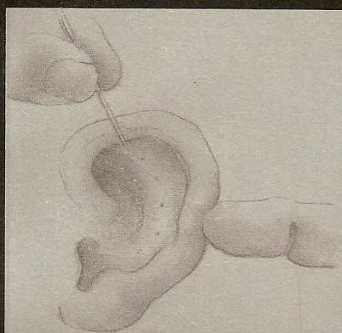


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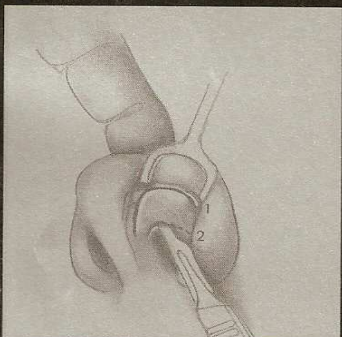
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OPERATIVE TECHNIQUES IN OTOLARYNGOLOGY- HEAD AND NECK SURGERY



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OTOPLASTY: SURGICAL CORRECTION OF THE PROTRUDING EAR

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Congenital abnormalities of the auricle span a spectrum of abnormalities from total anotia to slight asymmetries of an otherwise normal appearing ear. This article is dedicated to the management of the prominent, or protruding ear. A number of well-known surgical techniques have been described for the correction of the protruding ear. The ideal set of techniques must accomplish several goals. The desired post-operative results must include (1) a normal appearing auricular contour from both the frontal and lateral views, (2) an absence of unnatural sharp edges in the cartilage framework, and (3) symmetry of both ears. The techniques involved must be relatively easy to learn and must also yield reproducible results.

Congenital abnormalities of the auricle have been estimated to occur in 5% of the population.¹ Since the original description of surgical correction of the prominent ear in 1845, an evolution in surgical techniques has occurred due to the contributions of numerous surgeons.² A detailed understanding of auricular anatomy is necessary for successful surgical outcomes. The auricle develops from the 6 mesenchymal proliferations (hillocks) located at the dorsal ends of the first and second pharyngeal arches. These hillocks first appear in the 5-week-old embryo. These hillocks later fuse around the dorsal aspect of the first pharyngeal cleft (the future external auditory canal), giving rise to the auricle. Each hillock contributes to specific structures of the auricle. Areas corresponding to hillocks 4 and 5 are usually abnormal in the prominent ear.³ With further fetal development, the position of the auricle ascends from the lower neck to the side of the head.⁴ During this process, the primitive auricle matures to a more recognizable form.

Sensory innervation to the auricle is supplied by contributions from the following nerves: the greater auricular nerve from the cervical plexus, the auricular branch of the vagus nerve, the auriculotemporal branch of the mandibular nerve, and the lesser occipital nerve from the cervical plexus. The arterial supply of the auricle includes the posterior auricular and occipital branches of the external carotid artery, and the anterior auricular branch of the superficial temporal artery. Lymphatic drainage is to the preauricular nodes. The auricle is attached to the head by ligaments, cartilaginous attachments (via the external auditory canal), and skin. The ligamentous attachments include the anterior (zygoma to helix and tragus), superior (external auditory canal to helix), and posterior (mastoid bone to the concha) ligaments.

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The normal anatomy of the ear can be accurately understood by studying the topography of the auricle. Almost all surface landmarks of the auricle are created by the shape of the underlying elastic cartilage. The superior most aspect of the auricle is the helical curve that is a gently curving C-shaped cartilaginous fold that extends inferiorly to join the lobule. This helical cartilage extends anteriorly to form the root of the helix. Directly inferior to the helical root is the cartilaginous prominence of the tragus. The antihelix starts from the antitragus as a singular fold inferiorly and commonly divides superiorly into the superior and inferior antihelical crura. The scapha is an area of concavity that separates the helical and antihelical folds. The ear lobule, which is composed of areolar and fatty tissue, provides an important aesthetic landmark for the inferior auricle. The ear lobule and the helix should lie in the same vertical plane. The normal ear lobule varies widely, but it does not include an anteriorly or laterally projecting ear lobule.

