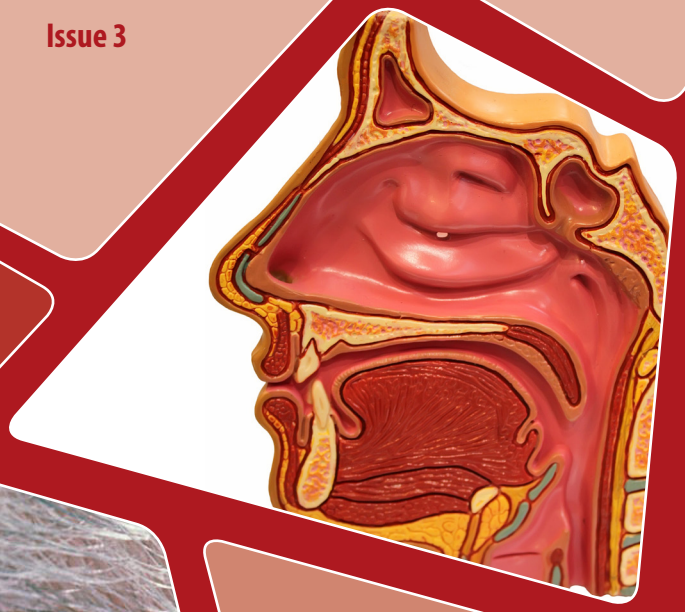
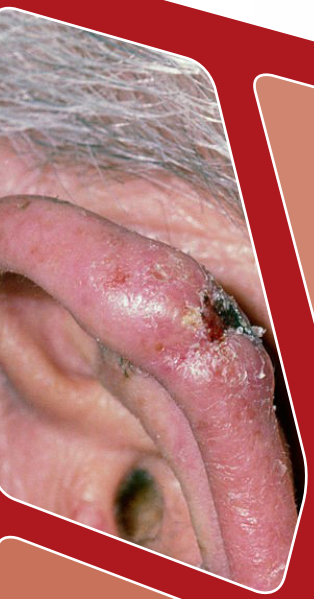
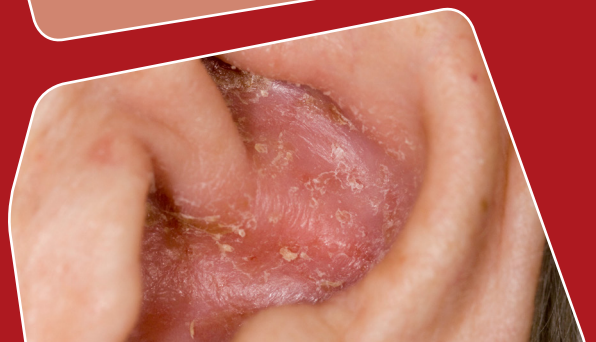
Ear Nose Throat

Issue 3







Springer Healthcare Education

Atlas of External Ear Pathologies

- Congenital Malformations
- Inflammatory Conditions
- Trauma
- Fibrous Dysplasia
- Benign Neoplasms
- Malignant Neoplasms

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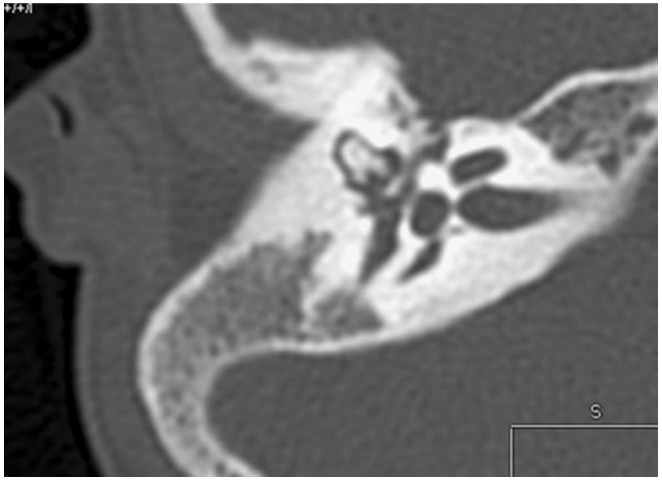
Section 1: Congenital Malformations

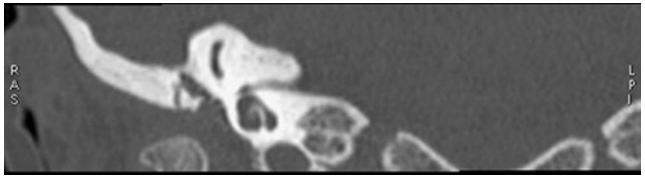
Congenital external ear malformation



Axial CT scan, bone window. Deformed ossicular chain is visible within hypoplastic tympanic cavity. Proper malleus and incus together with malleo-incudal joint can not be identified, instead, there is a V-shaped bony structure, representing the fused malleo-incudal complex. Among frequently observed middle ear developmental anomalies are: hypoplastic middle ear cavity, deformed ossicles, oval window atresia, aberrant course of the facial nerve, absent or hypoplastic tympanic bone.

Authors: Trojanowska, A., Drop, A., Trojanowski, P., *et al*.
Title: External and middle ear diseases: radiological diagnosis based on clinical signs and symptoms
Journal: *Insights Imaging*.
DOI: 10.1007/s13244-011-0126-z

Severe external and middle ear deformity accompanying Goldenhar syndrome



The image is of a patient with severe external and middle ear deformity accompanying Goldenhar syndrome (oculoauricular dysplasia). Coronal CT scan shows, that tympanic bone, forming the floor of external auditory canal (EAC) is absent. It also results in temporomandibular joint incomplete formation.

