Paparella: Volume II: Otology and Neuro-Otology

Section 3: Diseases of the Ear

Part 2: External Ear

Chapter 24: Surgery of the External Ear

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Many of the complex problems affecting the external ear may be amenable to surgical therapy. This chapter reviews some of these disorders of the external ear, with emphasis on appropriate surgical treatments. Related problems of the external ear, including congenital atresia, traumatic injury and infections, and cysts and tumors, are discussed in this volume in Chapters 20, 21, and 23, respectively.

Anatomy

There are a number of points serving to underscore the importance of the anatomy of the external ear. Further details regarding this anatomy can be found in Volume I in Chapter 2. The external ear can be considered to include the cartilaginous auricle (pinna), external auditory meatus, and external auditory canal. The auricle is a skin-covered elastic plate held in position by muscle and ligaments. This cartilage has a very complex, folded appearance and ends medially in the funnel-shaped conchal niche. This medialmost extension marks the beginning of the external auditory meatus, leading to the external auditory canal.

The external auditory canal is divided into cartilaginous and bony portions. The total length of the canal averages 3.5 centimeters and its internal diameter averages 7x9 millimeters. The lateral two-thirds of the external auditory canal is cartilaginous, and its long axis is directed in a posterosuperior direction. It is firmly attached to the surrounding temporal bone, yet remains mobile in a limited fashion. The mobility is due in part to fibrous channels within the cartilage (fissures of Santorini), which often facilitate the spread of infection or tumor from a diseased external canal to the adjacent parotid and neck regions. Skin lining the cartilaginous canal is relatively thick (0.5 to 1 mm) and has a well-developed subcutaneous layer. In this layer are found numerous hair follicles and ceruminous and sebaceous glands.

The medial one-third of the external auditory canal is bony. The skin lining the bony canal is quite thin, measuring as low as 0.2 millimeter in thickness. There is no well-developed subcutaneous layer, as this lining of skin is firmly attached to the underlying periosteum. Its long axis differs from that of the cartilaginous segment, taking off in an anterior-inferior direction. This change from the more lateral direction of the cartilaginous canal occurs at a point defined as the isthmus of the external auditory canal. Foreign bodies that make their way beyond this point subsequently may be difficult to remove.

The external auditory canal is normally lined by a protective, waxy, hydrophobic coating. This coating arises from contributions by the sebaceous glands, the ceruminous (apocrine) glands, and the exfoliated squamous epithelium. This material is found to migrate

in a lateral direction, thus serving a self-cleansing function. Motion transmitted from the adjacent temporomandibular joint also facilitates this process.

Cerumen

Accumulation of cerumen represents the most common and routine otologic problem. It may interfere with the clinician's view of the tympanic membrane, cause hearing loss and symptomatic discomfort, or potentially contribute to a cause of infection. Audiometric evaluation and tympanometric examination may be hindered by excessive accumulation of cerumen. Some patients may be categorized as "wax formers", in whom production of cerumen is excessive. Other patients make frequent attempts at removal of cerumen with cotton swabs, hairpins, or match sticks, and this activity medially impacts the already existing accumulation of cerumen.

Several techniques have evolved for the removal of cerumen, and these may be employed in a variety of ways. Prior to removing impacted cerumen, a brief otologic history is in order to help to identify those patients having problems that would interfere with a specific technique for removal. Points to look for include tympanic perforations or a history of canal-distorting surgery. If a perforation is not suspected, irrigation of the external canal with a 1:1 solution of warm water and hydrogen peroxide is used to flush the external canal. If cerumen or irrigating solution remains, a Frazier No 5 or 7 suctioning catheter is used to further cleanse the canal. An alternative method, in situations in which suctioning / irrigation equipment is not at hand, is the use of a cerumen-spoon or curet to dislodge and remove the accumulated cerumen, very carefully.

If impaction persists, the patient may be sent home with instructions for using an agent to soften the cerumen. Agents include hydrogen peroxide, ceruminolytic solutions (Cerumenex), and a variety of steroid antibiotic ear drops. Following their use, the patient is re-examined and what cerumen remains is much more easily removed. This technique is particularly helpful in young patients, who may be not fully cooperative with the clinical examination.

Foreign Bodies

Foreign bodies in the external auditory canal are identified most frequently in the pediatric age group or in cognitively impaired, institutionalized patients. An infinite variety of objects small enough to enter the external auditory meatus can become prospective foreign bodies. These include animate and inanimate objects that can be reactive or nonreactive within the confines of the external auditory canal. Foreign bodies may incite symptoms of irritation, pain, and deafness.