The ideal auricular position relative to other structures of the head also contributes greatly to the aesthetically pleasing ear. From an antero-posterior perspective, the desired auriculocephalic angle should be between 15° and 30°, with 25° to 30° considered to be ideal. The distance from the helical rim to the mastoid should be 15 to 20 mm (Fig 1). Both auriculocephalic angle and helicomastoid distance can be slightly greater in females and narrower in males.

The vertical orientation of the ear should roughly parallel that of the nasal dorsum. A horizontal line extending from the inferior orbital rims should be at the same level as the superior border of the tragus. Symmetric positioning, size, and appearance of the ear are all important.

A number of classification systems for auricular deformities exist. The Tanzer classification is based on clinical findings and is commonly used⁵ (Table 1). The operative techniques described in this report focus mainly on the prominent ear.

Analysis of the prominent ear shows certain anatomic features that are commonly present.⁶ An underdeveloped antihelical fold is often present in the prominent ear. The curvature of the antihelix is critical to the appearance of the middle and superior auricle. The lack of antihelical folding is often related to the extent of auricular prominence. Associated features of the prominent ear can also include a prominent conchal bowl, widened auriculoce-

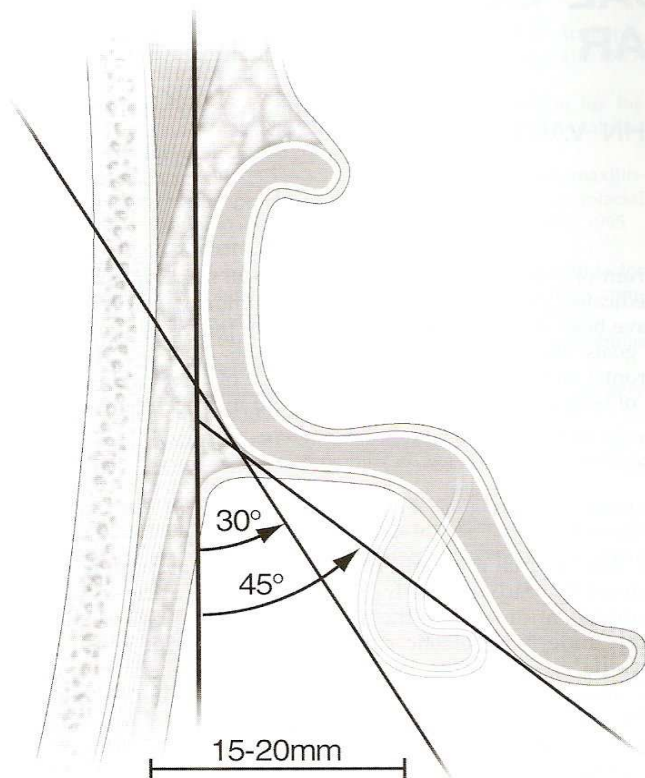


FIGURE 1. Axial section at level of crus helix. The aesthetically pleasing ear shows a auriculocephalic angle should be between 25 to 30°. The distance from the helical rim to the mastoid should be 15 to 20 mm.

phalic angle, and increased conchal distance from the mastoid bone (Table 2).

Another auricular variant is the constricted ear that is also known as the cup or lop ear deformity. The constricted ear is a subset of the hypoplastic ear and can present a diagnostic challenge to the untrained eye. Features of the constricted ear include a foreshortened helix, excessive folding of the superior helix, structurally weak cartilages, and decreased vertical auricular size. Both the constricted ear and the prominent ear may be accompanied by a protruding ear lobule.

TABLE 1. Tanzer's Clinical Classification of Auricular Defects

- (1) Anotia
- (2) Complete hypoplasia
 - (A) With atresia of the external auditory canal
 - (B) Without atresia of the external auditory canal
- (3) Hypoplasia of the middle third of the auricle
- (4) Hypoplasia of the superior third of the auricle
 - (A) Constricted (cupped or lop) ear
 - (B) Cryptotia
 - (C) Hypoplasia of the entire superior third
- (5) Prominent ear

Data from Tanzer.⁵

TABLE 2. The Main Characteristics of the Prominent Ear

- (1) Failure of antihelix to develop fully
- (2) Conchal enlargement or prominent angulation
- (3) Protrusion of the ear lobule
- (4) Wider than usual angle at the junction of the scalp and root of the helix.
- (5) Combinations of the above.