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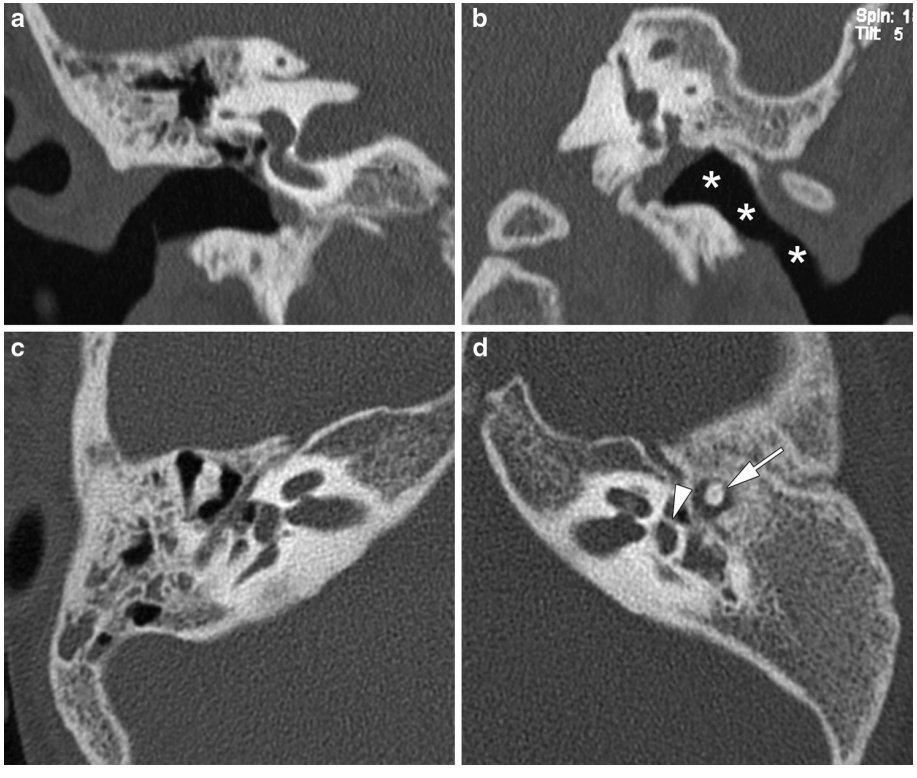
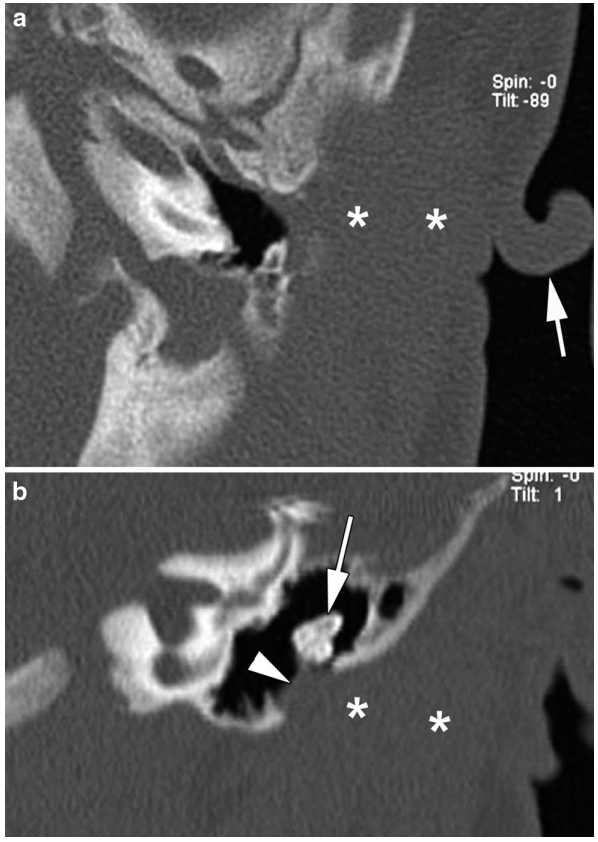
A 9-year-old child showing microtia on left side



a, b *Coronal* CT-images. The *right* external auditory canal appears normal, while on the *left* side it is narrowed and has a steeper slope (*asterisks*). **c, d** *Axial images*. Normally developed middle ear cavity on *right* side. On the *left* side, the epitympanum is very small, only containing the head of the malleus (*arrow*). The incus and stapedial superstructure are absent on the *left* side, while the *left* footplate (*arrowhead*) is well developed, although somewhat turned towards the coronal plane compared to the *right* side. The *left* mastoid is not pneumatized. The inner ear structures appeared normal on both sides.

Author: Hermans R.
Title: External ear imaging
Book: Temporal Bone Imaging
DOI: 10.1007/174_2012_763

Axial and coronal CT-image of left temporal bone in a neonate



Abnormal auricle (*arrow*, **a**) The external ear canal is absent: only soft tissue is seen (*asterisks*). The lateral wall of the middle ear consists of soft tissue (*arrowhead*, **b**) no tympanic membrane is identified. The malleus and incus appear deformed and fused (*arrow*, **b**).

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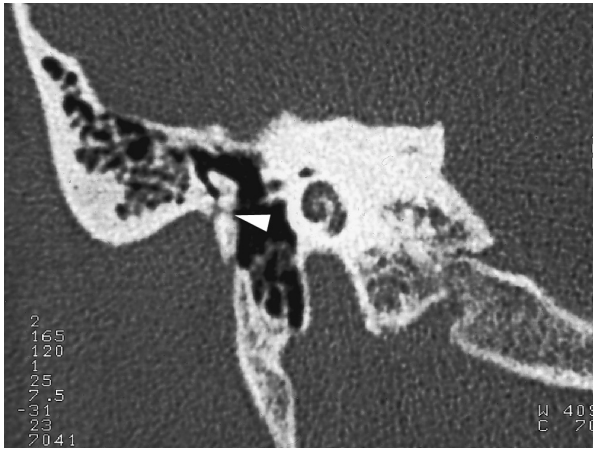
Coronal CT image through right temporal bone in an adult patient



Atresia of the external auditory canal. The neck of the malleus is fused with the atresia plate (*arrowhead*). When no external auditory canal is formed, the tympanic bone is aplastic. The lateral wall of the middle ear consists of soft tissue, or a bony plate which is situated at the expected level of the tympanic membrane. Such a bony plate is called an atresia plate, and this may correspond to a 'frust' tympanic bone or to downward extension of the squamous part of the temporal bone, meeting the floor of the middle ear.

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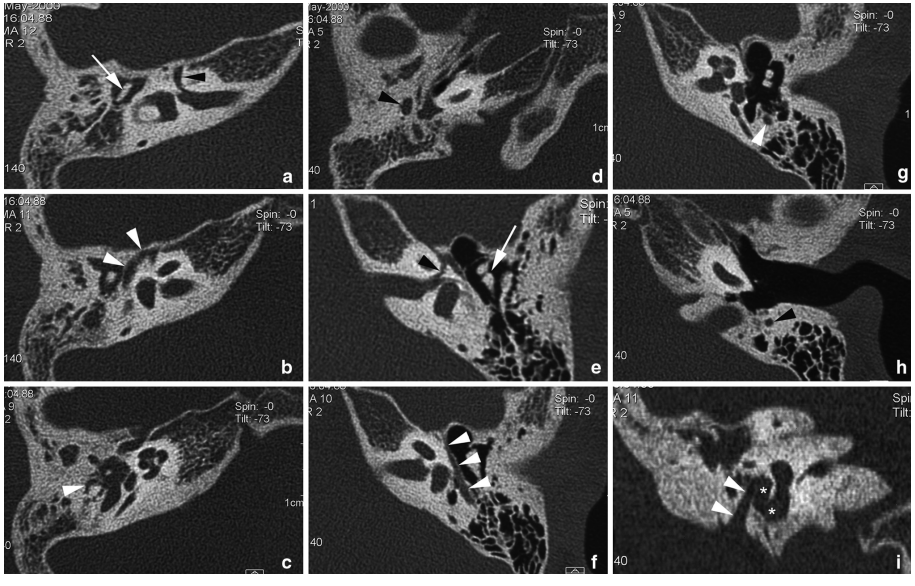
Right-sided Goldenhar syndrome in a 12-year-old patient



a–d *Axial* CT images through *right* temporal bone. The facial nerve canal shows a relatively long labyrinthine segment (**a**, *arrowhead*); note the associated hypoplastic appearance of the ossicular chain (**a**, *arrow*). Short tympanic segment of facial nerve (**b**, *arrowheads*); a second genu cannot be clearly identified, but the mastoid segment of the facial canal is running posterolaterally to the tympanic cavity (**c**, *arrowhead*). At a lower level, the mastoid segment of the facial nerve can be seen to run lateral to the middle ear cavity (**d**, *arrowhead*). **e–h** For comparison, the corresponding heterolateral structures are labelled on *axial* CT images of the normal left temporal bone at similar levels. **i** Coronal CT image through right temporal bone. The short mastoid segment of the facial nerve canal (*arrowheads*) can be seen to run inferolaterally, just lateral from the middle ear cavity (*asterisks*) (the opacification of the *right* middle ear cavity is presumably caused by chronic dysfunction of the Eustachian tube).

