Ear Pain in Otolaryngology

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Overview: discussion focuses on nonobvious causes of ear pain; primary otalgia disorder of ear; secondary (referred) otalgia related to another disorder; may involve structures of ear (mucosa of middle ear, tympanic membrane [TM], ear canal, outer ear) or neighboring structures (mandible, condyle, temporomandibular joint [TMJ], structures in infratemporal fossa)

External ear: cracked, desquamated external auditory canal (EAC) due to dermatitis or bacterial infection may be painful, pruritic, and edematous; treated with wicking or drops

Middle ear and tympanic membrane: otitis media may be complicated by bullous myringitis; ruptured bullae may leak straw-colored fluid; condition often misdiagnosed as perforation in urgent care setting; wax easily removable; foreign bodies painful and may affect TM

Medical history: detailed history important in patient with ear pain and normal examination; examiner should ask about duration, severity, type, and progression of pain; related problems may include symptoms in throat or other areas of head and neck; social history should cover use of tobacco, alcohol, and work habits that may produce muscle tension or degeneration of cervical spine; other possible problems include inflammatory diseases, bruxism and its effects on TMJ, sleep apnea, dental problems, medications, psychiatric history, personality type, and level of stress

Examination: includes assessment of nose and throat and microscopic evaluation of ear; fiberoptic scope used under local anesthesia to evaluate dimensions of nose and health of mucosa, nasopharynx, vallecula, supraglottic larynx, and larynx; palpation of neck, trigger points, TMJ, pterygoids, and rhomboids may reveal spasm

Innervation: important cranial nerves V, VII, IX, and X; ear pain may also originate from cervical plexus (C1-C4); nerves responsible for ear pain also serve other structures, which may result in referral of pain to ear; V3 — innervates portions of ear, anterior two-thirds of tongue, inner oral cavity, palate, lower teeth, mandible, TMJ, and major salivary glands (parotid and submandibular); branches include inferior alveolar nerve and lingual nerve; VII — sensory distribution variable; serves some areas of posterior nasal cavity; septal spur projecting into turbinates may cause pain that radiates to ear; VII innervates part of posterior ethmoid and sphenoid sinuses; chorda tympani branch provides taste sensation to anterior two-thirds of tongue; VII also responsible for motor control of face; IX and X — innervate portions of pharynx, tongue, and throat, and form pharyngeal plexus

Goals of treatment: to accurately diagnose and treat patient and avoid missing tumor or other serious lesion; important to investigate dental problems such as cracked teeth; dental issues, including bruxism, may account for 70% of unexplained ear pain; disease of cervical spine also common cause of otologic pain; cervical spine treated with physical therapy; if otolaryngologist cannot detect source of pain, patient should be referred

Evaluation of the Chronic Draining Ear

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Sources: drainage may originate in EAC or middle ear, or may be caused by leakage of cerebrospinal fluid (CSF) through tegmen (bone that separates middle cranial fossa from ear); misdiagnosis of CSF as fluid originating from ear may lead to treatment with pressure equalization (PE) tube, which then causes continuous leakage of CSF from ear and introduces risk for meningitis

Medical history: examiner should ask about previous history of surgery on ear or trauma, and recent history of swimming or use of hot tub; important elements of history presence of pain, conductive or sensorineural hearing loss, or tinnitus; branchial cleft cyst — unusual cause of otitis; duplication anomaly of EAC involves skin of ear or area below ear; characterized by intermittent swelling in area and drainage from ear; cysts may become infected repeatedly; definitive treatment accomplished by resecting duplicated system

Examination: complete examination of head and neck should be performed, including nasopharynx; source of drainage may be detectable during examination with flexible fiberoptic scope; if nasopharyngeal mass occludes eustachian tube, fluid may collect in middle ear; recurrent otitis may be sign of perforated TM; nasopharyngeal carcinoma 25 times more common in Chinese patients than in US population; palpable nodes or mass in neck and unilateral otitis in Chinese patient often indicate nasopharyngeal carcinoma

Type of drainage: serous — thin, serous, straw-colored fluid indicates problem in middle ear in patient with perforation of TM or PE tube; purulent — drainage with pus indicates chronic otitis media or cholesteatoma; cholesteatoma skin cyst that arises from retracted TM; chronic otitis media characterized by recurrent...
or constant purulent or mucoid otorrhea for ≥ 3 mo; patients may have mastoid disease and dysfunction of eustachian tube; *blood* — bloody drainage may be observed after open slap to ear; in such cases, air in EAC acts as missile that perforates TM; injury heals spontaneously if ossicles not damaged; infection may result in bloody or mucoid otorrhea; bloody drainage without previous injury usually caused by polyp; polyps may be associated with cholesteatoma; other causes of bloody drainage trauma and severe otitis externa; patients with diabetes may develop malignant otitis externa with extensive damage to soft tissue and erosion into temporal bone and facial paralysis; condition should be treated aggressively in patients with diabetes; *pulsatile* — pulsating otorrhea suggests vascular tumor (eg, glomus tumor) or other problem within temporal bone; CSF leakage may present as clear; pulsatile otorrhea with appearance of water; CSF leak may be spontaneous or secondary to trauma to temporal bone

