Chapter 159: Trauma

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Auricular trauma is common in all age groups for several reasons. The pinna is an unprotected appendage readily accessible to trauma. Certain activities (welding, boxing, wrestling) place it at great risk for trauma. In contrast to the eyes, there is no protective reflex - avoidance motion to impending trauma unless a warning sound is heard.

Trauma can result from cold or hot thermal injury and produce frostbite or auricular burns. Blunt trauma may produce only an ecchymosis or may result in a substantial hematoma that requires treatment. Sharp trauma may cause a simple laceration, a very complex laceration with or without tissue loss, or a partial or total avulsion. Foreign bodies may or may not produce trauma as they enter the ear canal, but may cause damage later merely by the body's reaction to their presence. This chapter briefly discusses these traumatic events and their management.

Auricular Hematoma

Because of its exposed location, the external ear is particularly vulnerable to blunt trauma, and blunt injuries are especially common in wrestlers and boxers. This type of trauma can produce shearing forces that disrupt the adherence of the perichondrium to the cartilage. Cartilage has no intrinsic blood supply and is dependent on the perichondrial blood supply for nourishment by imbibition. When the contact of perichondrium to cartilage is traumatically disrupted, the subperichondrial space fills with blood (Fig. 159-1, A and B). This hematoma deprives cartilage of nutrients and may result in cartilage necrosis and predispose the area to infection. Necrosis is especially likely if the perichondrium on both sides of an area of cartilage is elevated; the risk of infection is increased considerably when the overlying skin is penetrated or lacerated.

The principal complication of othematoma, deformity, and difigurement can result from loss of cartilage and any combination of fibrosis from infection, cartilage necrosis, or incomplete evacuation of the clotted blood. The "cauliflower ear" deformity is a familiar remainder of the severe consequences; more subtle deformities, such as permanent swelling at the site of hematoma, result from replacement of an unevacuated clot by fibrous tissue.

Management

The goal of treatment is to prevent permanent deformity. The underlying principles are to evacuate the hematoma, reappose the perichondrium to the cartilage, prevent hematoma recurrence, and avoid infectiion. These goals may prove difficult, and many different techniques have been tried, including simple aspiration with pressure dressings and the use of colloids to compress the ear. All have met with limited success.

The following procedure has proved to be reliable, highly successful, and technically simple. The area overlying the hematoma is anesthetized with 1% lidocaine. Using a No. 15 scalpel, the surgeon makes an incision over the hematoma paralleling the natural skin folds. The hematoma is completely evacuated and the cavity irrigated with saline. The incision should be long enough to allow complete removal of blood and inspection of the cavity.

An antibiotic ointment (Bacitracin) is applied to the incision. A 4-0 nylon suture is passed through the skin, cartilage, and the skin of the opposite side of the ear. It is passed around a dental roll on the side opposite the incision and then back through the skin, cartilage, and skin. The suture is then tied around a second dental roll overlying the incision. A second suture is passed, and tied in a similar fashion at the other end of the dental roll (Fig. 159-1, C and D). The dental rolls compress the wound and prevent reaccumulation of serum or blood in the potential space. An antistaphylococcal antibiotic is prescribed.

The rolls are left undisturbed for 1 week and then removed. During the intervening week, the patient may resume full activities, including work or even limited wrestling with protective headgear.

In almost all situations, simple aspiration is inappropriate. Adequately aspirating a clot through a needle is simply not possible, and incomplete aspiration results in fibrosis and deformity. In those rare instances in which the physician is not consulted until 2 weeks or so after the injury, the hematoma may have liquified and aspiratin may allow reapposition of the perichondrium to the cartilage. The dental roll - suture technique described can then revent reaccumulation of serum or blood.

Auricular Lacerations

Some physicians are hesitant to repair lacerations of the auricle because they fear a poor cosmetic result from whatever causes. The auricle does have an intricate cartilage framework covered with delicate skin and is difficult to recreate. However, it has an excellent blood supply, heals well, and is not easily infected. If lacerations are treated with respect and sound surgical principles are applied, good results can be achieved.

Management

The most important principle when the injury is extensive is preservation of all viable tissue. Small lacerations can be closed easily with minimal debridement, and the cartilage can be handled like other tissues. It can be trimmed or sutured using absorbable or nonabsorbable suture as needed. Abrasions of the skin and cartilage should be thoroughly cleaned and covered with an antibiotic ointment and a non-adherent dressing.