The safest method for removal of a foreign body is to do the removal under direct visualization. Instruments facilitating this task include the alligator type of forceps, curets, and spoons. Frazier suctioning catheters are quite useful, with the addition of a Per-Lee type of tympanostomy tube to the tip of the catheter where it forms a "suction cup". This is helpful in removing foreign bodies such as beads that may have a smooth surface and be difficult to grasp. Irrigation is useful in certain instances. Cyanoacrylate glue applied to the tip of a straightened paperclip creates a unique device which can be placed in contact with the foreign

body in the canal. The foreign body and the paperclip are then removed together.

Reactive foreign bodies present unique problems. Vegetables and plant debris can be especially damaging by producing an inflammatory reaction and becoming adherent to the skin of the canal or to the tympanic membrane. Miniature batteries used in electronic watches, hearing aids, and other devices are hazardous, once placed in the external auditory canal; they may cause inflammation and ulceration of the canal and perforation of the tympanic membrane. These batteries contain erosive alkaline chemicals (silver oxide, mercuric oxide, manganese oxide) and can react quite severely with the epithelial surface with which they come in contact.

A live insect found in the external canal should first be immobilized prior to its removal. This can be accomplished by instilling chloroform, oil, or alcohol into the canal. If a perforation in the tympanic membrane still exists, some solutions may enter the middle ear and may, potentially, enter the inner ear via the membranes of the round and oval windows. Transient vertigo has been reported with the use of lidocaine in such an instance; it passed through an unsuspected perforation in the tympanic membrane.

In those patients whose adequate cooperation cannot be obtained, general anesthesia should be chosen. In all circumstances, injury to the external canal from an attempt at removal should be avoided. Numerous complications from the removal itself have been reported, including perforations of the tympanic membrane, otitis media, and mastoiditis.

Injury

Injuries of the auricle can range from simple contusion or laceration to complete avulsion. Management should include meticulous conservation of tissue and prevention of infection. If contamination of the wound occurs, antibiotics are used to avoid perichondritis. The usual techniques for debridement and suturing apply, and care must be taken to obtain a cosmetically acceptable result. Careful approximation of perichondrium in disrupted cartilage may help to prevent subsequent notching.

Traumatic avulsion of the auricular tissue is managed by first cleansing the site of avulsion and the tissue with povidone-iodide, and then rinsing with Ringer's solution. Conservative debridement follows, and the tissue is reimplanted. Antibiotics and anticoagulants are used to promote viability in the tissue. For stab incisions it may be necessary to relieve accumulation of serous fluid in the reattached tissue.

The split earlobe is commonly caused by the pendulous weight of heavy ornamentation or by accidental downward force on an earring that results in a traumatic tear or laceration. Many techniques have been advocated for repairing the resulting split. An acute laceration may be closed primarily. If cut margins have become well epithelialized, removal of the opposing surfaces of skin will be necessary, prior to attempting closure. The superiormost aspect of the epithelialized split can be retained, if desired, for subsequent use. Various procedures for employing a flap have been described as facilitating an acceptable cosmetic result.

Hematoma of the Auricle

Hematoma of the auricle occurs when serum and blood accumulate between the cartilaginous framework and the overlying perichondrium. This usually follows traumatic injury affecting the external ear. Sporting activities including football, boxing, and wrestling are frequently the cause of auricular hematomas. Hematomas can occur spontaneously in hypertensive patients.

The cartilaginous auricle receives its blood supply from the overlying perichondrium. Early evacuation of the hematoma is important in order to avoid aseptic necrosis of the cartilage. Infection is an associated risk, leading to perichondritis and eventual deformity of the auricle. Improperly treated or recurrent hematomas, such as those seen in professional boxers, can result in the deformity termed "cauliflower ear". Diagnosis is easily made after taking of a brief history and clinical examination. Sterile needle aspiration with application of a contoured pressure-dressing is done as an in-office procedure. Repeated aspirations may be necessary, as the serosanguineous fluid has a propensity toward reaccumulation. Prophylactic antibiotics are often called for.

In those patients for whom therapeutic aspiration fails, an incision-with-drainage procedure is attempted. The postauricular surface is incised just opposite the greatest hematomatous swelling. A segment of cartilage is resected and the hematoma is evacuated with suction, irrigation, and curettage. A suctioning drain is placed, and skin is sutured with nonabsorbable material. The auricular contours are packed with cotton saturated with sterile mineral oil. A pressure dressing is applied. The drain is removed seven days following the incision and drainage.

Perichondritis of the Auricle

Infection of the perichondrium causes interference with the blood supply and subsequent loss of nourishment to the cartilage. This can eventually result in loss of tissue and in deformity. The common cause is injury and hematoma that becomes secondarily infected, allowing pus to collect between the cartilage and perichondrium. Other causes include penetrating trauma with exposure of cartilage, burns, and frostbite; also, there have been a few reports of perichondritis following treatment by acupuncture.