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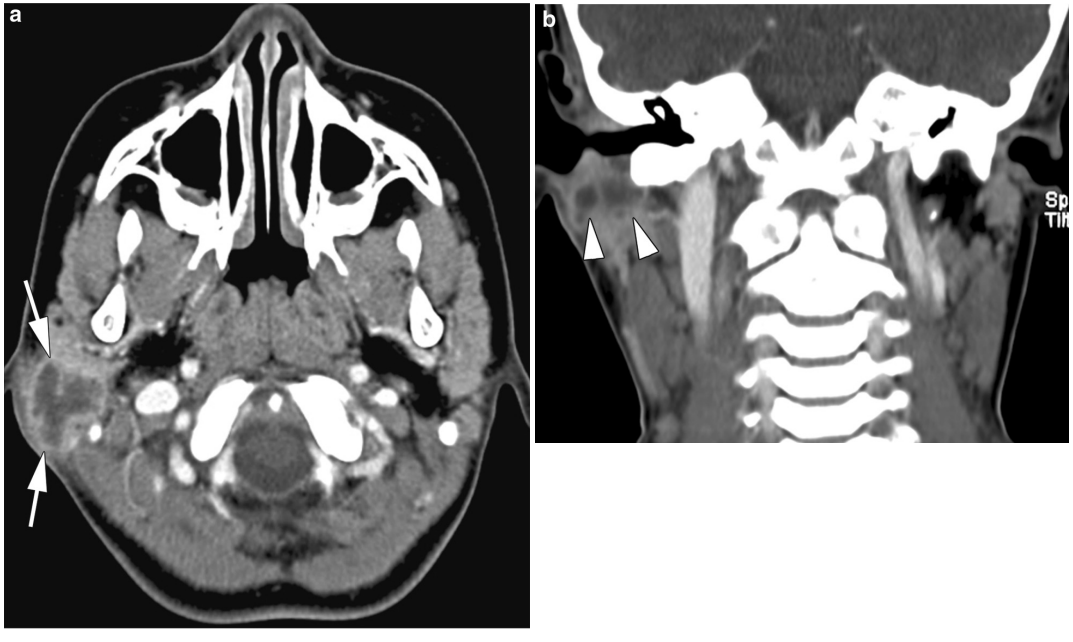
A 7-year-old child presenting with a painful infra-auricular swelling



Axial (**a**) and *coronal* CT-image (**b**) show a cystic lesion with a thick enhancing wall, embedded in the parotid gland (**a**, *arrows*) and running parallel to the external ear canal (**b**, *arrowheads*). Infected first branchial cleft cyst (type I). First branchial cleft anomalies lie close to, or have a connection with the external ear canal. A Work type I anomaly corresponds to a lesion in the preauricular region, running more or less parallel to the external ear canal, embedded within the parotid gland, and lateral to the facial nerve.

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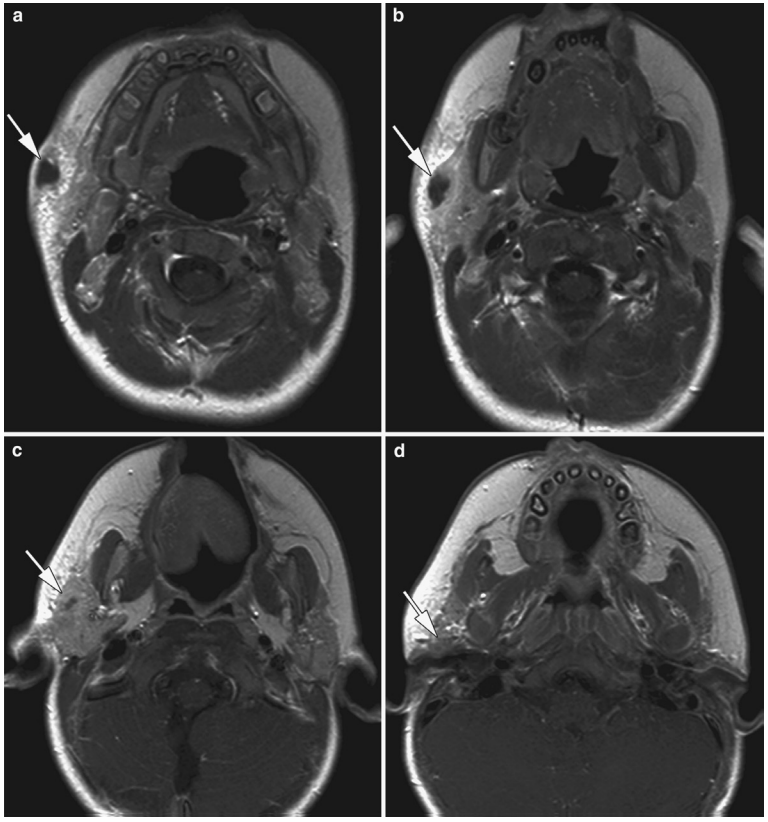
A right-sided preauricular abscess and a sinus opening at level of right mandibular angle



This opening was present since birth. *Axial* contrast-enhanced T1-weighted spin echo images (**a–d**) show a tubular enhancing structure (*arrows*), partially fluid-filled, extending from the skin at the level of the mandibular angle (**a**), through the superficial lobe of the parotid gland (**b, c**), eventually reaching the external ear canal (**d**). This sinus was excised, including its connection with the external ear canal. First branchial cleft anomaly (type II).

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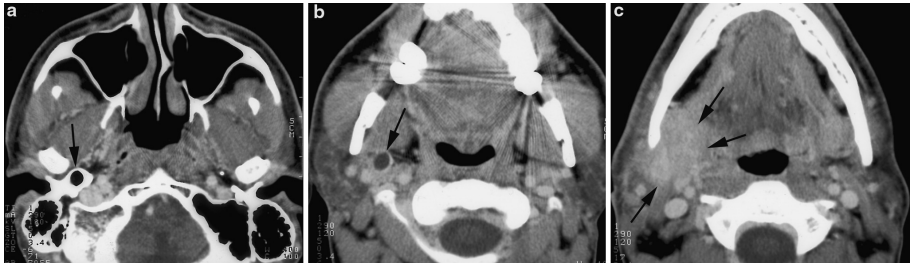
First branchial cleft anomaly (Type II)



Axial contrast-enhanced CT images. *Right* sided tubular anomaly communicating with the malformed tympanic bone (**a,** *arrow*), extending inferiorly just deep to the parotid gland (**b**, *arrow*), ending in an inflammatory mass in the submandibular space (**c**, *arrows*). At the level of the mandibular angle an inflammatory mass lesion may be produced. Demonstration of a connection to the external ear canal, typically at the junction of the cartilaginous and bony part, allows confirming the diagnosis.

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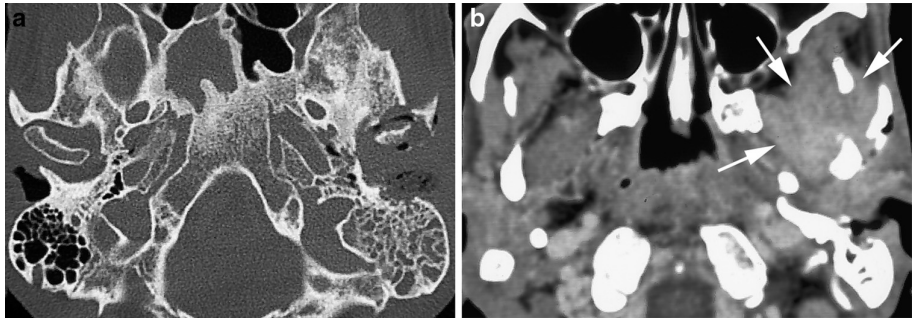
Section 2: Inflammatory Conditions

Necrotising external otitis



Axial CT-images through skull base show destruction of the bony external auditory canal, erosion of the mastoid bone and invasion of the temporomandibular joint (**a**). The contrast-enhanced image reveals extension of the infection into the soft tissues of the infratemporal fossa (**b**, *arrows*). Necrotizing external otitis is a severe infection of the external ear, almost exclusively caused by *Pseudomonas aeruginosa*. Because of the aggressive clinical course, it has also been called 'malignant external otitis'. However, the disease is not neoplastic, and also does not remain limited to the external ear. Generally, 'necrotizing external otitis' is considered the most accurate descriptive name of this disease process.

