

Paparella: Volume II: Otology and Neuro-Otology

Section 3: Diseases of the Ear

Part 2: External Ear

Chapter 22: Otolgia

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Otolgia (ear pain, earache) can be either primary or secondary. Primary otalgia describes ear pain resulting from pathologic conditions of the ear. Secondary otalgia is pain referred to the ear from distant or adjacent non-otologic sites. Fifty per cent or more of all pain experienced in the ear originates from nonotological source. Otolgia may not be proportional in seriousness to the disease causing it, or otalgia may signify serious disease such as cancer of the ear.

Sensory Innervation of the Ear

The ear is unique in that there is no structure in the body of comparable size that is supplied by sensory nerves from so many different neural segments (Dalessio, 1972). Contributions from cranial nerves V, VII, IX, and X and the cervical plexus provide afferent pathways for transmission of stimuli from the auricle, the external auditory canal, the middle ear, and immediately adjacent areas. Tremble (1965) has described the specific portions of the ear that are innervated by the various nerves and has related these to the evaluation of otalgia. The auriculotemporal branch of the mandibular division of cranial nerve V supplies sensory innervation to the skin of the tragus, the anterior and superior walls of the external auditory canal, the anterior limb of the helix, and a portion of the crus and anterior portion of the tympanic membrane. Diseases affecting structures innervated by the mandibular division of the trigeminal nerve, as well as those structures innervated by the maxillary and ophthalmic divisions, may result in referred otalgia.

Cranial nerve VII, the facial nerve, is primarily a motor nerve, but it contains several somatic sensory elements that innervate the posterior portion of the tympanic membrane and part of the posterior wall of the external auditory canal. Cranial nerve IX, or the glossopharyngeal nerve, exits from the base of the skull through the jugular foramen and is distributed to the tonsils, pharynx, eustachian tube, and posterior third of the tongue. The tympanic branch (Jacobson's nerve) of cranial nerve IX ascends into the middle ear, forms a plexus on the promontory, and exits from the antero-superior part of the middle ear as the lesser superficial petrosal nerve, which reaches the otic ganglion and supplies preganglionic special visceral motor fibers to the parotid gland. The tympanic plexus is formed by the tympanic branch of cranial nerve IX and the superior and inferior caroticotympanic branches of the sympathetic plexus of the internal carotid artery. Cranial nerve IX provides sensory fibers to the posterior portion of the external auditory canal and meatus and to the posterior portion of the external surface of the tympanic membranes, as well as most of the mastoid air cells, and eustachian tube. The tympanic plexus provides sensory innervation of the middle ear. Cranial nerve IX mediates deep ear pain referred from the tonsils and pharynx.

The auricular branch (Arnold's nerve) of cranial nerve X supplies sensory innervation to a portion of the cavum conchae, posterior wall of the external auditory canal, and posterior portion of the external surface of the tympanic membrane. Cranial nerve X, or the vagus nerve, also supplies the sensory innervation of the entire larynx, esophagus, trachea, and thyroid gland. Thus, disorders in these areas can cause referred otalgia.

The upper cervical nerves, especially the posterior branch of the great auricular nerve, supply the major portion of the posterior surface of the auricle and some of the skin of the cavum conchae. There is also overlap and communication with the lesser occipital nerve in the mastoid region. These cervical nerves also innervate the skin and muscles of the neck and spine. Therefore, disorders of the neck and cervical spine can cause secondary otalgia.

A likely pathway for referred otalgia in the head and neck is through the spinal tract nucleus of the trigeminal nerve, which descends from the caudal medulla to the level of C2 and C3, and is in anatomic continuity with the dorsal gray column of the cervical cord (Edmeads, 1978). Fibers entering the spinal trigeminal tract arise from the cutaneous distributions of cranial nerves V, VII, IX, and X and the cervical plexus (C2 and C3). The convergence of cranial and upper cervical nerve somatic afferents into a common synaptic region in the caudal medulla and upper cervical cord provides a possible centrally anatomic explanation for the occurrence of referred otalgia (Kreisberg and Turner, 1987). One can see, therefore, that because of the complicated ramifications of the various nerves, the cause of otalgia is often difficult to determine.

