INJURIES OF THE PINNA

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Trauma to the auricle is common in all age groups. The ear's position on the head exposes it to repeated insults and offers little protection when one turns to avoid direct facial impact. The tenuous peripheral blood supply depends on the integrity of the attachment of the base of the auricle. Disruption of this vascularity often leads to severe deformity of an otherwise intact auricle. This exposed appendage, with a high cartilage-to-skin ratio, has little protection from thermal, blunt, and sharp injuries.

The initial objectives in treating trauma of the auricle are to prevent even minor complications of infection and avascularity, which can destroy an ear within days. Reconstruction of the defects should be a secondary endeavor after the initial insult has been stabilized. It is essential to have a basic aesthetic knowledge of the normal appearance, configuration, size, and position of the auricle. Ears can be varied even on the same person, without appearing conspicuous.

The ear can be conceptualized as a three-layered structure with the concha being the most interior and the helix the most lateral. The scapha is the middle tier and is the main structural support. Re-creation of the anatomic subunits, folds, and convolutions is of secondary importance to obtain normalcy. Although several authors have described the ear with formulas, equations, and measurements, no one has suggested that the auricle empowers the beauty or evokes emotions as do the eyes, lips, and face. Perhaps the ideal ear is one that brings little attention to itself.

ANATOMIC CONSIDERATIONS

The delicate, non-hair–bearing, extremely thin auricular skin is unique. Gaining adequate coverage from adjacent areas is ideal, but often challenging. Donor skin coverage must be well vascularized and unscarred. Often there is a lack of nontraumatized, nonpileous mastoid skin available. Reconstruction should never compromise the position of the ear in the attempt to avoid placing non-hair–bearing skin on the auricle. Even a simple folded skin graft is thicker than the pinna, which consists of five layers (skin, perichondrium, cartilage, perichondrium, and skin). Skin grafts, also lacking normal texture and color, are a disappointing compromise.

The ear must have structural support to prevent distortion from scar contraction. Cartilage grafts will maintain the integrity but require vascularized tissue coverage to nourish grafted skin placed over it. Reconstruction should balance the effects of an additional deformity in another part of the body at the donor site. Supporting cartilage grafts from adjacent anatomic subunits of the traumatized ear, from the opposite auricle, and from the nasal septum meet these objectives. Rib cartilage lacks the delicate qualities of auricular fibroelastic cartilage. In many patients over age 40, much of the costal cartilage is already ossified and cannot be sculpted into the appearance of an auricle.

CLINICAL PROBLEMS AND THEIR CORRECTION

Birth Injuries

The unique characteristics of the neonatal auricle expose it to deformations when lying in abnormal intrauterine positions. The circulating maternal estrogens in the neonate delay binding of the mucopolysaccharides in the chondroitin sulfate matrix of the cartilage. This causes the ear to be excessively pliable and supple. If the ear is dysmorphic (i.e., deformed, but all anatomic subunits are present), it can be molded into a normal configuration with cotton and tape. The hair is shaved, and the deformed ear is sculpted by placing moist cotton in each abnormal part. Benzoin and tape secure the cotton, which remains for 10 days. This remolding technique is only effective if initiated within the first week while there is still a high concentration of circulating maternal estrogens.

Cysts

Uninfected sebaceous cysts can often be atraumatically removed without an incision. A dose of 0.2 to 0.3 ml of triamcinolone acetonide (Kenalog) 40 mg per milliliter is injected into the cyst, which usually lies in the fibroadipose lobule. One week later the area is injected with lidocaine (Xylocaine), and the liquified sebum is expressed through a puncture made in the skin with a 14 g needle. The decompressed lining of the cyst can be removed with an alligator forceps. No further treatment is necessary.

Keloids

Keloids represent major problems in susceptible people. It is now possible to differentiate keloids and hypertrophic scars in their physical and biochemical

properties. Electron microscopic scanning shows that the collagen bundles run parallel in tubelike groups in normal tissue. In hypertrophic scars the bundles also run in a parallel orientation but are flat. There are no discrete collagen bundles but rather a random organization of sheets of collagen in keloids. Biochemical analysis of the proline hydroxylase and collagenase enzymes reveals enormous concentrations in more disorganized tissue. These enzymes, necessary for collagen synthesis and degradation, are increased 3 to 4 times in hypertrophic scars, and elevated 20 times in keloids. Immunologically, the immunoglobulin G (IgG) levels within the actual keloid are elevated, although the circulating IgG levels are normal. Other studies have suggested that the IgE-mediated mast cell by-products, heparin and histamine, which decrease mature cross-linked collagen and increase soluble-fraction collagen seen in keloids, may be culprits.