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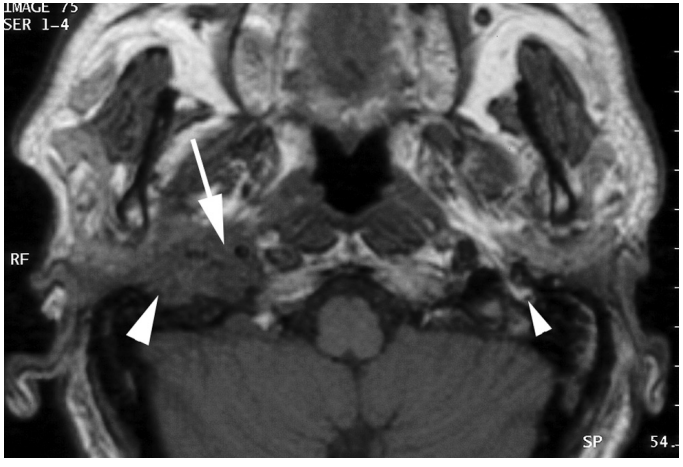
Diabetic patient suffering from right sided external otitis and facial palsy



Axial T1-weighted MR image shows necrotising external otitis. In continuity with the external auditory canal, an infratemporal soft tissue infiltration is seen, extending in the fat pad below the stylomastoid foramen (large *arrowhead*), and into the carotid space (*arrow*). On the *left*, note normal facial nerve just below the stylomastoid foramen (small *arrowhead*).

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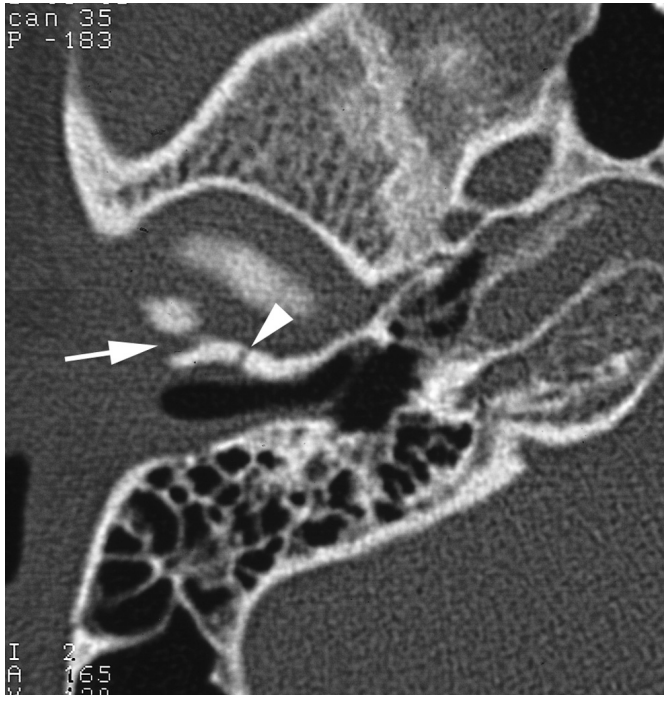
Section 3: Trauma

Axial CT-image in a patient with post-traumatic ear bleeding



Fractures of the tympanic bone are quite frequent; they are usually caused by the impact of a posteriorly displaced mandibular condyle, itself resulting from a blow to the chin region. Care should be taken not to misinterpret the normal squamotympanic suture as a fracture line. A nondisplaced fracture of the right tympanic bone is seen (*arrowhead*); no other temporal bone fractures were apparent. Normal squamotympanic suture (*arrow*).

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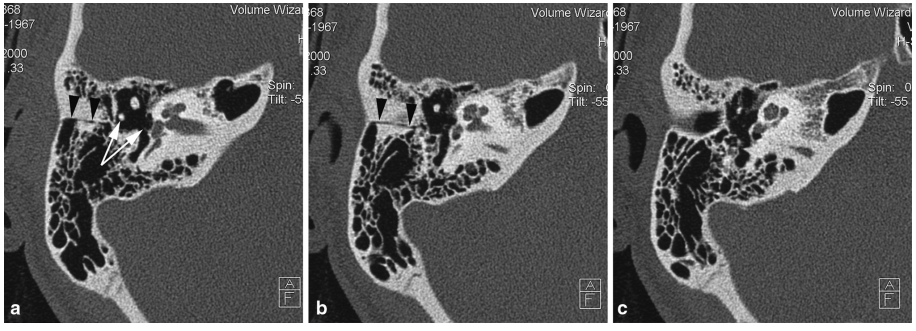
Axial adjacent CT-images in a patient with post-traumatic conductive hearing loss



A longitudinal temporal bone fracture (*arrowheads*) is extending in the lateral wall of the middle ear (**a–c**), as well as in the superior wall of the external auditory canal. The incus is luxated; dissociation is seen between long process of incus and stapedial superstructure (**a**, *arrows*).

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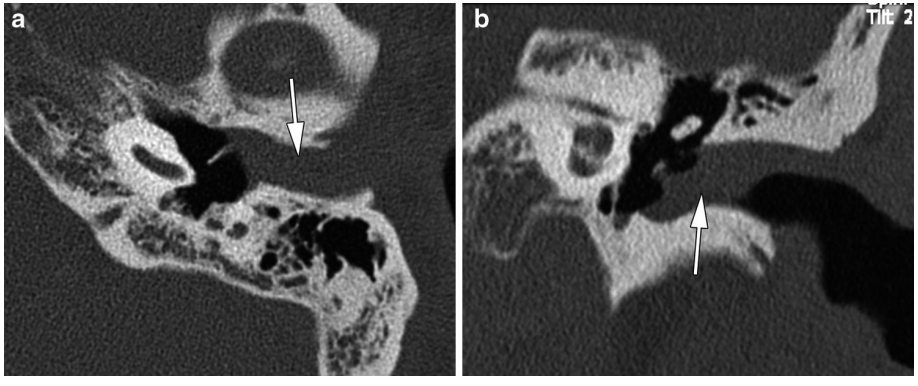
Posttraumatic fibrosis and stenosis



Left-sided conductive hearing loss after soft tissue injury to external ear canal. Clinical examination shows complete soft tissue obliteration of the *right* external ear canal. *Axial* and *coronal* CT images (**a, b**) confirm soft tissue obliteration of this structure (*arrows*); normal aeration of the middle ear cavity. Soft tissue trauma to the external ear canal, without recognisable fracture, may lead to fibrosis and stenosis of the external auditory canal. Post-traumatic canal stenosis may lead to accumulation of debris deep to the stenosis, and formation of a cholesteatoma.