Etiology

Otalgia may have multiple causes (Table 1), and sometimes the diagnosis can be made only after a detailed examination has been carried out.

Table 1. Causes of Ear Pain

Primary (Ear)

A. External ear

1. Furunculosis
2. Foreign body in external ear canal
3. External otitis
4. Abscess of auricle
5. Perichondritis of auricle
6. Eczema of meatus
7. Impacted cerumen
8. Frostbite of auricle
9. Herpes simplex and herpes zoster oticus
10. Malignant and benign growth of external ear
11. Preauricular cyst or sinus
12. Acute myringitis and myringitis bullosa
13. Trauma of tympanic membrane and external canal

B. Middle ear, mastoid, and eustachian tube

1. Acute otitis media
2. Acute mastoiditis
3. Acute aero-otitis media (barotrauma)
4. Acute eustachian tube obstruction
5. Otitis media with effusion
6. Complications of otitis media and mastoiditis
 - a. Petrositis
 - b. Facial paralysis
 - c. Labyrinthitis
 - d. Inner ear deafness
 - e. Subperiosteal abscess
 - f. Extradural abscess
 - g. Subdural abscess
 - h. Brain abscess
 - i. Venous sinus thrombophlebitis
 - j. Meningitis
7. Malignant and benign growth of middle ear and mastoid process

C. Idiopathic (ticlike pain confined to the ear)

1. Genuiculate complex of cranial nerve VII
2. Tympanic branch of cranial nerve IX

Secondary (Referred)

A. Oral cavity and jaw

1. Dental neuralgias
 - a. Dentine exposed, pulp inflamed, or nerves dying
 - b. Unerupted or impacted molars or wisdom teeth
 - c. Traumatic occlusion of teeth, faulty jaw closure, and improperly fitting denture
2. Temporomandibular joint syndrome
3. Acute diffuse glossitis or stomatitis
4. Carcinoma of oral cavity and tongue

B. Pharynx (naso-, oro-, and hypopharynx)

1. Pharyngitis
2. Acute tonsillitis (palatine, lingual, pharyngeal)
3. Peritonsillar abscess
4. Retropharyngeal abscess
5. Postadenoidectomy or tonsillectomy
6. Nasopharyngeal fibroma
7. Malignant growth

C. Larynx

1. Cancer
2. Laryngitis
3. Perichondritis and chondritis

4. Arthritis of cricoarytenoid joint
5. Contact ulcers

D. Esophagus

1. Foreign body
2. Hiatus hernia
3. Inflammation
4. Malignant and benign growths

E. Cervical area

1. Postauricular lymphadenitis
2. Whiplash injury and other cervical spine lesions
3. Cervical radiculopathy and arthritis
4. Inflammation such as tabes dorsalis or herpes
5. Carotidynia

F. Miscellaneous

1. Mumps
2. Acute thyroiditis
3. Trigeminal neuralgia
4. Sinuses
 - a. Inflammation
 - b. Malignant or benign growth
5. Erysipelas
6. Raynaud's syndrome
7. Chilblains
8. Glossopharyngeal neuralgia
9. Sphenopalatine ganglion cephalgia
10. Elongation of the styloid process
11. Angina pectoris
12. Thoracic aneurysm
13. Innominate artery aneurysm
14. Infections of nasal passageway
15. Infections of lung and bronchus
16. Myofacial pain syndromes.

Primary Otagia

Acute otitis media is probably the most common cause of otalgia, especially in the pediatric age group. In most instances acute otitis media is easily recognized by history and otoscopic examination. Infants less than 3 months of age who have excessive or unusual crying may have ear pain from unsuspected otitis media. Levin (1975) studied 66 babies with excessive crying who showed no signs of fever, diarrhea, vomiting, blocked nose, skin eruptions, or difficulties with breast or bottle feeding. Nine infants had pus or mucus in the middle ear. Almost all their mothers suspected stomach disorders.

