe destructive complications, prior to consultation with the senior author and then underwent surgical repair with either an auricular (conchal) cartilage graft or with autogenous costal cartilage.

Results: A total of 49 (25 female, 24 male) patients met the inclusion criteria. The mean age at presentation was 23 years (range of 10–59 years of age). The mean number of previous attempts to correct the ear deformity was 1.3 (1–12) times. Eight patients underwent reconstruction with a conchal cartilage graft and 41 with costal cartilage.

Conclusions: While more minor contour deformities are correctable with a contralateral conchal cartilage graft, when more than a quarter of the ear or more than two planes of its complex folds are deformed, costal cartilage is recommended for surgical repair. The principles of ear reconstruction should be well understood prior to attempting a repair of severe complications after otoplasty.

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The commonest congenital abnormality of the ear is prominence.1 The incidence in the Caucasian population is 5% with 8% of those having a positive family history.2,3 In order to repair the deformity the surgeon must have a thorough knowledge of the anatomy of the normal ear and the anatomical variations that lead to its protrusion. The most common variations seen in a prominent ear are absence of definition of the antihelical fold, an increased angle between the mastoid and concha, anterior projection...
of the lobule and overdevelopment of the posterior wall of the concha. The clinical deformity may include one or a combination of any of these variations. Surgery should be directed at the specifics of the deformity for each patient. There have been many modifications and improvements in the surgical techniques for correcting prominent ears over the past century. Some of the more well known advocate, a posterior approach, cartilage scoring (anterior and posterior), permanent retention mattress sutures, posterior skin excision and permanent concha-mastoid sutures to decrease the concha-scaphoid angle.4-10

Hundreds of techniques for prominent ear correction are described in the literature and satisfactory results can be achieved with many of these. Complications may occur despite good technique, with infection and poor scar formation (keloids and hypertrophic scarring) being particular risks. Complications due to technique, such as the pinched ear appearance, overcorrection, under-correction and recurrence can be reduced with a thorough understanding of the architectural anatomy of the ear.

In this paper severe destructive complications of otoplasty are considered and a review of patients with such a complication presenting to the senior author, assessed. Some of the resulting deformities were correctable with conchal cartilage. However many patients presented with such severe deformity that costal cartilage was required for correction. In these cases the principles of total ear reconstruction were followed.

Material and methods

A retrospective review of the notes of all patients with unsatisfactory results after correction of prominent ears, referred to the senior author at Clinique George Bizet between 1981 and 2007, was performed. Each patient’s age, gender, diagnosis, number of previous operations and final outcome were noted as available. Patients were included if they had undergone one or more operations for prominent ears prior to consultation with the senior author. Patients were excluded if they did not require reconstruction, presented with a simple recurrence or had deformities that were corrected without a cartilage graft. The remaining patients were divided into two groups according to the treatment they received: The first included those patients who underwent surgical management with a conchal cartilage graft and the second, those who required surgical repair with costal cartilage.

Results

A total of 49 (25 female, 24 male) patients met the inclusion criteria. The mean age at presentation was 23 years (range of 10–59 years of age) (Table 1). The mean number of previous attempts to correct the ear deformity was 1.3 (1–12) times.

Eight patients (2 females and 6 males) had a deformity which was correctable with a conchal cartilage graft. The mean age in this group was 25 (range 15–40) years old. The patients underwent a mean of 1 (1–2) previous operations prior to consultation with the senior author. They were defined as having deformities correctable with conchal cartilage using the senior author’s principle that with less than a quarter of the ear involved and two or fewer of the complex three dimensional anatomical planes of the ear being deformed, such a graft would suffice. Seven of the patients had isolated helical deformities and one patient had a deformity of the scapha. An anterior approach was used for all eight reconstructions.

The remainder of the patients had more severe deformity. With more than a quarter of the ear being deformed or more than two planes affected costal cartilage grafts were used for repair. There were 41 (23 female, 18 male) patients in this group. The mean age was 23 (10–59) years old. The deformities included isolated anthelix (16), combined helix and anthelix (14), isolated helix (3), isolated posterior wall of the concha (3), combined scapha, helix and anthelix (3), and combined helix and scapha (2) (Table 2). Fifteen of the patients had bilateral deformity. In this group three patients required a temporal fascia flap in order to cover the cartilaginous framework as the local skin was insufficient.

Only one of the patients had referral records and details of the original otoplasty. As a result, no definitive correlation could be drawn between the technique used and the resulting complication. However, whether the cause was the technique used or the result of infection was usually clear.