Findings of perichondritis include generalized or localized erythema, swelling, pain, and, if collection of pus develops, fluctuation. Treatment with antibiotics, according to results of culture and sensitivities studied, should be prompt, in an attempt to localize the infection as much as possible. Topical, wet treatments on a daily basis using 5 per cent aluminum acetate or a weak solution of silver nitrate can be helpful. Incision and drainage are reserved for refractory cases in which pus has developed.

Acquired Atresia

Meatal atresia may occur following otologic surgery in which an inadequate meatal opening was made at the time of surgery, or in which subsequent hypertrophic scarring occurred. Meatoplasty may be indicated and should include excision of conchal cartilage with or without adjacent auricular skin, for adequate enlargement of an opening. Treatment for

acquired atresia of the canal that has reached a final state of healing consists of removing the stenotic tissue and regrafting the canal with very thin skin, as described in the following section for treatment for refractory external otitis. In certain instances when stenosis is localized to a specific region of the wall of the canal, removal under local anesthesia without grafting will suffice.

If the stenosis is still actively healing with visible granulation tissue and has not yet been chronic or fixed, the granulation tissue should be completely removed and a firm cotton wick saturated with a topical steroid antibiotic preparation should be inserted. The patient should be seen frequently for removal of any recurrent granulations and for replacement of a snugly fitting wick. The wick serves as an obturator to maintain patency in the canal, and the topical steroid antibiotic preparation prevents formation of granulation tissue, thereby permitting epithelialization. This treatment is useful for active stenosis following trauma or surgery; in certain troublesome cases, 2 or 3 weeks of treatment may be necessary. Cases in which repair of congenital atresia is required will often require very close observation in order to avoid such a complication and the possible institution of this treatment.

Refractory External Otitis

Most instances of external otitis can be treated successfully with medical therapy. In the rare case in which external otitis fails to respond to the usual medications, marked hyperplasia of the skin may result; this, in turn, leads to an acquired atresia of the external canal. Refractory infection with associated drainage, pain, and hearing loss is usually present. In these patients, the middle ear cleft is normal on x-ray examination; if it is not, another diagnosis is sought.

When this condition is identified, the technique for canalplasty can be employed. This procedure, or modifications thereof, can be used for all forms of acquired atresia following trauma or surgery.

Technique for Canalplasty

A postauricular endaural incision may be used. For intractable external otitis, a postauricular incision through normal tissue is best. The canal is transected at the bony/cartilaginous junction and retractors are placed to facilitate exposure. All diseased skin in the canal is excised, including the outer squamous layer of the tympanic membrane. Large meatoplasty is made by a through-and-through excision of the conchal skin and cartilage.

The bony canal is widened circumferentially by drilling. Care must be taken to avoid entering the temporomandibular joint anteriorly. If mastoid air-cells are encountered posteriorly, exposed cells can be covered with temporalis fascia harvested from the superior limits of the wound. Two thick skin grafts (1/100th inch thick) are harvested from the upper medial arm; one grafts covers the posterior canal and drumhead, and the other covers the anterior canal. All exposed surfaces are completely covered to retard postoperative formation of granulation tissue.

A double-pack technique is helpful in maintaining position of the graft. The first pack consists of Owens silk-gauze and cotton saturated in an antibiotic steroid solution; this is

placed medially against the region of the drumhead in a "rosebud" fashion. The second pack is placed lateral to the first and usually consists of Vaseline gauze coated with an antibiotic ointment. The second pack is brought out through the auditory meatus and helps stent the newly created opening. Healing occurs quickly.

Malignant Tumors of the Auricle

Of all skin cancers, 5 to 8 per cent involve the surface of the auricle. Squamous cell carcinoma is the most frequently encountered tumor (50 to 60 per cent), followed by basal cell carcinoma (30 to 40 per cent) and melanoma (2 to 6 per cent). Excessive exposure to sunlight is an associated risk factor. The helical rim and antitragus are more vulnerable to exposure to sunlight compared with the conchal recess.

Recurrence of tumors following adequate treatment is associated with a number of factors, including neoplasms of a size greater than 0.1 centimeter, morpheaform basal cell carcinoma, and multiple recurrent lesions. Surgical excision is the recommended treatment for these tumors. The functional and aesthetic characteristics of the auricle must be respected when surgery is planned. The procedure should provide the best chance for cure, while least affecting these important factors. Alternatives to surgery include both chemotherapy and cryosurgery. The relative resistance of cartilage to freezing facilitates the usefulness of cryosurgical techniques.