A wide variety of techniques have been described to master this menacing, often recalcitrant problem. Injections, laser manipulation, simple excision, interferon, and even irradiation have been used. I have had success with the modifications of the technique described by Chenny with intralesional injections of Kenalog 40 with lidocaine and Wydase.

- Inject every 2 weeks for 4 to 5 weeks and evaluate for softening.
- Atraumatic surgical excision and intraoperative injection of Kenalog.
- Compression ear rings.
- Booster dose of Kenalog at 1 month.
- Monitoring with Kenalog as necessary if keloid recurs.

Several authors have described excellent results with immediate postoperative low-dose radiation, which destroys fibroblasts. However, the malignant potential of radiation therapy for a benign disease in a young person seems inappropriate.

Thermal Injuries

Thermal injuries of the auricle are associated with more generalized head and neck burns. Initially, there is cell damage with vascular permeability. If infection ensues, rapid cell destruction occurs. Perichondritis and chondritis are devastating complications that can begin as localized edema and progressive erythema 3 to 5 weeks after injury. This underlying, indolent process may even occur in an apparently "healed" ear. *Pseudomonas aeruginosa* and *Staphylococcus aureus* are the most common organisms that rapidly cause cartilage necrosis, loss of support, and complete loss of the pinna.

The severity of injury is classified as first, second, or third degree. The fourth degree is complete initial necrosis and autoamputation of the ear. First-degree burns have mild tissue erythema and discomfort. No treatment is necessary, and no problems develop. Second-degree burns necessitate hospitalization and preventive therapy. The vesicles should not be disrupted. The hair is shaved, and the ear is gently cleansed daily. Sulfamylon or sulfadiazine silver cream is applied, and headrests are used during sleep without external dressings. Systemic antibiotics are controversial. Third-degree burns necessitate aggressive emergency care. Minimal debridement under local anesthesia is begun, and the exposed cartilage is treated as a second-degree burn with cleansing and protection to allow granulation tissue to form. Intravenous ceftazidime is given, and Ciprofloxin drops are instilled into the canal. If infection and cellulitis develop, the auricle should be filleted, and drains should be instilled with pseudomocidal and staphylococcidal antibiotic irrigations. Fourth-degree injuries are aggressively debrided, treated for infections, and reconstructed no sooner than 1 year after injury.

BLUNT TRAUMA

Blunt trauma to the auricle is commonly treated in busy emergency rooms. This type of injury is most often seen in wrestlers, boxers, and people with neurologic disorders who frequently fall. The pathogenesis of blunt ear trauma is related to the differences of tissue on the medial and lateral sides. The medial surface has loose subcutaneous tissue that dissipates direct forces. The tightly adherent skin on the lateral side has no subcutaneous layer to disperse trauma away from the perichondrium. Ecchymosis and seroma-hematoma are the usual resulting injuries. Isolated ecchymosis occurs from shearing forces and rupture of capillaries. Analgesics and cold compresses for 48 hours, without antibiotics, are all that are necessary when the skin is intact. Hematomas usually occur on the lateral side from separation of the cartilage and perichondrium, where the protective subcutaneous tissue is lacking. The loss of nourishment from the separated perichondrium can lead to rapid necrosis and deformity. If not removed, the hematoma can quickly become organized and eventually be replaced by dense fibrous tissue or even new cartilage. The hematoma should first be aspirated with an 18 g needle and packed with gauze. Recurrences must be incised and drained into a less conspicuous area. Stenting with cotton or Silastic sheeting tied over bolsters for 7 to 10 days is essential to prevent inevitable recurrences. Late deforming, organized fibrous tissue can be removed with an open otoplasty technique to resculpture the cartilage.

Sharp Injuries

Lacerations

Lacerations must be thoroughly cleansed but minimally debrided of all foreign debris. Repair is begun in an orderly fashion from known landmarks to more complex areas of injury. Through-and-through lacerations should be closed in layers. Each side of the perichondrium is reapproximated with 6-0 plain suture.