Discussion

These cases are particularly challenging. Patients are psychologically distressed after years of hiding their

Table 1 Number of patients undergoing reconstruction with conchal or costal cartilage, according to age

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Number of patients</th>
</tr>
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<tbody>
<tr>
<td>11-20</td>
<td>5</td>
</tr>
<tr>
<td>21-30</td>
<td>10</td>
</tr>
<tr>
<td>31-40</td>
<td>15</td>
</tr>
<tr>
<td>41-50</td>
<td>5</td>
</tr>
<tr>
<td>51-60</td>
<td>5</td>
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</table>

Table 2 Location of defects at presentation

<table>
<thead>
<tr>
<th>Location of the Deformity</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthelix</td>
<td>16</td>
</tr>
<tr>
<td>Helix &amp; Anthelix</td>
<td>14</td>
</tr>
<tr>
<td>Helix</td>
<td>3</td>
</tr>
<tr>
<td>Posterior Wall of Concha</td>
<td>3</td>
</tr>
<tr>
<td>Scapha, Helix &amp; Antihelix</td>
<td>3</td>
</tr>
<tr>
<td>Helix &amp; Scapha</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>41</td>
</tr>
</tbody>
</table>
deformed ears and sometimes have unrealistically high expectations from reconstructive surgery. The parental decision to undergo prominent ear correction made some years previously, can in cases such as those presented below where severe complications have ensued, have a significant effect on the patient’s life. The principles outlined in this article optimise the likelihood of a satisfactory result, which will allow an improvement in these patients’ psychological well-being.

In such cases, minor corrections are rarely going to be the appropriate treatment. The decision then remains between using conchal cartilage from the opposite ear or costal cartilage. All of the deformities which involved solely the scapha or the helix were considered to satisfy the principles described for reconstruction with conchal cartilage from the opposite ear. However, where there were complex contour deformities of the concha, cartilage from the opposite ear would not have provided enough material to sculpt the framework required. So, in the cases with more than a quarter of the ear deformed, more than two anatomical planes involved or complex contours destroyed, costal cartilage was used for reconstruction.

As regards assigning a cause, where deformity is bilateral the technique used is likely to have been at fault. Of the 41 cases considered in this review, 32 were linked to technical error, nine of which resulted in severe bilateral deformity. Deformity due to post-operative infection and subsequent cartilage resorption was considered the cause in nine cases, each of which was unilateral. No patients presented with a history of bilateral infections. In infective cases, except in severe infection where the overlying skin has subsequently necrosed, the deformed skin can be released from the underlying scar tissue and is usually adequate to cover the new framework.

Principles for repair

The principles for correcting the abnormal contours or defects are consistent regardless of the cause:

Figure 1  Case 1 - Complex deformity involving the midpoint of the antihelix as well as the anterior and posterior roots of the antihelix. (a) Preoperative picture. (b) The small autogenous rib framework reproduces the normal contours. (c) Anterior approach allows direct vision of the deformity. (d) The sculpted framework replaces the removed deformity. (e) Skin closure. (f) Final result after one year.
1. The defect is analysed and the abnormal contours assessed by comparing with the unaffected ear, where possible.
2. A framework of conchal or costal cartilage is used to reconstruct the framework.
3. The framework is then covered with local skin or temporal fascia.

Instructive cases

Instructive cases will demonstrate how autogenous rib cartilage was used to achieve acceptable results.

When the helix is normal and the defect is limited to the central portion of the ear only a small segment of costal cartilage is needed. A short skin incision (2 cm) allows the access required to harvest the cartilage of the seventh rib. The deformed contours were most commonly seen involving the antihelix and its two roots. This may be a result of incorrect scoring or plication (e.g., cases 1–3).

When both the central structures and the helix are deformed a more complete framework has to be carved as is done with a standard total ear reconstruction. Sufficient rib cartilage will need to be harvested to recreate the helix and antihelix. If the cartilage is thick enough it is possible to sculpt all the structures in one piece (e.g., case 4).

A poor outcome after otoplasty usually involves the auricular cartilage rather than the overlying skin except when there has been severe destruction from infection and skin necrosis. In these cases an anterior approach is preferred. It allows for more accurate analysis of the deformed contours of the auricular cartilage. It is much easier to excise the damaged auricular cartilage, correctly place the carved three-dimensional framework and fix the new framework to the remaining auricular cartilage with this approach. The framework is usually fixed in place with 3/0 clear prolene. The posterior approach does not allow for direct visualisation of the anterior structures and requires wide skin undermining to reach the anterior deformity. A correctly sited anterior approach leaves an invisible scar however if there is already an anterior scar it should be used for the skin approach when possible.

Full thickness destruction of the ear is rare, but eight patients in this review suffered this severe complication.

Figure 2  Case 2 - Deformity of the antihelix resulting in a loss of the natural contour of the helix and concha. (a) Preoperative picture. (b) The framework reproducing the antihelix and part of the scapha which will support the curvature of the helix. (c) Anterior skin approach showing sharp edge of auricular cartilage. (d) Carved framework in place. (e) Postoperative result after one year.
Figure 3  Case 3 - Deformity of the antihelix with multiple irregularities. (a) Preoperative picture. (b) The autogenous rib cartilage sculpted to replace the deformity. Lobular reduction requested by the patient. (c) Anterior approach with adequate view of the defect. (d) Sculpted cartilage framework in place. (e) Postoperative result after one year including shortening of the lobule and relocation of the ear piercing.