In acute mastoiditis the pain is usually felt behind the ear on the mastoid. Simple barotrauma or eustachian tube obstruction with negative pressure can cause severe otalgia. If

pain occurs in the presence of chronic otitis media or chronic mastoiditis, impending or existing complications beyond the confines of the middle ear and mastoid may be present. For example, in petrositis, pain is felt in the ear and behind the ipsilateral eye and is accompanied by palsy of cranial nerve XI (Gradenigo syndrome). Malignant tumors of the ear are usually accompanied by severe, constant pain.

Origin in the External Ear

The cause of pain originating from the external ear and canal is easily recognized in most instances. An exception to this may be a very early neoplasm of the external canal. Examination of the external canal may be normal grossly, but if careful palpation of the quadrants of both the bony and the cartilaginous portions is carried out under adequate visualization, using a tightly wound cotton-tipped wire applicator, pain may be elicited (Nelms and Paparella, 1968). Biopsy of the areas of pain should be done immediately because of the possibility of early malignant disease. Some of the common causes of otalgia from external ear are listed under A in Table 1.

Origin in the Middle Ear, Mastoid, and Eustachian Tube

Otalgia originating in the middle ear and mastoid may be due to toxic products of infection, pressure, stretching, or invasion by tumors. Some of the common causes of disorders of middle ear, mastoid, and eustachian tube, which produce otalgia are listed under B in Table 1. When otalgia originates in the middle ear or mastoid, other accompanying symptoms, such as hearing loss, fullness of ears, and popping sensations, are present.

Idiopathic Otalgia

Ticlike pain confined to the ear is a rare condition that may originate in either the geniculate complex of cranial nerve VII or in the tympanic branch of cranial nerve IX (Cooper and Cavicke, 1963). Patients with geniculate neuralgia have deep external auditory canal pain that also involves the deep structures of the face. The pain is severe and paroxysmal in nature, without a trigger zone. A small number of patients have been treated with intracranial section of the nervus intermedius.

In neuralgia of the tympanic branch of cranial nerve IX, the pain is unilateral, paroxysmal, sudden in onset, and located deep in the tympanic cavity. This disease may occur at any age. Topical or local anesthesia may give a temporary relief for those patients with a trigger zone in the tonsillar area. Intracranial section of the cranial nerve IX has been required in severe cases (Reichert, 1933).

Secondary Referred Otalgia

Disorders of the Oral Cavity and Jaw

Referred otalgia from disorders of the oral cavity and jaw is transmitted through the auriculotemporal branch of the mandibular division of cranial nerve V. Dental problems such as exposed dentine, impacted wisdom teeth, and disorders of the gingiva may cause secondary otalgia. An anesthetic block of the branch of the trigeminal nerve innervating the suspected

tooth or gingival region will relieve the otalgia for the duration of effectiveness of the anesthetic.

Temporomandibular joint discomfort is one of the most common causes of secondary otalgia. Frequently the patient feels the pain sensation, which is associated with chewing and talking, deep in the ear or preauricular area. It is now thought that a major source of pain in this area is not only arthritis of the joint but also the masticatory muscles. The pain is characterized by sudden onset and is accompanied by dysfunction and spasm of the masticatory muscles and trismus. In addition to a complete otorhinolaryngologic examination, the examiner should pay careful attention to dentition and the possibility of malocclusion and should palpate the temporomandibular joints to see if tenderness can be elicited. Intraoral palpation of the pterygoid muscles at the space between the zygomatic arch and coronoid process of the mandible may elicit painful spasm of these muscles. In the majority of patients, roentgenograms are normal.

In selected patients anesthetic block of the auriculotemporal nerve behind the neck of the mandibular condyle will relieve otalgia referred from the temporomandibular joint. Treatment of otalgia resulting from temporomandibular joint discomfort consists of a soft diet, use of a bite appliance, application of heat, and high doses of aspirin. Corticosteroid injection into the joint usually gives temporary relief of pain.

