Chapter 8: Plastic surgery of the ear

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In the last 20 years, great advances have been made over earlier surgical methods of reconstructing the auricle. Otoplastic surgeons have learned to solve a number of problems inherent in a region that is extremely difficult to reconstruct surgically (Spira, 1974).

The present chapter offers a concise survey of surgical methods now in use for:

(1) auricular malformations
(2) acquired deformities
   (i) tumours
   (ii) trauma.

The body of literature covering the same ground is large, and the standardization of terminology is still awaiting agreement. The usual practice, observed here, is to classify defects, especially auricular deformities, by the surgical methods of treatment (Tanzer, 1974).

Anatomy

The anatomy of the external ear is described in Volume 1. The surfaces of the auricle will be referred to here as anterior and posterior - 'postauricular' will thus mean 'of the posterior surface of the auricle'. The term 'retroauricular region' will signify the mastoidal area.

Classification

The definitions that follow are modifications, by Rogers (1968), of those proposed by Marx (1926).

First degree dysplasia

Most structures of a normal auricle are recognizable.

Second degree dysplasia

Some structures of a normal auricle are recognizable (second degree microtia).

Third degree dysplasia

None of the structures of a normal auricle is recognizable (third degree microtia or anotia).
Description of a normal auricle

The different areas of the auricle lie in sharp relief in the normal ear. When the ear is viewed from the front, the helical rim lies slightly further out from the side of head than the antihelical fold.

An abundant supply of blood is carried to the external ear by the superficial temporal artery and branches of the posterior auricular artery. The sensory supply to the auricle is transmitted by the anterior and posterior branches of the great auricular nerve, which run parallel to the posterior auricular artery and the median anterior auricle. The auriculotemporal nerve supplies roughly the area of the anterior auricular arteries.

The normal protrusion of an ear is about 30°, or between 2 and 2.5 cm. The angle of inclination is measured from the long axis of the auricle to a line through the external auditory canal and parallel to the facial profile line. The inclination of the auricle is between 20° and 30° and is generally parallel to the profile line of the nose. The average length of the pinna is 63.5 mm in men and 59 mm in women (Table 8.1).

### Table 8.1 Average length and width of the normal auricle (Farkas, 1974).

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Males</th>
<th></th>
<th>Females</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Length (mm)</td>
<td>Width (mm)</td>
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<td>Length (mm)</td>
</tr>
<tr>
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<td>50.0</td>
<td>31.5</td>
<td></td>
<td>46.8</td>
</tr>
<tr>
<td>6</td>
<td>55.3</td>
<td>33.4</td>
<td></td>
<td>53.5</td>
</tr>
<tr>
<td>18</td>
<td>63.5</td>
<td>35.3</td>
<td></td>
<td>59.0</td>
</tr>
</tbody>
</table>

The normal angle between the concha and scapha is approximately 90°, with deviations of as much as 15°.

Where the angle at which the auricle protrudes exceeds 40°, or that between the concha and the scapha exceeds 110°, it is known as a protruding ear. In most instances, the distance from the side of the head to the helical rim exceeds 2.5-3 cm. The main categories of prominent ear are marked by a prominent antihelix, lack of a superior antihelical crus, lack of an antihelix and hypertrophy of the concha.

Surgery for auricular malformations

First degree dysplasia

Definition

Most structures of a normal ear are recognizable. Normally reconstruction does not require the use of additional skin or cartilage.
Macrotia

Wedge-shaped excision

A simple way to reduce a macrotic ear is by excising a wedge of skin and cartilage. This method's shortcomings are that it deforms the auricle slightly and leaves conspicuous scars.

A modification of the sliding helix procedure

The reductive procedure recommended combines a sliding helix with a crescent excision of anterior skin and cartilage (Gersuny, 1903). The author's own otoplastic method is used to form the antihelix (Weerda, 1982a-d). The results are excellent. A multitude of variations on the wedge-shaped and crescent excisions have been described in the literature.

Protruding ears

The synonyms are 'prominent ears', 'bat ears', and 'lop ears'. One of the goals of otoplasty is to invent a single simple operation for correcting all the different types and degrees of protruding ears.

