

# THE ROLE OF OTALGIA IN THE DIFFERENTIAL DIAGNOSTICS OF TEMPOROMANDIBULAR DISORDERS

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## Summary

Otalgia (earache) is pain presented in the ear, which does not necessarily originate from the ear (primary otalgia). In the differential diagnostics of (secondary) otalgia cervicocephalic syndrome, temporomandibular disorders, odontogenic pathology, parotitis, tonsillitis, pharyngitis, epiglottitis, oesophagitis and malignant tumours infiltrating trigeminal, vagal or auricular (cervical) nerves branches from oesophagus inferiorly and skull base cephalad, should be considered. Primary otalgia is usually confined to external otitis or acute otitis media, while it is rarely found as a symptom of chronic otitis media, except in exacerbations. In the chronic otitis media earache is usually a sign of complication and expansion of inflammation to the dura and cranial nerves.

In the differential diagnostics of primary otalgia otoscopy and otomicroscopy are necessary, as well as radiologic work-out, where CT and MRI scans are replacing former conventional x-ray Schuller and Stenvers views. If otalgia is associated with hearing or balance disorders without clinical manifestation of otitis, the etiology is most commonly viral neuritis of temporal bone nerves, and otoneurological diagnostic workout should be considered. If (secondary) otalgia is associated with dysphagia or odinophagia, the most common etiology would be tonsillopharyngitis, but quinsy, epiglottitis, tongue base abscess, parapharyngeal abscess, and tumours of pharynx, tonsill or tongue base or epiglottitis should be considered. Eagle syndrom or elonged styloid process syndrom is also characterised by painful swallowing and referred otalgia.

Earache can be caused by temporomandibular disorders, where otalgia is usually increased by mastication and joint palpation. The role of otorhinolaryngologist is to exclude otogenic and pharyngogenic otalgia, and the differential diagnostics should include workout considering cervicogenic otalgia (cervical spine x-ray or MRI), temporomandibular disorders (TMJ x-ray, dentist consultation), or odontogenic otalgia (dentist consultation). The diagnostic workout of otalgia should include radiologist, dentist, reumatologist, and neurologist.

**Key words:** earache; temporomandibular disorders; differential diagnostic procedures.

## INTRODUCTION

Otalgia is subjective earache, usually perceived by the patient like the inflammation of the ear, and that is the reason why patient is often referred to the otorhinolaryngologist. However, more than 50% of otalgia in adults is not related to the ear disease. Patient commonly describes her/his pain as aching, burning, or stabbing. It may be variable in the severity, but the perception of pain often does not correlate with the severity of the underlying illness. It may be constant or intermittent. The first step in the differential diagnostics is to determine whether the source of the earache (otalgia) is in the ear. If the pain is originated from the ear, otalgia is defined as primary otalgia, if it is referred, it is called secondary otalgia. Ear pain can be referred pain to the ears in five main neural pathways: 1. the auriculotemporal nerve, a branch of maxillary nerve (2<sup>nd</sup> trigeminal branch), 2. great auricular nerve (cervical branch C2, C3), 3. auricular branch of the vagal nerve 4. and 5. via facial and glossopharyngeal nerve anastomosis (Jacobson anastomosis). Differential diagnostics of secondary otalgia includes cervical syndrome, temporomandibular disorder, dental pain, parotitis, tonsillitis, pharyngitis, epiglottitis, esophagitis, stomatitis, glossitis, malignant tumors infiltrating trigeminal and vagal nerve, spreading from oesophagus inferiorly, to the skull base cranially, even intracranial process may be involve otalgia [1,2].

## PRIMARY OTALGIA

Primary otalgia is more often found in acute than in chronic inflammatory process of the mastoid, external ear, ear canal, or tympanic membrane. The findings are evident with inspection, palpation, and otoscopy; although mild redness of the tympanic membrane or mild swelling of the external auditory canal are common findings and may not firmly indicate the source of earache. Vesicles on the auricle or in the external auditory canal should suggest Herpes zoster oticus (Ramsay Hunt syndrome), often associated with facial palsy, deafness, and dizziness. As the cause is herpes zoster virus, treatment is oral antiviral drug, acyclovir [3]. It should not be confused with bullous myringitis seen in bacterial complications following influenza. Generally it can be said that acute middle ear infections are more common in preschool children going to daycare, than in school children, and they are rare in adults. Usual treatment involves oral antibiotic and nasal drops, aiming to the improvement of Eustachian tube patency, if no perforation occurs. In the cases eardrum perforation and otorrhea, ear lavage are indicated. Aminoglykozide ear drops should be avoided in the acute

inflammation due to ototoxicity. Otolgia resulting from disorders of the middle ear and mastoid may be associated with hearing reduction.