Avulsions

Local cartilage debridement is begun if repair can be accomplished without moderate compromise of the size, shape, and location. Large avulsion injuries may survive on the most tenuous pedicle as composite flaps. Injection of vasoconstrictive agents should be avoided because of the vulnerable remaining vascularity. Survival may depend on the delicate primary plasma circulation, before small vessel re-anastomosis and vessel ingrowth occur. Avulsed segments less than 1 cm have a 90 percent survival rate with simple primary reapproximation. Several decisions must be addressed with larger, more vulnerable detached segments. The condition of the avulsed and remaining segments, availability of the vessels, and the timing of injury influence the options of reconstruction. Microvascular re-anastomosis has been disappointing if the adjacent vessels are damaged or if the injury is more than 4 hours old. Baudet's method of reattachment has been moderately successful, and, most important, it does no harm and burns no bridges. Each segment is minimally debrided and placed in an ice slush. The medial surface of the avulsed segment is de-epithelialized. The perichondrium and cartilage are fenestrated with radial incisions to increase plasma circulation and to decrease venous congestion. Adjacent postauricular mastoid skin is elevated, and the avulsed segment is secured to the mastoid with ties over Xeroform bolsters. The avulsed segment is also sutured to the edges of the remaining auricle to increase peripheral circulation. The auricle is elevated from the mastoid and covered with a skin graft 6 to 8 weeks after injury.

Microvascular reimplantation has been unreliable because the vessels are either not present or not viable. If reimplantation or another technique of reattachment is not possible, further reconstruction should be delayed. It is not prudent to use composite grafts, local flaps, and rib grafts until infection has been resolved and healing is complete. However, clean residual defects from tumor ablation can be repaired after the neoplasm has been controlled and all margins are free of disease.

Total avulsions that either arrived too late or have failed attempts of reimplantation may be considered for rib cartilage grafts, removal of scarred skin, and coverage with temporoparietal fascia as in secondary microtia repair. Costal cartilage from the opposite chest wall is sculpted into a three-tiered auricle. This graft is inserted into a subdermal pocket over the mastoid and covered with fascia.

REGIONAL REPAIR

The ear can be divided into four anatomic locations; each area has different inherent problems with reconstruction. Most defects are partial and require specific techniques to manage problems with structural support, free margins, and tissue coverage.

Preauricular Defects

The majority of these deformities are from cutaneous lesions. The facial nerve must be considered when preauricular tissue is dissected. In older patients the laxity of skin allows primary cheek advancement or V-Y advancements. Larger defects may require skin grafting or rotational flaps for closure.

Upper-Third Defects

Upper-third deformities are functionally the most important area requiring repair for patients with hearing aids and glasses. I use the "15 mm rule." Defects less than 15 mm heal without noticeable deformity when closed directly with a small triangular excision of the scapha. Pure defects of the helix, without extensive involvement of the scapha, can be closed by staged postauricular-based tubed pedicles and by helical advancement flaps.

Upper-third defects that are larger than 15 mm and involve the scapha require skeletal support. Composite chondrocutaneous graft from the opposite ear heals well with excellent tissue and color match. The donor graft, half the size of the defect, should be placed as has been described for reimplantation of an avulsed segment. The posterior surface should be de-epithelialized, sutured to all edges, and secured to the de-epithelialized mastoid for 1 week.

Larger defects require autogenous cartilage grafts. I have had success with transposed ipsilateral composite conchal grafts. Even larger deformities may necessitate rib cartilage, temporoparietal fascial flap coverage, and skin grafting. Postsurgical defects of the lateral surface can easily be closed by rotational flaps. This is better than skin grafts in color and texture, and the free margins of the helix are not altered.

Middle-Third Defects

The scapha is the major supporting layer of the pinna. If this foundation is not reconstructed, the ear will "fall over upon itself," as seen with severe congenitally cupped ears. Similarly, advancement flaps, composite grafts, or rib cartilage may be necessary. Large deformities of the helix and scapha have healed nicely with a two-stage postauricular flap. Initially, the postauricular flap is approximated to the anterior auricular skin. Six weeks later, autologous septal cartilage is placed under the flap to maintain support. The postauricular flap is divided and draped over the medial surface of the ear. Postmastoidectomy or tumor defects of the conchal bowl only need coverage with skin grafts because the surrounding cartilage support has been preserved.

Inferior-Third Defects

Through-and-through lacerations of the earlobe are less common than partial tears from earrings. The complete epithelium-lined tract must be excised and