**Causes of otorrhea related to external canal:** *cerumen* — usually does not cause drainage; *otitis externa* — treated with antibiotics and stent (wick); traumatic causes may result in drainage of CSF or blood; if infection of EAC does not improve with antibacterial ear drops, otomycosis should be considered; hyphae may be visible in EAC; fungal material should be completely removed and canal treated with home remedy of rubbing alcohol and white vinegar or with antifungal drops containing clotrimazole (Lotrimin); *osteonecrosis* — may follow radiation to head; ear canal unique because unlike other tissues, no subcutaneous tissue interposed between skin and bone; breakdown of skin may result in necrosis of bone with purulent drainage; *malacacy* — may cause bloody otorrhea; in EAC; most common type squamous cell carcinoma; on auricle; most common type basal cell carcinoma

**Causes originating in middle ear:** *acute otitis media* — bloody, purulent drainage possible if TM ruptures; rupture may relieve pain; *chronic otitis media* — related to chronic perforation; treated with antibiotics, drops, and ultimately surgery; *cholesteatoma* — white, soft mass behind TM; *tuberculosis* — uncommon; characterized by multiple perforations, pale granulation tissue, and purulent drainage; may be found in patients with history of foreign travel or another source of exposure

**Surgical management:** *cholesteatoma* — only removal can correct drainage; type of procedure depends on size of cholesteatoma; *leakage of CSF* — usually requires repair of defect in dura from above in collaboration with neurosurgeon

**Treatment Options for Single-sided Deafness**

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**Types of hearing loss:** *conductive hearing loss (CHL)* — cochlea functional but TM or ossicles affected; example congenital atresia; several good treatment options; *sensorineural hearing loss (SNHL)* — commonly referred to as single-sided deafness

**Unilateral hearing loss:** results in inability to localize sound; socially awkward; in head shadow effect, head blocks sound waves and contributes to 5 to 6 dB worsening of threshold; head shadow affects higher more than lower frequencies; patients with unilateral hearing loss have impaired word discrimination; *summation* — patient who hears with 2 ears can hear 2 to 3 dB better than patient with unilateral hearing loss; *tinnitus* — often primary complaint; *management* — 70% to 80% of patients helped by cochlear implant (CI)

**Treatment options:** passive middle ear implants may be used for cholesteatoma; other options contralateral routing of signal (CROS) hearing aid, temporal bone-anchored hearing aid (BAHA), and CI; *CROS hearing aid* — nonimplantable aid in affected ear transmits sound contralaterally to microphone in good ear; *implantable aids* — include BAHA (made by Cochlear), Ponto (Oticon), and CI

**Bone-anchored hearing aid:** includes metal post in bone attached to hearing aid; procedure takes 30 min and well tolerated; vibration of bone and cochlea bypasses middle ear mechanism; patients with unilateral CHL usually happy with BAHA; BAHA may be implanted in patient with unilateral SNHL; patient still cannot localize sound, but device helps with head shadow effect by funneling sound to good side; BAHA simulation should be performed before implantation to demonstrate potential result to patient; to implant, hollow screw inserted through small hole in bone; criteria for implantation include reasonable hearing in contralateral ear, especially in patients with SNHL

**Surgical technique:** involves linear incision to punch technique; location of glasses behind ear should be considered; degree of subcutaneous thinning required depends on anatomy of patient; in punch technique, bone exposed and screw placed; patients heal quickly; alopecia around base of implant possible; punch technique suboptimal for large men; to encourage osseointegration, cautery should be minimized; integration usually adequate but failure possible in patients with history of radiation therapy; longest possible implant should be used; implant should sit above skin to allow attachment of hearing aid

**Outcomes:** patients with SNHL do not hear in stereo, but children with atresia do; subjective outcomes exceed objective (audiologic) benefits; patients with CHL have excellent outcomes

**Transcutaneous devices:** Attract has no abutment; screw and magnet implanted and skin closed over implant; magnetized hearing aid placed on outside; device not compatible with magnetic resonance imaging; indications similar to those for other BAHAs; cosmesis superior; Cochlear and Sophono both offer transcutaneous BAHAs; issues include low-frequency attenuation and breakdown of wound and skin; not good option for patients with significant hearing loss in contralateral ear

**Cochlear implants:** patients with single-sided deafness have tinnitus and poor localization and discrimination of sound; implant significantly reduces tinnitus in 70% to 80% of patients; devices not approved by Food and Drug Administration; devices improve sound localization but do not restore perfect hearing

**Summary:** CROS, BAHA, and CI all help with head shadow effect; CI stimulates affected side, but signal processing not equivalent to that in good ear; children with bilateral deafness may develop normal speech if CI placed at ≤ 1 yr of age; in future, CI may also be considered in children with single-sided deafness