Other intraoral lesions and carcinoma of oral cavity and tongue can cause severe otalgia. Otolgia in the presence of intraoral carcinoma usually indicates an advanced stage and is a poor prognostic sign.

Significant malocclusion may produce referred otalgia. This can occur because of missing molar teeth or poorly fitting dental prostheses. The latter may be due to alveolar ridge resorption, which is more commonly seen in elderly patients who have worn dentures on a long-term basis without proper supervision and maintenance.

Nocturnal bruxism is an additional significant cause of referred otalgia that is of dental origin. This is often referred to emotional factors (Goodhill, 1979). Nocturnal bruxism has been shown to occur as an autonomic arousal reaction associated with changes in sleep physiology and has no causal relationship to dental occlusion (Kreisberg, 1982). Wear facets on the teeth, especially the canines, and hypertrophied masseter muscles are indicative of bruxism. The referred otalgia is typically experienced bilaterally.

Myofacial pain syndromes may contribute to referred otalgia from myofacial trigger points in several muscles of the head and neck. Pain referral patterns have been established from the deep masseter muscle to the temporomandibular joint and deep to the ear (Travell and Simons, 1983). Many other such trigger points exist in the head and neck and may be responsible for a variety of contributions to referred otalgia.

Disorders of the Pharynx and Tonsillar Area

Cranial nerve IX mediates referred pain in the ear from the tonsils and pharynx through the tympanic branch of this nerve. Inflammatory disorders of the pharynx and the tonsillar area such as pharyngitis, tonsillitis, peritonsillar abscess, and retropharyngeal abscess

commonly cause secondary otalgia. Secondary otalgia after tonsillectomy is so common that patients should be told preoperatively about this. Malignant tumors involving the base of the tongue, tonsillar areas, the hypopharynx, and the nasopharynx can cause secondary otalgia. We have seen patients with malignant tumors in this area who presented with otalgia as a chief complaint. In fact, any middle-aged patient presenting with otalgia and normal otoscopic findings should be suspected to have a tumor in this area and should undergo a careful otolaryngologic examination.

Disorders of the Larynx

Disorders of the larynx, such as cancer, laryngitis, perichondritis, and chondritis, and arthritis of cricoarytenoid joint can cause referred otalgia through the superior laryngeal nerve and Arnold's nerve.

Constant deep otalgia is a frequent complaint of patients with supraglottic carcinoma. Hooper (1971) describes three cases of chemodectoma of the larynx (glomus laryngicum superior). Previously, nine such cases had been described in the literature. Interestingly, each of Hooper's patients had a long history of otalgia and throat pain.

Disorders of the Esophagus

Esophageal disorders such as foreign body, hiatus hernia, inflammation, and tumors rarely cause secondary otalgia. We have seen a patient with severe bilateral ear pain with advanced carcinoma of esophagus. Otolgia was the presenting symptom and bothered her more than carcinoma of the esophagus.

Cervical Area Disorders

Pain originating from the upper cervical nerves can cause referred otalgia around the postauricular and conchal area through the great auricular nerve. Patients with cervical disorders usually have other associated symptoms but often seek medical attention because of otalgia.

Miscellaneous Sources of Referred Otolgia

Referred ear pain may be felt from any area innervated by cranial nerves V, VII, IX, and X, by cervical nerves I, II, and III, and by the sympathetic and parasympathetic nerves. Pain can originate from such remote visceral sources as the lung and bronchus, hiatal hernia of esophagus, angina pectoris, and aneurysms of the innominate artery or thoracic aorta (Yules, 1967). Thyroiditis can cause otalgia through cranial nerve X and sinusitis through cranial nerve V. Elongation of the styloid process or ossification of the stylohyoid ligament may produce otalgia along with vague facial pain, throat discomfort, dysphagia, and carotid artery pain (carotidynia) (Messer and Abramson, 1975). The incidence of this problem has been estimated to be as high as 28 per cent. Intraoral palpation of the styloid process through the tonsillar fossa in a post-tonsillectomy patients helps to establish the diagnosis. The best treatment may be surgical excision of the styloid process.