A child's ears grow only slightly after his or her sixth birthday, so that children with the stigma of prominent ears may be operated on about that time without any detrimental effects on the long-term growth of the auricle. Although the size of the ear does not increase significantly, the consistency of the cartilage does change, becoming less flexible as the child grows older. This may influence the method and results of surgical correction (compare Table 8.1).

The main features of protruding ears are underdevelopment or absence of the antihelix and crus superius and an overdeveloped concha. There are three widely used corrective procedures and scores of variants that are preferred by individual surgeons.

Converse procedure

This is the procedure used by most plastic surgeons (Converse et al, 1955; Converse and Wood-Smith, 1963; Converse and Tanzer, 1977). The posterior auricle is incised parallel to the helix and the cartilage underneath exposed. The superior and inferior borders of the antihelix are marked on the posterior aspect of the exposed cartilage with straight cutting needles and blue ink.

Incisions, which should not meet, are made through the exposed cartilage. If need be, the surface between the upper and lower incisions can be thinned with an electric diamond drill or rotating wire brush. This last procedure contributes to better results when the antihelix and crus superius are folded with mattress sutures. Conchal cartilage and the cauda helicis may have to be removed. An elliptical excision of postauricular skin may also have to be made (Walter, 1972). The incision in the posterior auricle is closed with interrupted or running sutures.
Modification of the Converse procedure

Whereas the Converse procedure uses the incisions illustrated, in the author's modification (Weerda, 1979, 1982a-d), the cartilage is thinned above and below a new antihelix with a diamond burr. This method can be applied in correcting other anomalies besides protruding ears, for example in dysplasia surgery, in reconstructing a missing helical rim, and in elevating a cup ear antihelix.

Mustarde's procedure

When the ear cartilage is thin, Mustarde (1963) prefers to fold the antihelix with mattress sutures without incising or weakening the auricular cartilage. Except in this one respect, Mustarde's procedure is similar to that of Converse.

Stenström procedure

The scapha, conchal rim, and crus superius are marked with straight cutting needles and blue ink after exposure of the posterior auricular cartilage (Stenström, 1963). An incision is made through the cartilage of the scapha, and the anterior cartilage of the antihelical area is freed of skin and perichondrium. The cartilage here is scored parallel to its free margin with a knife or an instrument specially designed for this purpose.

With the tension thus taken out of the cartilage, the antihelix begins to curl back, and assumes a normal curvature without any suturing.

Additional procedures

Rotation of the concha

One way to avoid an elliptical incision of cartilage from the hypertrophic concha is by rotating the concha to the mastoid (Furnas, 1968; Spira and Stal, 1983). The posterior auricular muscle is divided, and the mastoid exposed. The concha is rotated towards the mastoid and fixed with 3-0 Vicryl sutures.

Mild pressure dressings

The ear is carefully packed with a cotton-wool dressing that has been soaked in mineral oil. The dressing is applied for 7 days. From the ninth day after surgery, when the patient's sutures are removed, he/she should wear a second, elastic dressing or cap for 4 weeks.

Complications

On the rare occasions when a haematoma or perichondritis occurs, it is treated by coagulation and with antibiotics. Unsatisfactory results are corrected 6 months after surgery. Hypertrophic postauricular scars are treated with pressure and cortisone injections shortly after surgery and again by scar revision one or 2 years later if necessary.
Cryptotia (pocket ear)

Definition

The upper part of the auricle is buried beneath the temporal skin.

Procedure

An incision is made along the helical rim, and a flap is incised at the retroauricular hairline. After the auricle has been elevated, the flap is used to cover the postauricular defect. The wounds are closed with sutures.

Colobomata

A small transverse coloboma can be closed by Z-plasty. The ear illustrated is also protruding; the otoplastic procedure was used to correct the additional anomaly.

Larger defects are closed with a rib cartilage support and retro- and postauricular flaps.

A coloboma of the lobule is closed by excising and adapting skin.

Lobule reconstruction

This will be discussed in connection with trauma surgery.

Cup ear deformities

Type I

Synonyms are 'lop ear, 'lidding helix', 'constricted helix', 'minor (or moderate) cupping'. The otoplastic procedure for treating cup ear deformities of type I is outlined above.