Earache is the main symptom of acute inflammation of external auditory canal (external otitis). It is diagnosed by otoscopy, which usually shows red and swollen ear canal, with detritus, and, less commonly, pus. Simple cases can be treated and cured with topical treatment with antibiotic and corticosteroid ointments or drops. Severe external otitis may spread to the cartilage of the auricle (perichondritis), retroauricular space, imitating mastoiditis, and anteriorly into the parotid gland, imitating parotitis. In such cases, systemic antibiotics are indicated. Exteremly painful form of external otitis is an epidemiologically and etiologically specific form called malignant external otitis, which means skull base osteomyelitis caused by *Pseudomonas aeruginosa*, usually affecting diabetic or immunocompromised patients, and starting as an external otitis [4]. Besides otorrhea and otalgia, patients develop progressive palsies of facial, abducent, oculomotor, vagal, glossopharyngeal and hypoglossal nerve. Although findings and severity are suggesting that the treatment should be surgical, clinical experience showed that surgical treatment may be fatal due to spreading of infection further on the skull base, and results are better with high dose of systemic antibiotic targeting *Pseudomonas* during 6 weeks. Even earwax may cause otalgia, especially following swimming or shower. The treatment is simple by removal of the ear plug.

Chronic inflammation of the ear canal or middle ear is usually not painful. Earache in such chronic condition may be a sign of imminent complication. Pain in the chronic otitis media, characterised by otorrhea and hearing reduction, or mastoiditis, may be associated with neurologic complications like facial palsy; labyrinthitis; sensorineural deafness; extradural, subdural or brain abscess, meningitis, sygmoid sinus thrombophlebitis.. Although chronic otitis media itself is typically not painful, petrous apicitis, or petrositis, may be very painful, due to trigeminal ganglion involvement (Gradenigo syndrome – otorrhea, abducent palsy and trigeminal neuralgia), [5]. Rarely, severe unilateral, paroxysmal, tic-like pain may involve the external auditory canal.

Inflammatory disorders of the ear, besides hearing loss, may cause tinnitus and dizziness, vertigo. Tinnitus may occur in any form of ear disease, including Eustachian tube disorders, but vertigo is usually indicating inner ear involvement. However, tinnitus and vertigo, originating from the inner ear, may be triggered by neural and circulatory disorders of the inner ear without inflammation in the external ear canal or middle ear. Hearing disorders, tinnitus and vertigo are clinically evaluated by simple clinical methods, like acumetric hear-

ing examination with tuning fork, or gaze and postural vestibular tests, but are usually followed by more sophisticated tests. Acumetric tests with tuning fork may determine whether hearing impairment is conductive (due to external or middle ear lesion) or sensorineural (due to lesion of cochlea or cochlear nerve). Diagnostic audiology test are used to determine the level and to locate the origin of hearing impairment more precisely.

Pure tone audiometry is the basic test used to identify hearing threshold levels of the patient, enabling determination of the degree and type of hearing loss based on response to pure tone stimuli. It is done on adults and children to provide ear specific thresholds using specific pure tones to give place specific responses, so that the configuration of a hearing loss can be identified. It uses both air and bone conduction audiometry and the type of loss can also be identified via the air-bone gap. Pure tone audiometry may differentiate between conductive and sensorineural hearing loss, but it is not enough to locate the site of perceptive lesion. In differential diagnostics of sensorineural deafness. Supraliminal audiometry, recording of stapedial reflex threshold using tympanometry (STAR), otoacoustic emission (OAE) and brainstem evoked response audiometry (BERA) are used as precise topodiagnostic procedures which may differentiate and determine the severity of cochlear vs. neural lesion, with additional imaging procedures for precise location and etiology of sensorineural hearing loss.

Sensorineural hearing loss may be accompanied with balance disorder due to inner ear or vestibulocochlear nerve lesion. In the acute peripheral vestibular lesions, like labyrinthitis or apoplexia of the labyrinth, vertigo is most common balance disorder. It is the sensation of rotation while the body is actually stationary with respect to the surroundings. Acute peripheral vestibular lesion is usually accompanied with nausea and vomiting, which gradually decreases in hours or days due to central compensation. In the patient with peripheral vestibular disorder with central compensation, severity of the lesion may be determined using instrumental diagnostic tests, like electronystagmography. Orientational tests in balance disorders may be done in ambulatory patient without instrumentation, using only gaze test, to search for nystagmus, and postural tests and walking. For more precise testing, electronystagmography and imaging methods are used.