Figure 4  Case 4 - Deformity of the antihelix and helix from a postoperative primary infection. (a) Preoperative picture. (b) Autogenous cartilage with helix and antihelix sculpted from one piece. (c) Postoperative result after one year. A portion of the concha and reshaping of the antihelix would have improved the final result.
These should be treated as a subtotal or total ear amputation. (e.g. cases 5–6).

Case 1: This patient had a deformity at the midpoint of the antihelix as well as part of the anterior and posterior roots. Resculpting the cartilage was considered to be unlikely to allow for good results. The posterior wall of the concha was very low with the antihelix lacking projection. Auricular cartilage would not have permitted reconstruction of the three dimensional contours. Therefore, these contours were sculpted from a small block of rib cartilage which provided all the necessary contours. An anterior approach was chosen to allow for appropriate exposure for repair. Once healed, the scar was well concealed (Figure 1a–f).

Case 2: This patient’s deformity of the antihelix resulted in a loss of the natural contour of the helix. This was likely to have been due to incorrect placement and excessive tightening of plication sutures in the upper part of the ear obscuring the root of the antihelix. Removing the plication sutures would not have reestablished the normal contours as the two branches of the antihelix and triangular fossa are not present. By recreating the antihelix the normal shape and size of the concha is reestablished (Figure 2a–e).

Case 3: This patient had a deformity limited to the antihelix but with multiple irregularities. Three previous attempts at correction had been performed through a posterior skin approach. A posterior approach does not allow for adequate exposure of the defect. It was evident in this case that the cartilage had been cut in several locations resulting in the irregularities seen. With the skin covering the auricular cartilage being very thin, any irregularities will be visible as seen in the preoperative photograph. Costal cartilage replaced the distorted auricular cartilage and restored a natural appearance to the ear’s contours (Figure 3a–e).

Figure 5  Case 5 - Full thickness defect of the middle third of the ear due to skin necrosis and secondary infection. (a) Preoperative picture. (b) Sculpted framework reproducing all of the contours except the root of the helix, tragus and antitragus. (c) Drawing of the skin approach with plan for flap from postauricular skin. (d) Reconstructed framework with elevation during the second stage using a split thickness skin graft from the scalp and advancement of the postauricular skin. (e) Postoperative result after six months.
Case 4: This patient had a unilateral deformity that was a result of a postoperative primary infection. Cartilage resorption occurred after chondritis of the middle portion of the ear resulting in horizontal folding of the antihelix and helix. The rib cartilage was thick enough to provide the framework for both the helix and antihelix. The strength of the costal cartilage provides a support which allows for re-expansion of the skin, and which resisted post-operative scar contracture (Figure 4a–c).

Case 5: This is a patient with a full thickness defect of the middle third of the ear. This is the only patient that was referred to us by the original surgeon. During the primary surgery an anterior scoring technique was used. Skin necrosis occurred over the antihelix that the referring surgeon attributed to an excessively tight dressing placed at home. Severe chondritis with pseudomonas was unable to be controlled with antibiotics. The result was destruction of the middle portion of the ear. This reconstruction will therefore follow the principles of any traumatic amputation. All the contours except the tragus, anti-tragus and root of the helix were needed. The posterior auricular skin flap will cover the framework in the first stage. The ear will be elevated in the second stage with a scalp split thickness skin graft (Figure 5a–e).

Case 6: This is a patient with a defect involving everything except the lobule and the tragus. She underwent 12 previous attempts at reconstruction including multiple local flaps and an opposite ear conchal graft. The failed skin flaps resulted in a wide range of skin scars in the auricular area necessitating removal of the scarred skin and coverage of the framework with a temporal fascia flap. The retroauricular sulcus was created in a second stage (Figure 6a–f).

When well established techniques are used otoplasty is likely to lead to a satisfactory result for both patient and surgeon. Complications however, can occur, and are occasionally severe and destructive. Usually they are the result of technical error or of destructive post-operative infection.

Figure 6  Case 6 - Defect involving the entire ear except the lobule and the tragus. (a) Preoperative picture. (b) Framework with the base sculpted from one piece and the helix added as a separate piece. (c) Drawing of the ear with the scarred skin that will be removed marked, and marking of the location of superficial temporal artery. (d) Temporal fascia flap covering framework. (e) Split thickness skin graft from the scalp covering the temporal fascia. (f) One year postoperative result after elevation.
Following the general principles of ear reconstruction, with a robust framework and appropriate soft tissue cover, can allow for very good results.

References