Data from Spira.⁶

CLINICAL PRESENTATION/INDICATIONS

The inheritance pattern of the prominent ear has been described as an autosomal dominant mode of transmission with incomplete penetrance.⁷ Potter reported that a dominant gene might be involved based on a review of a 92-member family tree of 5 generations of families with cupped and protruding ears.

On average, half of the members with ear abnormalities transmitted the trait to their children, whereas family members with normal ears who married other normal-eared people did not transmit this trait.⁷ There have also been cases of suspected intrauterine auricular deformity as a result of the umbilical cord being twisted around the head.⁸

Aesthetic considerations are the most common indication for performing corrective surgery on the prominent ear. The stigma associated with protruding ears can negatively affect a child's psychological development. As such, children are the most common candidates for otoplasty, especially before the start of the child's elementary education and group socialization. As Becker originally noted, "the protruding ear is a deformity, unlike most malformations, produces reactions of mirth in other people. To be constantly ridiculed about the deformity will break defense mechanisms of patients and can lead to the development of insecurities".³ The procedure is best performed after the age of 4 to 6 years so that the child has appropriate maturity and insight to participate in the post-operative course. As patients age, it is important to remember that the cartilage can become more calcified and less malleable, such that predictable long-term results may be more difficult to achieve in adult patients. In the adult population, men often seek this operation more frequently than women, who are more likely to be able to camouflage their ears with longer hairstyles.

HISTORY AND LITERATURE REVIEW

In 1845, Dieffenbach presented the first published technique for the surgical correction of the prominent ear in the German literature.² He described a technique in which only postauricular skin was removed, followed by suture fixation of the cartilage to the mastoid periosteum. The first English-language publication on otoplasty was an article by Ely in 1881.⁹ His technique involved the full thickness excision of both cartilage and skin.⁹ The cartilage excision provided for a longer lasting result, but the full thickness excision left patients with a scar on the anterior surface of the auricle. In 1890, Keen described a technique in which a postauricular incision was used to excise both skin and a V-shaped section of cartilage.¹⁰ This technique avoided a more visible scar on the anterior surface.¹⁰ In this paper he expressed the opinion that "if the skin alone is removed, the natural elasticity of the cartilage would stretch the skin in time and probably reproduce the deformity."¹⁰ Shortly thereafter, in 1891, Monks described 2 operations, 1 involving the removal of skin only, and the

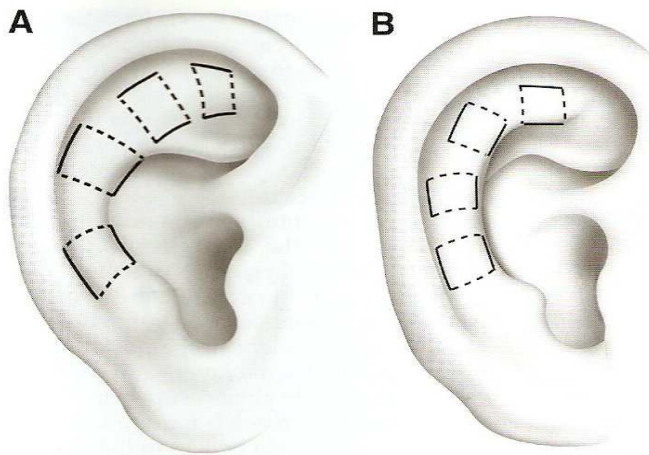


FIGURE 2. Marking the new antihelical fold. Symmetrical positioning of both antihelical folds is ensured by accurate marking of the suture placement sites. Note that the sutures are parallel to the natural curve of the antihelical fold (A). Sutures placed in a straight line (not parallel to the antihelical fold) will produce an unnatural tubular look to the antihelical fold (B).