Most common postural test is Romberg's test, which shows both peripheral and central lesion. In the test with closed eyes, even the patients with old lesions experience imbalance. Similar results are achieved with the walking tests. Combination of all of these tests, combined with hearing tests, indicate not only if the lesion is peripheral or central, fresh or compensated, but also the side of lesion.

Electronystagmography (ENG) is recording of involuntary eyes movements (nystagmus) which are result of vestibuloocular reflexes. Nystagmus is recorded during testing in positional, cervical, caloric and rotational tests. ENG may differentiate and quantify peripheral and central balance disorder in fresh and compensated lesions, may record nystagmus induced by vertebrobasilar circulation impairment in retroflexion, dextrotorsion and levotorsion. Caloric test is used to quantify lesion and register asymetry of the peripheral vestibular organ by stimulation of each lateral semicircular canal with cold and hot water. Rotational tests are testing both peripheral vestibular organs simultaneously. Various imaging techniques may help in the differential diagnostics of vertigo induced by neural or circulatory lesions of vestibular system [6]. Vertigo, sometimes accompanied with tinnitus, with pain in the ear, mastoid and occipital region is indicating cervical spine lesion. In differential diagnostics of such lesions, temporomandibular disorder should be considered. In temporomandibular disorder, tinnitus and balance disorder with pain in the ear and temporomandibular region used to be called Costen's syndrome [7].

Tinnitus is perception of the sound within the ear, without corresponding external, and most commonly, internal sound. When there is no internal sound, like vascular pulsation or sounds within pneumatized parts of the skull, tinnitus is subjective, while situation when examiner can hear tinnitus within the patient, usually using instruments, like stethoscope or microphone, is called objective tinnitus [8]. Usual causes of objective tinnitus are vascular (pulsating or continous), myoclonus, spasms etc. Vascular causes may be important, like sign of aneurysm or artery dissection, vasculitis or arteritis.

Characteristics of subjective tinnitus may be variable, from noise to tone, from narrow to broad band noise, from low to high pitch, continuous or intermittent. Even the impact of tinnitus on quality of life may be variable, from suicidal tendencies in depressive patients with tinnitus, to complete ignorance. Some drugs may induce tinnitus, like ACE inhibitors, anaesthetics, antibiotics, antidepressants, antihistamines, beta blockers, narcotics, hypnotics etc. Tinnitus may raise suspicion of the tumour of 8<sup>th</sup> nerve or glomus tumour of the temporal bone. Diagnostic approach to tinnitus should be multidisciplinary. The first specialist that patient is referred to to evaluate tinnitus is otorhinolaryngologist. Following precise history, audiologic evaluation, including pure tone audiometry, OAE, STAR and BERA, differential diagnostics between cervicogenic, vascular, neural, medicamentous, toxic or infective etiology is further evaluated by the collaboration between ORL, neurologist, radiologist, neurosurgeon and rheumatologist. Some patients need psychiatric evaluation and treatment.

Important diagnostic procedures include MRI or MSCT with contrast which should exclude expansive process in internal auditory canal, pontocerebellar angle or brain. Vascular evaluation is done using MRI angiography or Doppler. Approach to treatment is also multidisciplinary and it usually includes vasoactive drugs, hyperbaric oxygen, systemic steroids, and antidepressants.

In the differential diagnostics of otalgia, CT and MRI are more useful than conventional radiology, as skull base, middle and inner ear, retromandibular space, sphenopalatine and infratemporal fossa, as well as parapharyngeal space should be evaluated to detect pathological changes of sometimes not more than few millimeters [9].

## SECONDARY OTALGIA

Secondary otalgia may be triggered by peritonsillary abscess (quinsy), epiglottitis, abscess of the tongue base, parapharyngeal space, aphthous stomatitis, glossitis and tumours of the throat, tongue or tonsil, which are usually diagnosed and treated by ORL [10]. Due to projection of pain into the ear, otoscopy should be performed, even in secondary otalgia, so that primary otalgia may be easily excluded [11]. Most of these disorders are accompanied by swallowing impairment (dysphagia), or painful swallowing (odinophagia), even with hypersalivation, in more difficult cases. Trismus and fetor may be recorded in peritonsillar abscess, and torticollis is a usual sign in parapharyngeal abscess.

Rhinosinusitis is important trigger of craniofacial pain and headache [12]. The diagnosis is symptoms-based, and headache is more common in acute rhinosinusitis than in chronic, where it is intermittent, less severe, but irritating [13]. Headache may be a symptom of expansive processes in the sinuses, like pyocoele, mucocoele and tumours. Otagia is not a characteristic of sinusitis, however, symptoms of the ear disease are often accompanying rhinosinusitis. Temporal pain is occasionally seen in patient with posterior ethmoiditis. Headache in the acute sphenoiditis is located in temporal and parietooccipital region and may be accompanied by diplopias due to palsy oculomotor cranial nerves, mostly of the abducent nerve, sometimes even the lesions of optic nerve leading to temporary amaurosis have been described in the literature [14].