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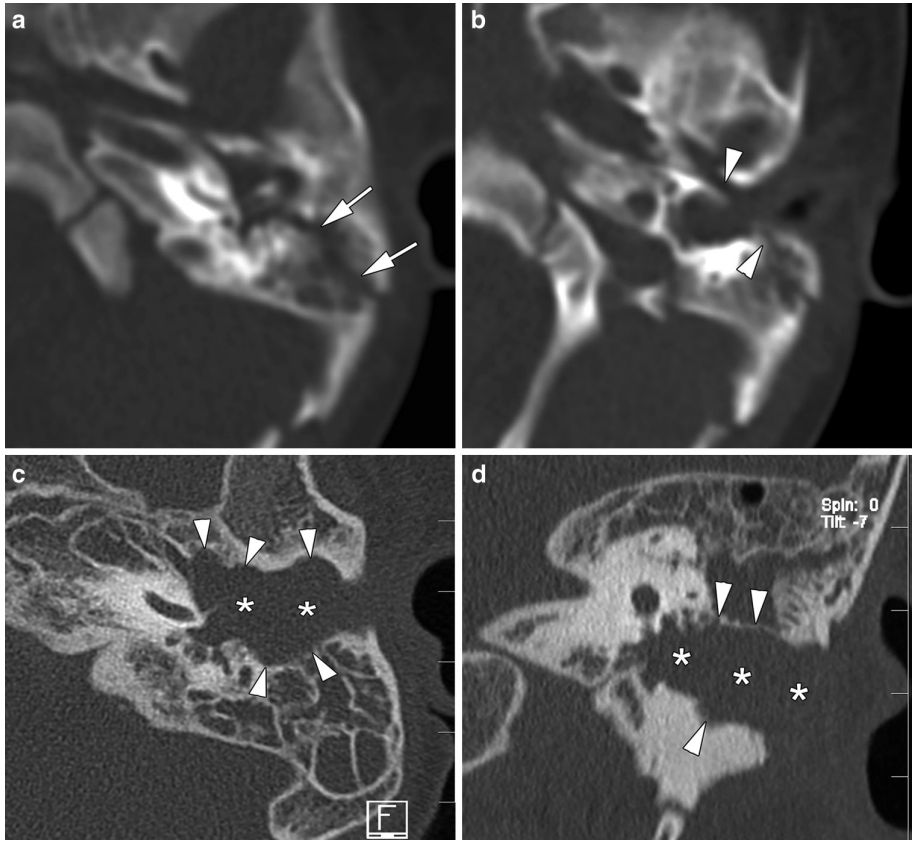
Posttraumatic cholesteatoma



a, b *Axial* CT-images through skull (magnified on *left* temporal bone) in a child involved in a traffic accident. A longitudinal temporal bone fracture (*arrows*), running through the external ear canal (*arrowheads*) is present. **c, d** The patient presents 6 years later with left-sided otorrhea. *Axial* (**c**) and *coronal* (**d**) CT-image show complete opacification of the external ear canal and middle ear cavity (*asterisks*). The external ear canal appears widened, with eroded margins (*arrowheads*). Taking into account the previous history, this appearance is very suggestive for a posttraumatic cholesteatoma. This was surgically confirmed.

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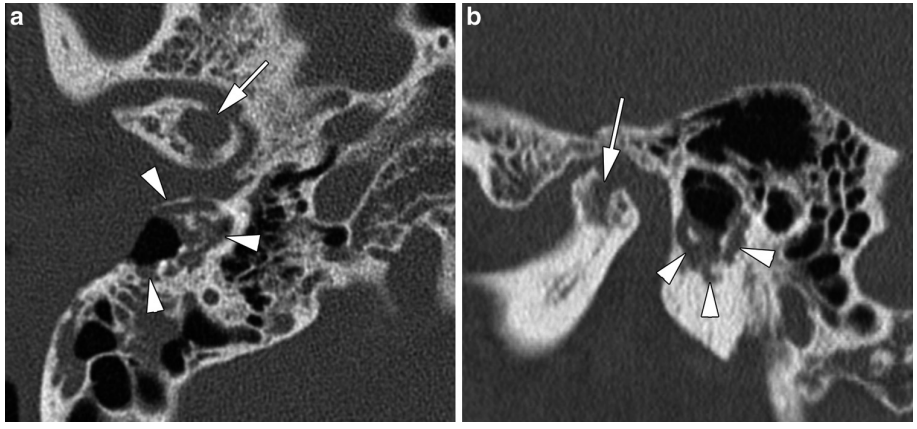
Osteoradionecrosis of the tympanic bone and mandibular head



Patient treated by irradiation for a *right*-sided lateral oropharyngeal squamous cell cancer, 6 years earlier. During the follow-up, the patient mentioned *right*-sided otalgia; clinical examination showed some debris in the external ear canal. *Axial* (**a**) and *sagittal* CT-image (**b**) through the *right* external ear show irregular osteolysis of the tympanic bone, with some small bone sequesters embedded in soft tissue swelling (*arrowheads*). Also some osteolysis is seen in the mandibular head. This was interpreted as osteoradionecrosis of the tympanic bone and mandibular head. Conservative treatment was initiated. Osteoradionecrosis of the external ear canal is a rare complication of radiotherapy of head and neck neoplasms. Often there is a delay of several years after the end of therapy before symptoms occur. Usually, the patient complains of otalgia and/or otorrhea. Imaging shows variable amounts of bone fragmentation and soft tissue thickening.

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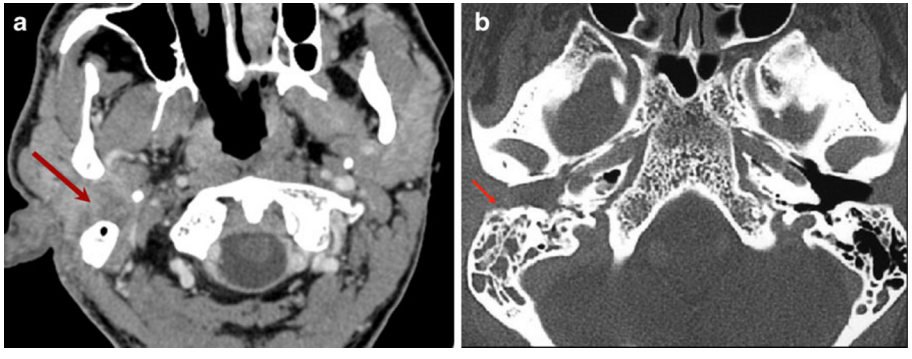
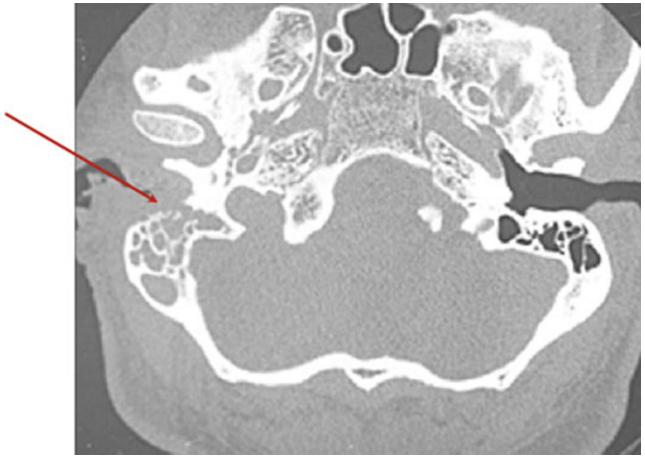
Malignant external otitis



a Axial contrast enhanced CT scan shows thickening and heterogenous contrast enhancement of the soft tissue around auricle and in masticator space (*arrow*). **b** In the bone window, subtle bone erosion is visible (*arrow*) and mastoid air cells are filled with fluid.