other both skin and cartilage.¹¹ He avoided cartilage excision, except in cases of stiff cartilage, to prevent the unnatural sharp ridge that can follow cartilage excision. Luckett introduced an important concept to the otoplasty literature in 1910, when he noted the significant contribution of an absent or underdeveloped antihelical fold to the prominent appearance of the auricle.¹² In 1949, Becker published his original technique involving incision and excision of cartilage, removal of the cauda helix, and application of sutures.³ This paper helped lead to the development of many modern otoplasty concepts. In 1959, Farrior published his technique of excising partial thickness longitudinal cartilage wedges along the antihelix.¹³ After his study of axial cross-sectional auricular anatomy and patient outcomes, he noticed that by weakening the cartilage and reducing its memory, he could achieve a more natural-appearing and convex antihelix. He cautioned against full thickness cartilage excision aimed at creating auricular contours, and he showed the use of horizontal mattress sutures to permanently secure the shape of the newly-formed antihelix. In 1963, Mustarde introduced the use of horizontal mattress suturing alone without excising cartilage to reproduce the antihelical fold.¹⁴ He advocated this technique as a technically simple method of obtaining a natural appearing antihelical fold without destruction of the cartilage framework. In 1968, Furnas expanded on Mustarde's technique, with particular attention to the deeply cupped concha.¹⁵ He described the correction of conchal prominence through the use of permanent sutures that were placed through the full thickness of conchal bowl cartilage and then anchored to the mastoid periosteum.¹⁵

OUR OTOPLASTY TECHNIQUE

Adults and appropriately selected adolescent patients can undergo the operation with a combination of intravenous sedation and local anesthesia. Younger children and anxiety-prone adults often require general anesthesia. After careful review of preoperative photographs, the affected ear(s) are marked to outline the postauricular incision, as

well as the proposed placement of the mattress sutures. We have found that the best way to define the antihelical fold is to gently bend the ear until a natural curvature is achieved. Symmetrical positioning of both antihelical folds is ensured by accurate marking of the suture placement sites (Fig 2). Local anesthetic infiltration of the postauricular incision and anterior conchal bowl is accomplished with 3 to 6 mL of 1% lidocaine with 1:100,000 epinephrine. This injection assists in hemostasis and hydraulic dissection of the soft tissues from the perichondrium. The ears are then prepped with either iodine paint or hexachlorophene topical scrub, being careful to prevent excessive solution from entering the external auditory canal. The sterile field is draped in such a manner to allow for adequate exposure of both ears simultaneously. Bilateral exposure is important in allowing the surgeon to constantly scrutinize the symmetry of changes being affected throughout the operation. A dumb-bell-shaped incision is made postauricularly from the eminentia triangularis superiorly, extending inferiorly to 0.5 cm from the end of the auricular cartilage. This incision is approximately 2 mm from the postauricular sulcus and has a usual width of 1 cm at the center. Careful dissection of the thin postauricular skin is performed sharply with Converse scissors. The dissection is extended anteriorly to the fossa antihelicalis and posteriorly to the auriculomastoid angle. During this dissection, the postauricular muscle is dissected free from the cartilage. An effort is made not to disturb the fine branches of the greater auricular nerve in this area. Wide

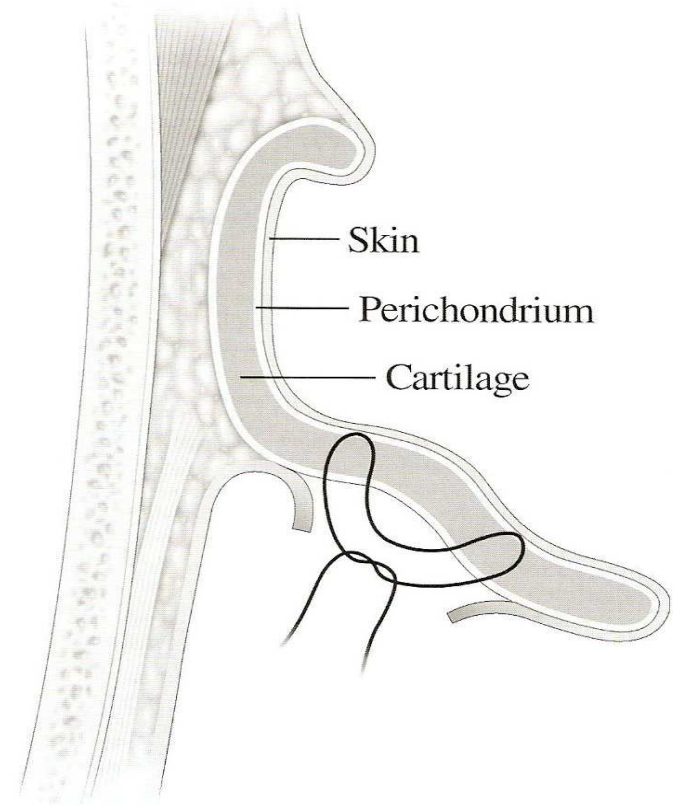


FIGURE 3. Mustarde suture technique. Antihelical contour is created by placing permanent horizontal mattress sutures.