**Hearing Aids and Connectivity**

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**Hearing aids:** styles range from invisible hearing aids to bulky styles that fit behind ear; style may be chosen according to preference of patient, degree of hearing loss, and health of ear; style with receiver in EAC popular because of cosmetic appeal and ease of use; appearance, comfort, and technology of hearing aids improving

**Technologic improvements:** hearing aids now permit sharing of information between right and left devices; exchange of information and smart processing produce best hearing outcomes; another important development is use of 2 microphones on each hearing aid; directional microphone picks up sound in front of patient; omnidirectional microphone picks up sound from surrounding area; when 2 hearing aids worn, they work as single system, using combination of microphone inputs to maximize most intense speech signal; newer aids also less likely to whistle and may reduce environmental noise and improve clarity of speech signal

**Assistive listening devices:** used to improve on signal; frequency modulation (FM) technology standard traditional; FM requires transmitting microphone (worn by speaker), radio signal, and...
receiver (worn by patient); this option sometimes used by schools but costly for individual use

**Streamer devices:** developed to provide more affordable solutions; streamer codes sound from source such as cell phone, television, or land line and delivers sound directly to hearing aids without interference of external sound sources; streamer can also control volume or program

**Other devices:** other devices allow input from variety of sources without intermediary streaming device and deliver sound directly to hearing aids

**Applications:** one manufacturer allows patient to operate hearing aids using application on cell phone or tablet; patient can change programs, adjust volume and frequencies, use phone as remote microphone, stream music, and reduce background noise or environmental noise such as wind; application helps user locate hearing aids and check batteries

**Mini-microphone:** in noisy restaurant, mini-microphone may be used by companion or placed on table; user can remotely adjust hearing aids and functions of mini-microphone; geolocating function can make automatic adjustments based on custom settings previously programmed by patient

**Underuse of hearing aids:** only ≈20% of people who need hearing aids wear them; untreated hearing loss may profoundly affect quality of life; caregiver may identify candidates for hearing evaluation by observing whether patient requests repetition of dialogue or answers questions incorrectly; assessment tools may be used to determine whether hearing evaluation needed; early referrals may improve outcomes

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HIGHLIGHTS FROM LOYOLA OTOLARYNGOLOGY UPDATE 2015, PART 1

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1. Which of the following cranial nerves form(s) the pharyngeal plexus?
   (A) V
   (B) VII, IX
   (C) VII, IX, X
   (D) IX, X

2. Which of the following conditions accounts for 70% of nonobvious causes of ear pain?
   (A) Stress
   (B) Disorders related to tobacco and substance use
   (C) Dental issues
   (D) Tumors

3. Purulent otorrhea is commonly associated with:
   (A) Trauma to the tympanic membrane (TM)
   (B) Cholesteatoma
   (C) Leakage of cerebrospinal fluid through tegmen
   (D) Nasopharyngeal carcinoma

4. Pulsatile otorrhea is associated with:
   (A) Polyps
   (B) Leakage of cerebrospinal fluid
   (C) Tuberculosis
   (D) Malignant otitis externa in a patient with diabetes

5. If an infection of the external auditory canal does not improve with antibacterial ear drops, the otolaryngologist should consider a diagnosis of:
   (A) Cerumen impaction
   (B) Polyp
   (C) Osteonecrosis
   (D) Otomycosis

6. In a patient with a history of foreign travel, a diagnosis of _______ is suggested by the presence of pale granulation tissue, purulent drainage, and multiple perforations in the TM.
   (A) Chronic otitis media
   (B) Nasopharyngeal carcinoma
   (C) Meningitis
   (D) Tuberculosis

7. In patients with unilateral hearing loss, the head shadow affects higher frequencies more than lower frequencies.
   (A) True
   (B) False

8. When placing a bone-anchored hearing aid, which of the following should the surgeon do?
   1. Use cautery to accomplish adequate subcutaneous thinning in large patients
   2. Assess the possibility of failure of osseointegration in patients with previous radiotherapy
   3. Ensure adequate hearing in the contralateral ear
   4. Place the implant flush with the skin
   (A) 1,2
   (B) 1,2,3
   (C) 2,3
   (D) 1,3,4

9. Cochlear implants do not:
   (A) Have approval from the Food and Drug Administration
   (B) Improve sound localization
   (C) Help reduce the head shadow effect
   (D) Reduce tinnitus

10. Why do some newer devices feature 2 microphones on each hearing aid?
    (A) To reduce whistling
    (B) To permit communication with cell phones and other electronic devices
    (C) To allow directional and omnidirectional hearing
    (D) To permit transmission of sound between bilateral hearing aids

Answers to Audio Digest Otolaryngology Volume 48, Issue 12: 1-B, 2-C, 3-B, 4-D, 5-A, 6-B, 7-A, 8-C, 9-D, 10-C