Authors: Trojanowska, A., Drop, A., Trojanowski, P., *et al*.
Title: External and middle ear diseases: radiological diagnosis based on clinical signs and symptoms
Journal: *Insights Imaging*.
DOI: 10.1007/s13244-011-0126-z

Axial CT show destruction of mastoid segment of petrous bone



The image is of a patient diagnosed with malignant external otitis. Axial CT scan in bone window demonstrates destruction of mastoid segment of petrous bone. There were also subtle cortical destructions visible in tympanic bone. Thickened mucosa of the external auditory canal and auricle, enhancing after contrast medium administration, together with destructive, osteomyelitis appearance of the tympanic and mastoid bone, strongly suggest malignant external otitis.

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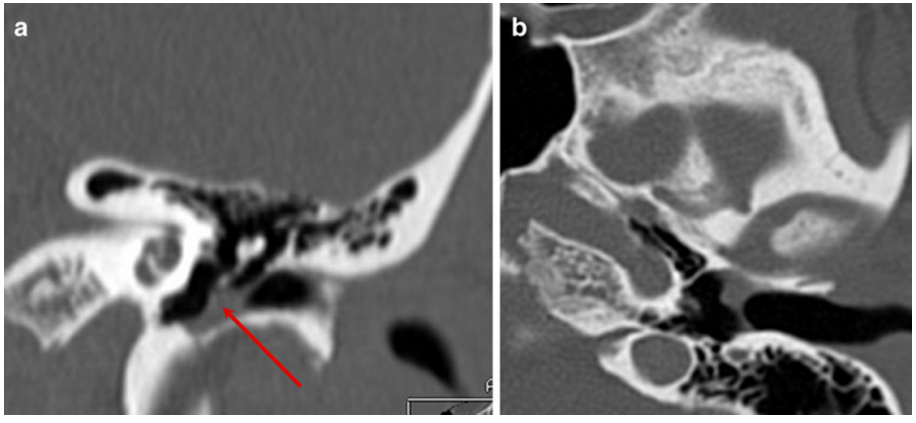
EAC medial canal fibrosis



The disease is characterised by formation of fibrous tissue, overlying lateral surface of tympanic membrane. In many cases (~60%) it occurs bilaterally. Clinically the disease may be discrete, with conductive hearing loss, otorrhea and history of chronic otitis. Medial canal fibrosis typically is seen as a homogenous soft tissue against the tympanic membrane, there are no EAC bone changes. **a** Coronal CT demonstrates soft tissue crescent abutting tympanic membrane (*arrow*)—classic CT findings. **b** On axial CT, soft tissue is visible, filling EAC and sparing middle ear cavity.

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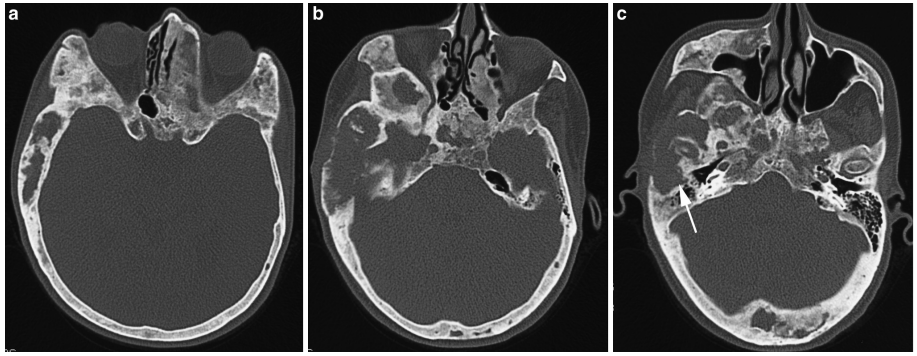
Section 4: Fibrous Dysplasia

McCune–Albright syndrome



Both sides of the sphenoid bone, *left* ethmoid bone, and squamous part of the *right* temporal bone show expansion of the bone, with a mixed osteolytic appearance, areas of dense calcifications and partly a ground-glass appearance (**a, b**). Stenosis of the *right* external ear canal by the bone expansion (**c**, *arrow*).

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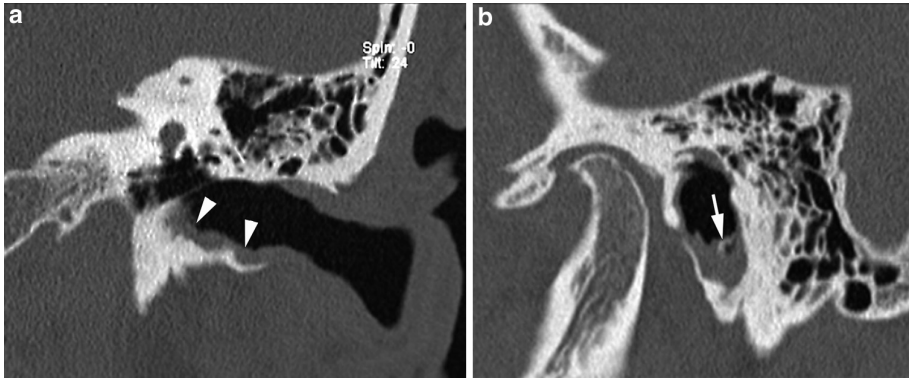
Book: Temporal Bone Imaging
DOI: 10.1007/174_2012_763

Section 5: Benign Neoplasms

External auditory canal cholesteatoma



Coronal (**a**) and *sagittal* (**b**) CT-images. Soft tissue thickening in the external ear canal (*arrowheads*), causing erosion of its inferior bony wall. A small calcification is present (*arrow*). Cholesteatoma is an expansive mass of exfoliated keratin within a sac of stratified squamous epithelium, most often occurring in the middle ear. Cholesteatoma is usually an acquired disease ('secondary cholesteatoma'), but may be congenital ('primary cholesteatoma'). Congenital cholesteatoma is an ectoblastic derived mass, originating from epithelial rests; as such lesions may be found everywhere in the temporal bone, they may also occur in the external auditory canal.

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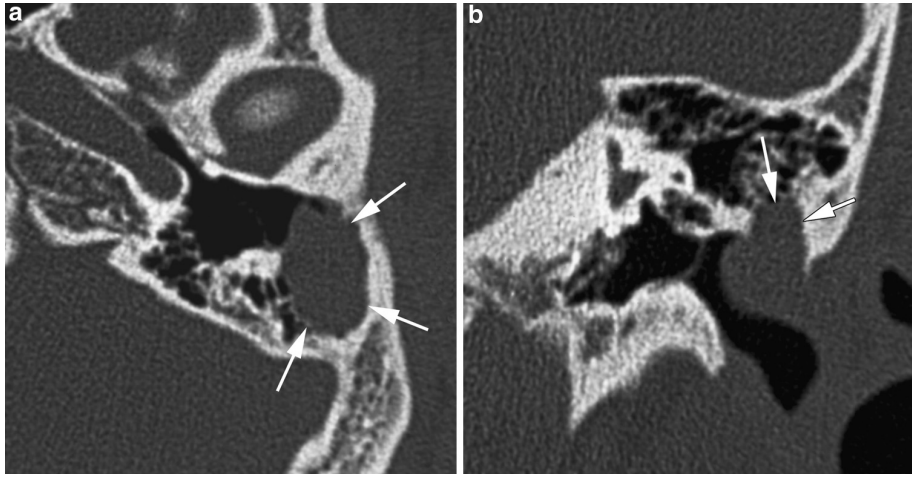
Middle ear and mastoid extensively pneumatised



Axial (**a**) and *coronal* (**b**) CT-images of *left* temporal bone. Soft tissue mass eroding through the posterocranial wall of the external auditory canal into the mastoid (*arrows*). In patients with external auditory canal cholesteatoma, the middle ear and mastoid may be extensively pneumatised; once such a cholesteatoma has gained access to these cavities, it may become quite large.