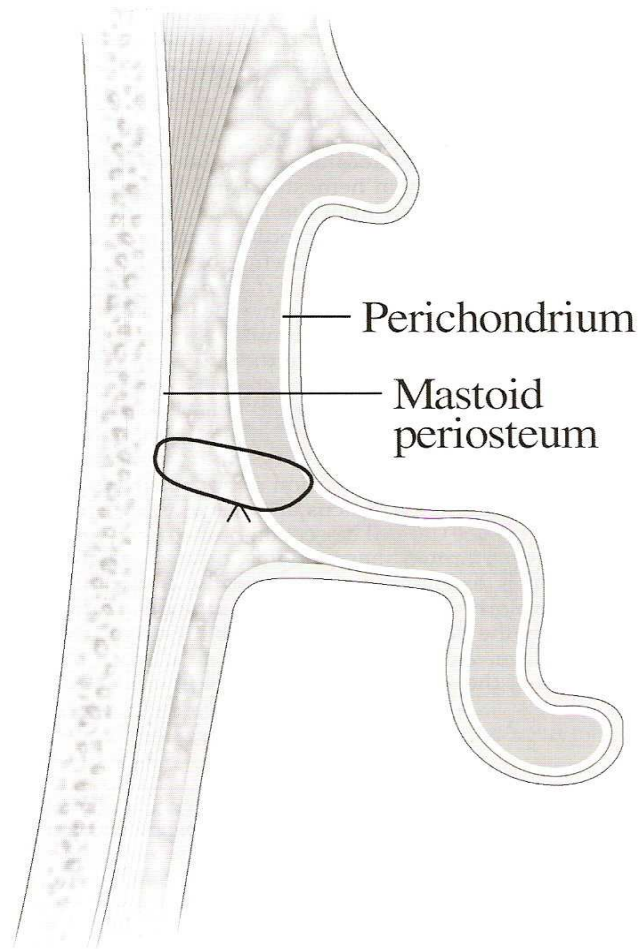


FIGURE 4. The conchal-setback suture. Desired auriculocephalic position is achieved by the placement of a permanent suture from conchal cartilage to the mastoid periosteum.

exposure of the postauricular cartilage and auriculomastoid angle is important. A moderate amount of soft tissue is removed from the auriculo-mastoid angle to facilitate conchal bowl setback. The position of the new antihelical fold is once again assessed with gentle bending of the auricular cartilage. We prefer 4-0 or 5-0 permanent horizontal mattress sutures for recontouring the antihelical fold (as originally described by Mustarde)¹⁴ (Fig 3). A 25-gauge needle is then passed antero-posteriorly through auricular cartilage to assist in the exact placement of mattress sutures. We find the application of 4 to 5 such sutures is needed to recreate a natural-appearing antihelical fold. All sutures are placed and their position is secured by placement of a hemostat on their free ends. With all the sutures being properly aligned and having the right amount of tension, they are tied one by one, starting from the most inferiorly positioned suture and proceeding superiorly.

After establishing the antihelical fold, attention is then directed to the conchal bowl and ear lobe position. In cases

of an excessively protruding conchal bowl, postauricular soft tissue can be more widely removed to allow extra space for the conchal setback. A permanent suture is then placed from the conchal cartilage to the mastoid periosteum as originally described by Furnas¹⁵ (Fig 4). It is important to be certain that these sutures incorporate periosteum, and one should be familiar with the characteristic feel of suture fixation to periosteum.