Primary reattachment should be considered when the ear is not totally severed from the head but remains attached by a pedicle of skin (Lacher and Blitzer, 1982). A small pedicle may provide adequate blood supply (Fig. 159-2). Consideration should be given for heparinization and multiple incisions for bleed-through (see later), especially for the part most distal to the pedicle of attachment.

Partial loss

All degrees of partial loss can exist. Helical rim defects that are 2 cm or less can often be closed primarily. Closure may require extending a wedge resection more centrally or using other relaxing incisions. Additional tissue is needed for closure when the defect is greater than 3 cm. If it is necessary to stage the reconstruction, the principle of implanting the injured auricle beneath a postauricular skin packed is used (Mladick et al, 1971).

Total and subtotal avulsive injuries

Total and subtotal avulsive injuries are uncommon. When they occur, different treatment options are available and the physician's choice depends on at least three variables: Amount of abrasions and contusions, amount of time from injury to treatment, and the extent of other injuries. The amount of abrasions and contusions to the detached auricle influences how it should ultimately be managed. Cleanly lacerated auricles are preferable to those that have been avulsed and severely abraded. The amount of time from the injury until treatment influences the choice of treatment, as does the extent of other injuries to the patient, such as fractures, contusions, and lacerations, as they may contraindicate the use of heparin.

As soon as possible after injury the detached auricle should be thoroughly but gently cleansed in cold saline and placed in a container of heparinized Ringer's lactated solution containing aqueous penicillin and streptomycin (unless allergies to the drugs are known). The container should be surrounded by ice, cooling the detached part without freezing.

If the ear has been totally but cleanly severed, less than 2 or 3 hours have elapsed before treatment, and the patient's other injuries do not preclude heparinization, primary reattachment of the segment should be considered (Fig. 159-3). Success depends on reestabishment of the capillary circulation and venous drainage.

The entire skin edges of the avulsed segment and the avulsion site should be debrided by excising 1 mm or less. Local anesthetic without epinephrine should be used. Interrupted sutures are used for the reapproximation. Reestablishment of the arteriolar circulation occurs first; and in the past most reimplanted auricles failed because of venous congestion, sludging, hypoxia, and tissue acidosis. To avoid this problem, Clemons and Connelly (1973) made multiple small incisions in the skin and subcutaneous tissue of the congested auricle and placed their patient on 10.000 units of heparin initially and 5.000 to 10.000 units intravenously every 6 hours. The heparin prevents clotting of the congested microvasculature and ensures bleeding through the skin incisions, preventing hypoxia and acidosis. The heparin dose is determined by bleeding times and is decreaseed when the segment appears viable and venous return is established. The blood loss can be sufficient to necessitate transfusion, and the patient must be carefully monitored. Vasodilators may be used but do not seem to be necessary. When larger vessels are available, microvascular reanastomoses may be used and, if successful, can obviate the need for the skin incisions and bleeding.

The more conservative treatment, using the pocket principle (Mladick et al, 1971), is indicated when the circumstances are less favorable. The auricle injuries are more severe, the patient cannot safely be heparinized, or considerable delay occurs before treatment. The pocket principle allows for the broadest area of revascularization. The avulsed segment is

dermabraded, and the avulsed area is attached to its bed; however, and the dermabraded segment is placed beneath the postauricular skin for 10 to 14 days before it is reexpanded and allowed to reepithelialize.

The Split Ear Lobule

Persons who wear pendulous or very heavy earrings risk acutely or slowly splitting the ear lobule. If this occurs acutely, primary reapproximation with fine interrupted sutures is sufficient, and a new lightweight post can be inserted at the time of the repair. Heavy earrings are contraindicated for at least 2 months. If the splitting process has occurred slowly or if the primary injury was allowed to heal without repair and resulted in a well-epithelialized deep notch, the problem is more complex. Even though several very complicated repair techniques have been advocated, a simple excision of the scar tissue with primary repaiir of the split segments gives excellent results. A new lightweight post can be inserted at the time of repair.

Frostbite

The forstbite injury begins once the temperature falls below freezing. Temperatures below 10 C block sensory nerve input, depriving the patient of the warning of impending danger. The initial response is vasoconstriction, which is manifested as pallor. Ice formation occurs in the extracellular fluid, resulting in intracellular dehydration and hypertonicity of the remaining extracellular fluid. As the affected area thaws, subcutaneous edema from extravasated fluid causes bullae to form (Fig. 159-4). Later, erythema develops around the demarcating tiissue and can be detected for weeks or even months (Holm and Vanggaard, 1974).