Approach to Therapy for Ootalgia

Therapy for otalgia is directed to the source of the disease that causes the pain, whether it is in the ear (primary) or has a distant origin (secondary). A detailed history and physical examination of the head and neck are essential.

History

Accurate history is the first step of proper diagnosis and therapy for otalgia. In order to obtain an accurate history, the physician should ask appropriate questions, remembering that the ear has multiple innervations and that the majority of cases of otalgia are secondary (referred). A precise understanding of neural pathways of referred otalgia will enable one to differentiate secondary otalgia from primary otalgia and to find the true cause of otalgia. One should also remember that otalgia may be an early warning of serious disease, such as carcinoma of the ear canal, and it may not be proportionate to the seriousness of the disease causing it; mild otalgia or vague pain may result from laryngeal or esophageal carcinoma, whereas dental caries may cause severe pain.

Physical Examination

A complete examination of the ears should be done. The auricle, preauricular area, and postauricular area should be examined and palpated. Pain on palpation of the tragus usually indicates the presence of external otitis. The external auditory canal should be examined for any inflammation or other anomalies. Next, the tympanic membrane should be examined for any abnormality on the drumhead itself or any signs of middle ear disorder. Any abnormality in color, transparency, contour, or presence of defect in the tympanic membrane will indicate disease process in the middle ear. Examination of the ears using an operating microscope is helpful to detect abnormalities. Tympanometric testing will aid in detecting the presence of negative pressure and fluid in the middle ear.

If the otologic examination is normal, a thorough head and neck examination should be performed to find the source of referred otalgia. Likely areas of a possible source of secondary otalgia innervated by cranial nerves V, IX, and X and the upper cervical nerves should be carefully examined. The oral cavity, teeth, gums, and temporomandibular joint should be examined. The nasal cavity should be examined for clues suggesting the presence of sinus disease. The nasopharynx, oropharynx, hypopharynx, and larynx also should be examined. A flexible fibro-optic nasopharyngoscope is necessary in difficult-to-visualize patients. Palpation can be especially important in detecting abnormality, especially in the base of the tongue.

Further Evaluation and Specific Therapy

When routine, thorough otolaryngologic examination fails to reveal any source of otalgia, the patient may need additional radiologic studies. Radiographs of paranasal sinuses, mastoid, cervical spine, and soft tissues of the neck may be helpful. The esophagus can be evaluated with barium swallow studies. In the presence of deep, persistent otalgia, computerized tomography and magnetic resonance imaging should be used to rule out the presence of hidden deep lesions in the skull base and neck that may be the source of otalgia.

If a hidden tumor is strongly suspected in a patient, endoscopy under general anesthesia can be considered.

If further studies are not felt to be necessary, the patient should be reexamined periodically for any new findings. Early hypopharyngeal or supraglottic tumors may be detected during follow-up examinations.

Treatment

Once a definite source of otalgia, whether primary or secondary in origin, is found, specific therapy for the disorder is instituted. For example, pain emanating from temporomandibular joint is treated first conservatively with soft diet, head, and nonsteroidal anti-inflammatory drugs. Surgery may be directed to the joint when sufficient pathology exists. If dental disease or malocclusion exists, it is corrected. Diseases related to the cervical vertebrae and regional musculature are identified and managed with heat and analgesics.

A severe infection involving the external auditory canal is treated with topical and systematic antimicrobial drugs combined with topical steroids. Biopsy should be performed for any suspicious lesions on and around the auricles and in the external auditory canal. Otalgia originating from neuralgia without any observable anomaly is usually treatable with symptomatic care. Analgesics, reassurance and, for more severe cases, Tegretol can be tried. Consultation with a neurologist or neurosurgeon may be necessary in certain cases. Occasionally, in extreme cases, sectioning of the nerves or injection of alcohol into the nerves may be employed.

By understanding the neural pathways of otalgia and evaluating the disorder in a systematic manner, the majority of causes of primary and secondary otalgia can be detected and treated.