Type II

A more severe lopping of the upper pole of the ear is corrected by a modification of Tanzer's (1974) method. The postauricular skin is incised, and the cupping cartilage is exposed on both sides. The cartilage is dissected and turned approximately 180°. The otoplastic procedure is used to elevate the scapha.

Rib cartilage is used when a short ear has to be expanded, or for additional support when the auricular cartilage is limp (Weerda and Walter, 1984).

After surgery, the auricle is supported for 14 days by mattress sutures.
Second degree dysplasia (second degree microtia)

Definition

Some structures of a normal auricle are recognizable. Reconstruction requires the use of some additional skin and cartilage.

Type III (severe) cup ear deformities

The severe cup ear is malformed in all its dimensions.

First stage of reconstruction

The auricle is incised and expanded by a method similar to that described by Davis (1974). The middle part of the auricle is reconstructed with a rib cartilage support and a retroauricular flap.

Second stage

The ear is raised, and a full-thickness skin graft is sutured and glued to the rough post- and retroauricular surfaces.

The mini ear

The mini ear is reconstructed in the same way as severe cup ear deformities.

Third degree dysplasia (third degree microtia or anotia)

Definition

None of the structures of a normal auricle is recognizable. Reconstruction requires the use of skin (from the surrounding area) and large amounts of cartilage.

Auricle reconstruction (normal hairline)

The procedure for treating third degree microtia is similar to the procedures described by Tanzer (1974), Converse and Brent (1977), and Brent (1980).

First stage

Before surgery, a template of the size of the patient's normal ear is cut out of a piece of transparent celluloid. The position of the new auricle is outlined on the mastoid region and a rib cartilage support is carved. Remnants of auricular cartilage are removed by a small incision in the vestige. The mastoidal skin is tunnelled, and the rib cartilage support inserted. With mattress sutures, which are tied over gauze, and fibrin sealant, the thin mastoid skin is snugged into the helical sulcus.
Second stage

The auricle is raised from the side of the head, and the postauricular defect is surfaced with a full-thickness skin graft from the buttocks. The lobule can be rotated in the same stage into a transverse position.

Third stage

In this stage the scapha is formed, which may require the removal of fibrous tissue and fat. The crus helicis, tragus, antitragus, and concha are formed in the third or in a fourth stage according to whether or not the helix is well defined.

Postoperative care

The reconstructed ear (its concavities in particular) and the auriculocephalic sulcus are packed with fluffed oiled wool. The whole area is then covered with a bulky wool and gauze dressing and bandaged in order to cushion pressure on the ear, especially at night.

Antibiotics may be administered for the first 3 or 4 days after surgery.

Complications

1. A small necrosis exposing cartilage is covered with an antibiotic ointment to prevent the cartilage from drying out.

2. A larger necrosis is excised. The defect created by excision is covered with flaps from the surrounding area.

3. Because fibrin glue is used, bleeding rarely occurs. In the event of a haematoma, the bleeding has to be staunched and the haematoma evacuated.

4. Infection is likewise a very rare complication. When an infection occurs, the surgical wound has to be opened and the affected cartilage removed. An antibiotic appropriate to treating the infection is administered.

Middle ear reconstruction

The planning of treatments is outlined. Middle ear surgery is not performed on any child with unilateral microtia and atresia when one ear is normal. Reconstruction (Weerda, 1984) of the pinna is begun once a child reaches the age of five or six (Jahrsdorfer, 1974; Bellucci, 1980; Weerda, 1985b).

A child with bilateral microtia and atresia is fitted with a bone-conduction hearing aid before his or her first birthday. The child has to be at least four before the author will consent to perform middle ear surgery. Children aged 5 or 6 years are operated on for bilateral microtia after they have undergone successful middle ear surgery.
Surgery for acquired deformities

Often it is irrelevant to one's choice of procedure whether a defect is due to tumour excision or traumatic avulsion.