Treatment consists of rapidly rewarming the frostbitten area with moist cotton pledgets at a temperature of 38 C to 42 C. Silver nitrate (0.5%) soaks are applied if there is superficial infection. Ordinarily, no dressings are used (Sessions et al, 1971). The use of sympathectomy, hyperbaric oxygen, and low molecular weight dextran remains controversial, but rubbing with snow or exposure to radiant heat is contraindicated.

The Burned Ear

Acute injury management

Burns of the ear present two major management problems: the acute injury and the late complication of perichondritis. The management of the acutely burned ear depends on the degree of burn. First-degree burns are treated expectantly. For second- and third-degree burns, Grant (1967, 1969, 1973) and Mills et al (1988) stress the importance of avoiding pressure on the ear, and Goel et al (1980) advocate, in addition, the use of gentle local cleansing and topical antibiotic applications until complete debridement occurs. Split-thickness skin grafts are used if there are large denuded areas. Systemic antibiotics are not administered. As a prophylactic initial treatment, Baers (1984), injects gentamycin (80 mg/2 mL) subperichondrially to all second- and third-degree burned ears at several different sites anteriorly and posteriorly. He repeats this during hospitalization with additional injections when the patient is receiving general anesthesia for other skin graft procedures. Using this

method, the most recently reported 25 patients did not develop perichondritis.

Infection

Infection in the burned auricle has developed in up to 25% of facial burns (Dowling et al, 1968) and is responsible for a prolonged hospital course and severe deformity. The onset is delayed, and the infecting organism is usually *Pseudomonas aeruginosa.* It begins with diffuse redness, swelling, and pain and progresses to abscess formation, fluctuance, and ultimately perforation of the overlying skin and purulent drainage. Various authors have referred to the entire infectious process as either perichondritis or chondritis; the importance lies not in the name, but in the recognition of two distinct stages.

The first stage, most appropriately called perichondritis, is a local infection that has not progressed to abscess formation. It can be managed successfully with appropriate intravenous antibiotics, but not by topical ointments alone. The second stage, most appropriately called chondritis, occurs when fluctuance indicates that an abscess has formed (Fig. 159-5). Cartilage is involved and systemic antibiotics alone will never be effective in eliminating the infection.

In the past, total debridement of the auricular cartilage was the treatment of choice once chondritis was evident. This treatment is not recommended. Current management has evolved after Stevenson (1964) reported an effective treatment referred to as *dakinization.* He used local instillation of antibiotics through polyethylene catheters inserted beneath the skin. Wanamaker (1972) modified this technique by using multiple ladder incisions over areas involved, tunneling a multiple fenestrated No. 190 polyethylene catheter beneath the skin. Apfelberg et al (1974) advocate this method and irrigate with gentamycin, 80 to 120 mg mixed in 1 L of normal saline and instill 2 to 5 mL of the solution two to five times a day. Baers (1984) irrigates with any one of the following in 1 L of normal saline: gentamycin, amikacin sulfate, colistin sulfate, or tobramycin. The irrigation is continued for 5 to 10 days.

In summary, acutely burned ears require gentle cleansing, local debridement, and topical antibiotics, with avoidance of any pressure. Second- and third-degree burns may be injected prophylactically with gentamycin to prevent suppuratiive chondritis. Skin grafting is performed early and when judgment dictates. Chondritis should be treated by incision and drainage and insertion of subcutaneous or subperichondrial catheters and irrigated with topical antibiotic solutions effective against *Pseudomonas.*

Foreign Bodies of the External Ear Canal

Removal of a foreign body from the ear canal is generally simple if adequate tools are available and prior removal has not been attempted. The majority of patients with foreign bodies in the ear are children. Patience and gentleness are required if removal is to be achieved painlessly.

Live-insect foreign bodies pose a unique situation and can be very annoying if the insect is creating a loud noise. The patient is recommended to drown the inseft if immediate medical attention is not available. Crushing the insect is to be avoided. Ears with vegetable foreign bodies should not be irrigated, as this may cause the vegetable matter to swell.

For cases in which previous removal has been unsuccessful or where the foreign body is impacted in the canal, anesthesia may be necessary. Four-quadrant canal skin injection with a local anesthetic agent is advisable; however, young children may not tolerate a local anesthetic and may require a general anesthetic.

The operating microscope simplifies removal, and useful tools include the alligator forceps, Hartman ear forceps, cupped forcems, Schuknecht pick, small and large Buck curettes, Sharpleigh curette, Day hook (a dull, right-angled hook), and Turner needle (Fig. 159-6).