Lesions of the Helical Rim

Excision of a lesion from the helical rim should be accomplished by a procedure that does not produce excessive circumferential tension that would result in auricular cupping or cartilaginous notching. A wedge incision followed by primary closure is preferable for limited cancers. If the circumferential tension requires a reduction, an excisive pattern that includes more centrally placed auricular tissue can be used, facilitating a closure under less tension. Alternatively, greater length can be incorporated into the circumference by advancing adjacent helical tissue. A composite skin/cartilage graft up to 2 centimeters in width can be harvested from the contralateral auricle. This tissue can be added to the surgical defect created following removal of the tumor. If a patient is unable to tolerate the more prolonged surgery necessary to improve the auricle cosmetically following removal of the tumor, a longer hairstyle may be suggested in order to camouflage an auricular deformity.

Lesions on the Surface of the Auricle

A through-and-through excision with an adequate margin is necessary to remove these lesions. If the defect is too large for primary closure, a pedicle graft of postauricular skin can be elevated and sutured into position to close the defect.

Extensive Malignancy of the Auricle

A larger, exophytic auricular carcinoma may require complete auricular excision with salvage of tissue. If regional metastatic disease is suspected, a contiguous parotidectomy and/or radical neck dissection may be warranted. The exposed surfaces can be covered using an adjacent periosteal flap, a free skin graft, a pedicle skin graft, or a regional myocutaneous

flap.

Prosthetic Auricle

Auricular tissue may be congenitally absent or may be lost to an extensive resection of malignant disease. Surgical reconstruction of a replacement auricle is usually multistaged, and the results are often cosmetically unpleasing. The prosthetic auricular device is a useful alternative for replacement of tissue and provides a cosmetically acceptable auricle that may surpass the appearance of a staged plastic reconstruction. Prosthetic reconstruction is approached by a team that includes the surgeon and maxillofacial prosthodontist.

Planning should begin prior to surgery. When possible, the tragus and the exterior canal should be preserved, to provide better retention of the prosthesis. The tragus tends to break up the skin/prosthesis junction, thus providing better cosmesis. A preserved remnant ear lobule may interfere with prosthetic reconstruction in that it may interfere both with retention of the prosthesis and with a satisfactory cosmetic appearance.

The technique consists of first making an impression and cast of the contralateral ear, which is used as a guide in producing a wax pattern for the proposed prosthesis. Such factors as color, texture, and orientation of the prosthesis are critical in obtaining an optimal result. The wax pattern is next reproduced in one of several pliable plastics such as the various types of vinyl chloride compounds and silicone rubber materials. During the final phase of casting, coloring can be added to the material to further enhance its appearance. Final detailing of the prosthesis may require the application of extrinsic coloring. The original mold is kept on file, to be available for use in making duplicates, since the prosthetic material will deteriorate in time; duplicates can be readily produced with minimal expense to the patient.

The prosthesis is attached by way of several different available adhesives. This will require daily attention, as the prosthesis is usually removed in the evening and replaced again the following morning. This task becomes routine and is acceptable to most patients.

Tumors of the Ear Canal

Primary malignancy of the external ear canal is a rare disease. Conley (1960) estimated that malignancy occurs in only one of 4000 to 5000 cases of otologic disease. Squamous cell carcinoma is the most common type of malignancy in the external canal. The majority of those patients who harbor a tumor of the external ear canal are treated medically, prior to biopsy and definitive excision. Most frequently, the chief complaint associated with a tumor of the canal is pain. This is followed by the complaint of bloody otorrhea. Biopsies should be done as early as possible and can be accomplished by punch for excrescences, or by excisional biopsy. The preferred definitive treatment is surgery.

A major factor in determining the extent of disease is an understanding of the involvement of bone. High-resolution computerized tomography with a bone algorithm plays an important role in this regard. Vascular contrast studies are useful in those instances in which carotid or jugular disease is suspected. The parotid gland is an important consideration in determining local extension of disease. The fissures of Santorini, located in the cartilaginous external canal, provide little barrier to lymphatic spread of tumors. Both the

superficial and deep lobes of the parotid can be involved with regional disease; the cervical lymphatics are rarely involved. Postoperative therapeutic radiation is recommended if gross or microscopic evidence of the involvement of bone is found.

The operation should consist of removal of the anterior wall, parotidectomy, and condylectomy and may include widening of the posterior bony canal or mastoidectomy and removal of part or all of the tympanic membrane. If the tumor is detected early and involves the posterior canal, modified radical or radical mastoidectomy alone may suffice. If there is definitive evidence of malignant spread to the middle ear and mastoid, total or subtotal resection of the temporal bone is advisable, in the absence of metastasis. A step-by-step removal of all gross tumor remains an alternative to en bloc resection of the temporal bone. This type of approach allows the operation to proceed sequentially and provides for intraoperative decision-making and innovation. The carotid artery and facial nerve are spared if they are not directly involved with tumor. If a tumor-free dural margin can be obtained medially, intracranial dural grafting can be employed with the use of fascia lata and with neurosurgical consultation.