Tumour surgery

A small defect in the rim from a wedge-shaped excision can be closed by a single operation (Converse and Brent, 1977). A defect in the crus hellicis is closed with a preauricular flap. The anterior part of the upper auricle is reconstructed according to a modified version of the sliding helix procedure (Gersuny, 1903; Antia, 1974). Any additional preauricular defect can be closed with a rhomboidal flap. The author prefers to reconstruct conchal defects with a full-thickness skin graft taken from either auriculocephalic sulcus. Alternatively a pedicled retroauricular graft may be used.

Subtotal resection with preserved helix

Microscopically controlled surgery allows preservation of parts of the auricle (Weerda, 1978; Weerda and Walter, 1984). A helix and lobule saved in such a fashion are showed; the other parts of the auricle were reconstructed in one stage with a bilobed flap from the neck. To prevent shrinkage, a defect-filling support of rib cartilage has to be inserted. Epithelium must be removed preparatory to affixing a folded transposition flap.

In reconstructions after ablation or petrosectomy, flaps from the surrounding area or myocutaneous pectoralis major island flaps are used.

Trauma surgery

After removal of a haematoma, seroma, or fibrous tissue (wrestler's ear, cauliflower ear), the thinned skin is readapted with fibrin glue and sutures (Weerda, 1979, 1980). A deep abrasion of skin from an auricle, or through-and-through laceration, is repaired with thin sutures if the auricle is well supplied with blood. Small defects in the rim or the anterior upper part of the auricle are closed with Burow's triangles of a sliding helix (Gersuny, 1903; Antia, 1974; Brent, 1978).

Replantation

Replantation of a freshly avulsed auricle or part of one is hazardous work. The largest avulsed parts that have been successfully replanted as composite grafts have been under 26 x 10 mm.

Baudet's method of replantation

The only methods that significantly diminish the risks incident to replantation of larger parts of the auricle are those described by Baudet, Tramond and Goumain (1972) and Arfai (after Spira, 1974). Ninety per cent (or 13 out of 14 of replantations of larger parts of the auricle by a simple procedure have resulted in loss of the replant. By contrast, 90% of the auricles replanted experimentally according to Baudet's method have taken. Replantation
should be performed within 24 hours of avulsion (Weerda, 1986). Arfai's modified version of the Baudet operation preserves the postauricular skin of the totally avulsed auricle. The auricle is replanted as a composite graft. The fenestrated cartilage and the postauricular skin are glued and sutured to the rough surgically enlarged mastoid wound (Spira, 1974. Using Arfai's method, the totally avulsed ear could be reconstructed in four stages - the lobule was repaired with a Gavello flap.

**Microvascular anastomosis**

This is discussed in connection with surgery for total avulsion by Buncke and Schultz (1966) and Pennington, Lai and Pelly (1980). Their advice is that auricles should be replanted within 5 hours of avulsion.

**Reconstruction of partially avulsed ears**

**The upper part of the pinna**

In tumour and trauma surgery, reconstruction of parts of the auricle is begun by incising and tunnelling the retroauricular skin and inserting a support of rib cartilage. The helix is moulded with fibrin glue and mattress sutures tied over gauze. In a second stage, the auricle is raised, and the post- and retroauricular defects are covered with full-thickness skin grafts. Later on the ear can be corrected, for a satisfactory end result, by deepening the scapha os crus helicis or other parts of the auricle.

**The middle part of the auricle**

This is reconstructed in the same manner as its upper part.

**The lower part of the ear**

This and the lobule are both reconstructed by the Gavello-flap technique.

A rib cartilage support is embedded to prevent shrinkage. The work of shaping the auricle is completed in a second stage.

**Reconstruction after the total loss of an avulsed auricle**

**Retroauricular implantation**

A rib cartilage is embedded under the retroauricular skin in the same way as in the procedure for correcting severe microtia. The helix is moulded with fibrin glue and mattress sutures. The auricle is raised and formed in either three or four stages.

**The fan-flap method**

When a low hairline makes it impossible to repair a microtic or avulsed auricle by one of the methods outlined so far, a support is embedded under the pedicled temporoparietal fascia. The fascia can be adapted to the support with fibrin glue and by suction drainage. A
full-thickness skin graft is glued to the rough surface. The auricle is raised from the side of the head in a second stage (see Brent and Byrd, 1983).