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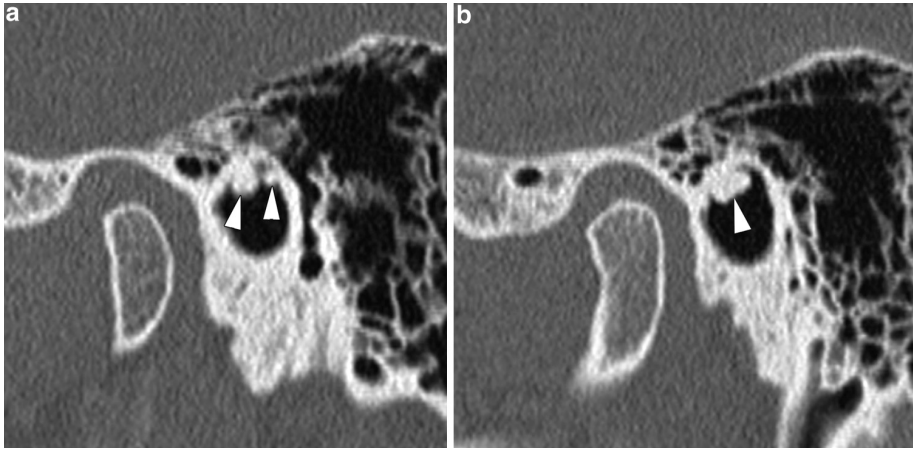
Exostoses



Exostoses are multiple, usually bilateral, nodular elevations of bone involving the tympanic bone. They develop because of prolonged irritation of the EAC, most commonly secondary to excessive contact with cold sea water (surfer's ear). Patients may present with conductive hearing loss. *Sagittal* CT-images (**a, b**) through right and *left* external ear canal in same patient, showing multiple nodular bony structures (*arrowheads*) arising from the bony canal wall: exostoses.

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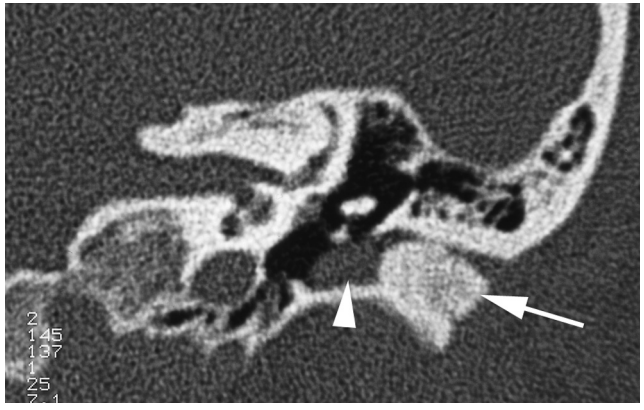
Osteoma



An osteoma is a solitary, unilateral and pedunculated bony growth in the outer half of the bony external auditory canal (EAC). It is usually asymptomatic, but symptoms can arise if obstruction occurs. *Coronal* CT-image through left temporal bone. Solitary bony outgrowth, attached to the tympanic bone, corresponding to an osteoma (*arrow*). Some retro-obstructive debris or inflammation is present between the osteoma and the tympanic membrane (*arrowhead*).

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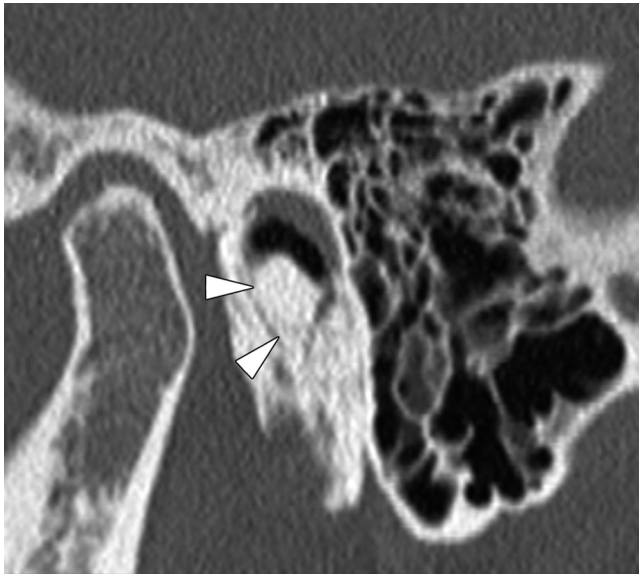
CT-image showing small osteoma



CT shows a solitary, unilateral and pedunculated bony growth of the bony external ear canal. The underlying bone appears normal, as well as the overlying soft tissues. Medial to the stenosis, debris may accumulate; erosion of the surrounding bone at this level suggests a secondary cholesteatoma. *Sagittal* CT-image showing small osteoma (*arrowheads*) attached to anterior and inferior wall of bony external ear canal.

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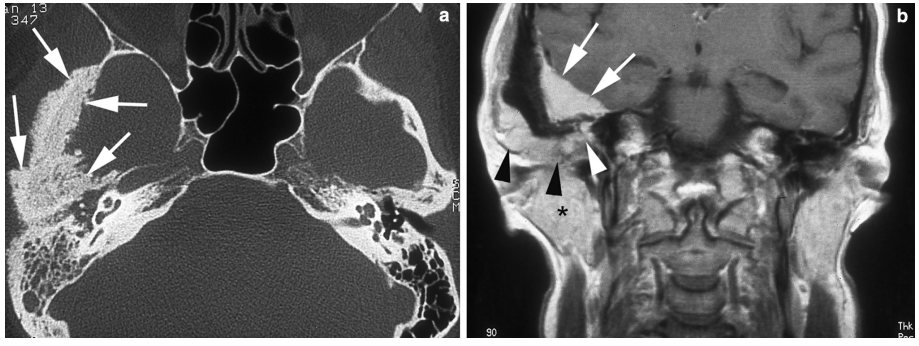
Patient with acquired soft tissue stenosis of the right external ear canal



Axial CT-image (**a**) shows extensive sclerotic bone remodelling of the squamous part of the right temporal bone (*arrows*); although somewhat reminiscent of the ground-glass aspect seen in fibrous dysplasia, the irregular surface should rise the suspicion of hyperostosis induced by a meningioma. Opacification of the right middle ear cavity is seen. Coronal enhanced T1-weighted spin echo image (**b**). A strongly enhancing mass lesion is seen in the middle cranial fossa (*arrows*), with transosseous extension into the middle ear, external ear canal and along the outside of the squamous bone (*arrowheads*). Biopsy of the external ear mass revealed meningioma. Parotid gland (*asterisk*).