Finally, deformities of the lobule can undermine an otherwise optimal otoplasty. The ideal lobule position should lie in the same vertical plane as the helix and should appear symmetric with the contralateral side. An excessively protruding ear lobule can be set back with a suture placed near the inferior extent of the postauricular incision that incorporates the dermal layers and sets back the fibrofatty tissues of the lobule posterosuperiorly to the conchal bowl (Fig 5). If further setback is required, another suture can be placed from the cauda helices to the mastoid periosteum. In rare cases, the cauda helices can be repositioned by dividing their fibrous connections to the fissura antitragohelicina, and then suture-fixating it to the concha. Excessive lobular skin can also be specifically addressed. A posteriorly based fusiform skin excision or advancement M-plasty can be used to remove excess tissue and reshape the lobule.^{16,17}

After all modifications are concluded, the ears should appear symmetric and possess a natural contour to the antihelical fold, conchal bowl, and lobule. Wound closure is achieved with 5.0 PDS suture in the subcuticular layer, followed by 6.0 fast-absorbing suture in the skin. Cotton balls soaked in mineral oil are molded into the conchal bowl and postauricular sulcus. A mastoid-type dressing is applied to the operated ear(s), and the patient is normally sent home the same day. Antibiotics are routinely prescribed. The patient is seen again the next day, at which time the dressing is removed. Another dressing is applied and is left in place for 5 to 7 days. Patients are then instructed to wear a hand-band during the daytime when possible for the next 2 to 3 weeks and are also instructed to wear a modified stocking over the ears while sleeping for the next 6 to 8 weeks. Patients are allowed to resume sports activities by 12 weeks postsurgery.

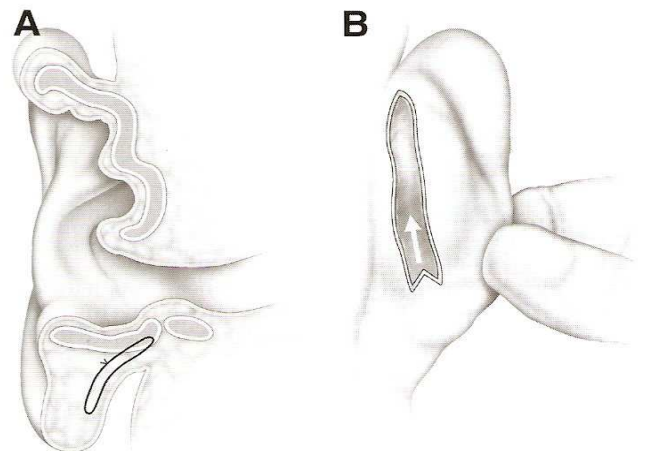


FIGURE 5. Lobule adjustments. (A) Contour adjustments can be made with sutures that incorporate dermal and fibrofatty tissues of the lobule to the conchal bowl. (B) M-plasty type closure at the inferior end of the incision. By advancing the triangle superiorly, the earlobe will be moved closer to the head.



FIGURE 6. Patient before (A) and after (B) correction of protruding ears.

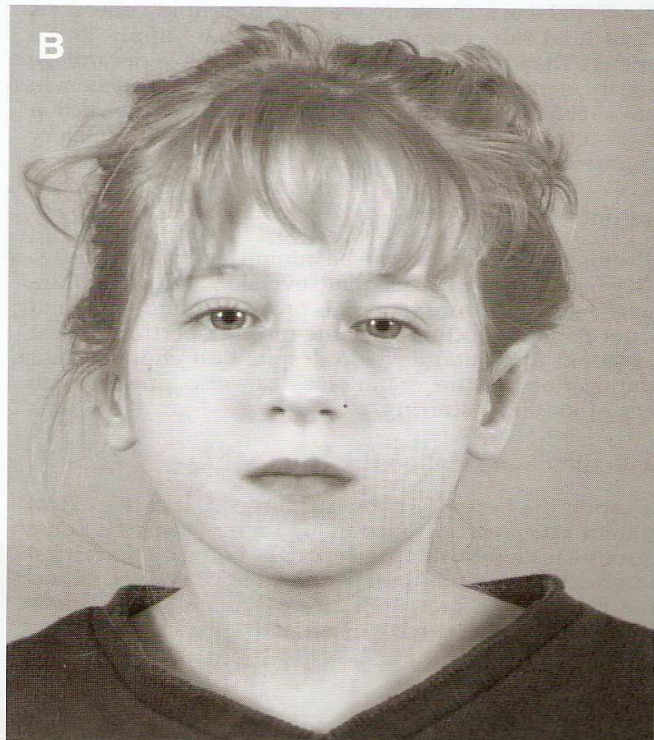


FIGURE 7. Patient before (A) and after (B) correction of protruding ears.