Diagnosis is symptoms based, and imaging, especially in the acute rhinosinusitis is not necessary. The treatment is empirical [13]. If potential sinusitis trigger in temporal pain is to be evaluated, conventional x-ray projections (as the ethmoid sinuses cannot be analysed), would be inadequate, CT-scans are major diagnostic tool.

Eagle's syndrome (syndrome of elongated styloid process) involves painful swallowing with secondary otalgia, may be diagnosed with conventional x-ray or orthopantomographs, but more precisely using CT scans. It is triggered by irritation of sensitive branch of glossopharyngeal nerve and is treated surgically, by resection or fracturing of the styloid process [15].

Otalgia, followed by tinnitus and balance disorders, are clinical characteristics of Costen syndrome (syndrome of temporomandibular joint), [16]. This rare disorder, first described by Costen in the thirties of the XX century is attributed to patients with malocclusion or arthrotic changes in temporomandibular joint. Nowadays, the syndrome is called temporomandibular disorders. There are still controversies in the literature whether audiovestibular symptoms are triggered by temporomandibular disorders, as there is no anatomical or pathophysiological explanation. However, epidemiological studies are indicating higher prevalence of tinnitus and vestibular impairment in patients with temporomandibular disorders than in comparable populations [17,18]. Recent literature offer theoretical hypotheses that explain neurological association of tinnitus and temporomandibular disorders [19].

## CONCLUSION

The role of otorhinolaryngologist is to exclude primary otogenic or pharyngogenic secondary otalgia, and then further differential diagnostic procedures include workout to exclude or confirm secondary otalgia due to cervical spine lesion, temporomandibular disorders or dental pain. Besides otorhinolaryngologist, dental surgeon, rheumatologist and neurologist are involved in differential diagnostics with primary and secondary otalgia.

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## Sažetak

### Uloga otalgija u diferencijalnoj dijagnostici temporomandibularnih poremećaja

Otalgija je bol koja se prezentira u području uha, međutim to ne uključuje nužno otogenu etiologiju. U diferencijalnoj dijagnostici otalgije dolaze u obzir cervikocefalni sindrom, artralgi-ja temporomandibularnog zgloba, odontogeni procesi, parotitis, tonzilitis, faringitis, epiglottitis, ezofagitis te maligni tumori s infiltracijom grana trigeminusa, vagusa i auricularis magnusa, koji se inferiorno šire do područja jednjaka, a kranijalno do lubanjske baze. Otogena bol najčešće se susreće u upalama vanjskog i srednjeg uha, dok je rijetka u kroničnim upalama, osim u fazama egzacerbacije. Kod kroničnih upala srednjeg uha, bol je znak komplikacije i širenja bolesti prema duri ili kranijalnim živcima.

Za diferencijalnu dijagnostiku otogene boli nužna je otoskopija, katkad mikrootoskopija, te radiološka dijagnostika, ranije konvencionalne snimke temporalne kosti po Schulleru i Stenversu, koje danas sve više zamjenjuje CT i MRI. Ako je bol povezana s ispadom sluha ili ravnoteže, što je najčešće rezultat virusnog neuritisa u temporalnoj kosti, a bez kliničke manifestacije otitisa, u obzir dolazi i audiovestibulološka dijagnostika. Ako je otalgija povezana s disfagijom ili odinofagijom, najčešće je riječ o tonzilofaringitisu, ali u obzir dolaze i peritonzilarni apsces, epiglottitis, apsces korijena jezika, parafaringealni apsces, tumor ždrijela, tonzile, korijena jezika ili epiglottitis. Eaglov sindrom, sindrom elongiranog stiloidnog nastavka, također uključuje bolno gutanje i refleksnu bol u uhu.

Bolovi u uhu mogu biti uvjetovani temporomandibularnim poremećajima, s time da se otalgija pojačava žvakanjem ili palpacijom zgloba. Uloga otorinolaringologa jest isključiti otogenu ili faringolaringogenu otalgiju, a potom se diferencijalno dijagnostički uključuje obrada u smjeru cervikogene otalgije (radiološka obrada vratne kralježnice), artralgi-je temporomandibularnog zgloba (radiološka obrada zgloba, konzultacija stomatologa) ili odontogene otalgije (konzultacija stomatologa). U tome su smislu u obradu uključeni radiolog, stomatolog, reumatolog i neurolog.

**Ključne riječi:** otalgija; temporomandibularni poremećaji; diferencijalnodijagnostički postupci.

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