COMPLICATIONS

The patient most often embraces the changes noticed after corrective surgery of the auricle.¹⁸⁻²⁰ Nevertheless, like all surgical procedures, complications can occur and less than ideal aesthetic outcomes can be observed.

Hematoma

In the immediate postoperative period (days 1 through 5), close monitoring of the ear for hematoma formation is important. The patient should be educated regarding this rare complication to facilitate its timely recognition. The early hallmarks of a developing hematoma include increasing tightness in the auricle, pain, and increased fullness of the auricle. Auricular hematomas are treated by prompt evacuation and removal of any collections. Prophylactic postevacuation antibiotics can help in minimizing secondary infection. Reported hematomas rates from 0.04% to 3.3% have been noted, with 2% being more typical.^{19,21}

Infection

Infection of the newly operated ear can be quite unsettling to both the patient and surgeon. Infection may arise from the skin, underlying cartilage, or secondarily from fluid collections such as a hematoma. Broad-spectrum antibiotics, along with drainage of any fluid collections, are key to successful management of auricular infections. Antibiotic coverage should target *Staphylococcus* and *Pseudomonas* bacterial species.

Cartilage Loss

An interruption of the perichondrial vascular supply to auricular cartilage can compromise the avascular cartilaginous framework. Pressure created from fluid collections of any kind can compromise the vascular supply to the cartilage. The insult can range from a minor loss of cartilage integrity to more substantial areas of cartilage destruction. In cases of abscess and hematoma, further cartilage destruction can result from enzymatic degradation and inflammatory responses.

Scarring

Postoperative scarring can be minimized by tension-free skin edge closure with adequate eversion and use of minimally reactive suture material, proper wound care, and proper patient selection. In some cases, hypertrophic scar and keloid formation develop despite best efforts at scar minimization. Suture granulomas can also present with areas of localized scarring.

Aesthetic Complications

Despite the best efforts by the surgeon, less than ideal aesthetic outcomes are encountered after otoplasty. Some degree of aesthetic compromise can be noted by the critical and objective observer in most patients who have undergone otoplasty. More significant postoperative aesthetic complications can be recognized and are included in the following review.

Suboptimal Outcomes

A malpositioned auricle may become apparent immediately after removal of the occlusive dressing. Noticeable

asymmetry, iatrogenic deformities, inadequately addressed pre-existing malformations, functional deformities, and unnatural contours all can occur. The loss of intended auricular shape may be caused by technical error, suture breakage, postoperative trauma, patient noncompliance, or unpredictable factors (eg, cartilage memory or scarification from healing). If cartilage-cutting techniques are used, resected or divided areas of cartilage may manifest themselves through the thin auricular skin. Sharp edges and contours can undermine the natural look of the ear. Fixation sutures placed through auricular cartilage can sometimes be visible through skin on close inspection. The severity of these deformities may become indications for revision surgery.

Telephone Ear Deformity

The telephone ear deformity is characterized by overprominence of the superior and inferior helices of the auricle, particularly in relation to the conchal bowl. Overcorrection of the middle third of the auricle, in comparison with the superior and inferior thirds, can produce this effect. This deformity can result from overresection of soft tissues from the auriculo-mastoid angle, or from setting the conchal bowl too closely to the mastoid. Unrecognized or uncorrected deformity of the cauda helices or relapse of repairs made to the superior auricle can also lead to this deformity.

Deformities of External Auditory Canal

Conchal repositioning or resection can alter the relationship between the conchal bowl and the external auditory canal (EAC), at times causing EAC narrowing. Sutures placed too posteriorly on the concha can also lead to narrowing of the EAC.

Deformities of the Tragus and Ear Lobule

Changes made to the superior and middle auricle may shift the position of the tragus and ear lobule. Medializing a laterally displaced concha can change the relative position of the tragus. An undesirable anterior projection of the tragus can result. A final review of the auricle may necessitate tissue manipulations of the ear lobule to idealize its position or shape.

The stigma of surgery-induced deformities may become greater than the original, natural deformity. To minimize such complications, a careful review of preoperative findings is essential to guide the planning of a logical and well-thought-out surgical plan. Attention to precise suture placement, adherence to minimal tissue resection, and knowledge of different otoplasty techniques can further help to achieve desirable outcomes.

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