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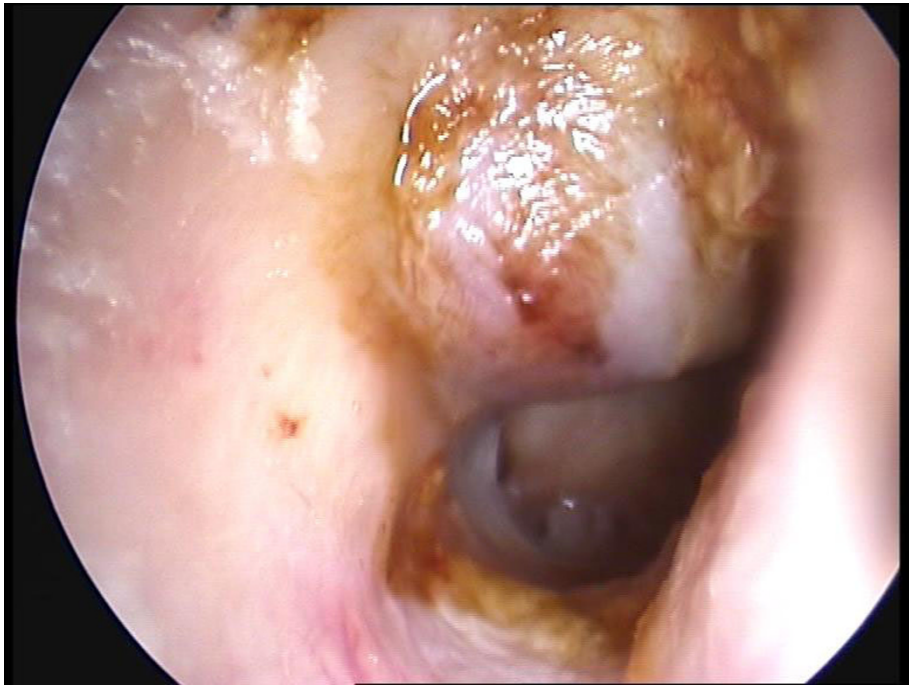
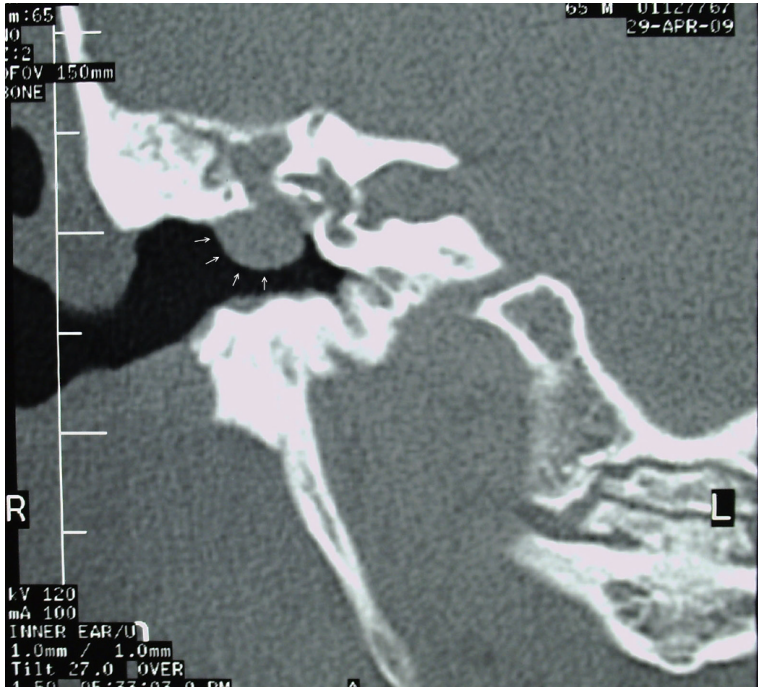
Cholesterol cyst



The image shows cholesterol granuloma occupying the posterior-superior part of the external ear canal. Cholesterol granuloma (CG), or cholesterol cyst, is a clinical entity that appears as an expansible benign mass that contains *brownish-yellow* debris with cholesterol crystals and is characterized by slow growth. The lesion can be found in any part of the body where deposition of cholesterol crystals may occur though the temporal bone and specifically the petrous apex is the most common site.

Authors: Nikolaidis, V., Malliari, H., Psifidis, D., Metaxas, S.
Title: Cholesterol granuloma presenting as a mass obstructing the external ear canal
Journal: *BMC Ear Nose Throat Disord.*
DOI: 10.1186/1472-6815-10-4

Temporal bone CT showing a soft tissue mass in the right EEC



Temporal bone CT (coronal) showing a soft tissue mass occupying the mastoid antrum and part of the external ear canal (EEC). *Arrows* indicate the mass expanding into the external ear canal. The posterior-superior bony wall of the EEC was eroded; the mass expanded into the mastoid antrum and was separated from the middle cranial fossa by a thin bony plate. Erosion of the ossicles of the right ear was also present. At MRI the mass appeared homogeneous with increased signal intensity relatively to the brain on both T1- and T2- weighted images. Inner ear formations were normal in both ears and pneumatization of both temporal bones was poor.

Authors: Nikolaidis, V., Malliari, H., Psifidis, D., Metaxas, S.
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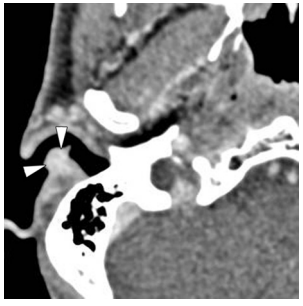
Section 6: Malignant Neoplasms

Small squamous cell carcinoma



Axial CT-images. A small, exophytic enhancing soft tissue mass is seen on the posterior wall of the right external ear canal (*arrowheads*). Primary external ear malignant neoplasms are not common. External ear cancer initially appears as a painless lesion; enlarging lesions cause minor bleeding, itching, pain and intermittent drainage of serous fluid. Often, these symptoms are attributed to external otitis. Eventually, as the clinical situation progressively becomes worse, further exploration will reveal the true nature of the lesion. More advanced cancer may cause stenosis of the external auditory canal, trismus, conchal and preauricular swelling, and facial nerve palsy. Spread towards the middle ear, and more rarely inner ear, may occur.

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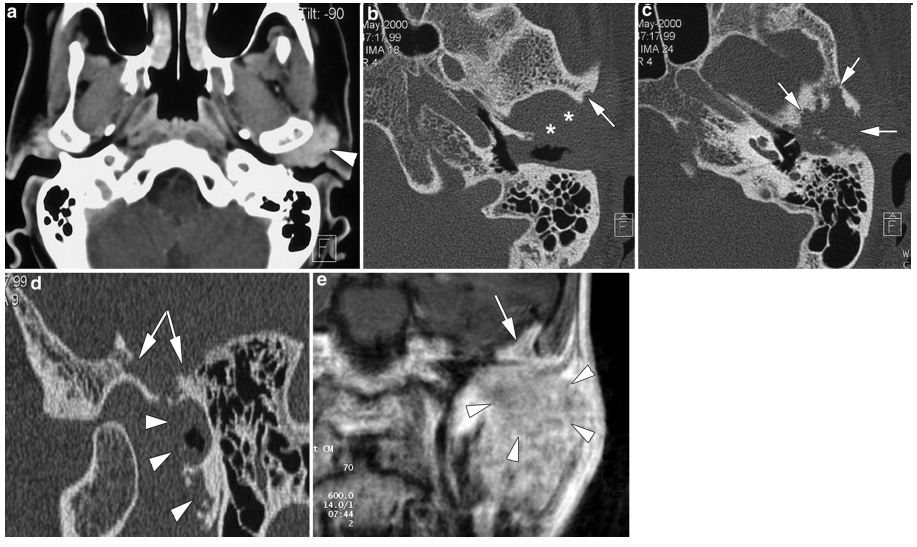
Patient with squamous cell carcinoma of left external ear canal



a *Axial* CT-image (soft tissue window) shows enhancing mass lesion originating from the anterior wall of the canal (*arrow*), growing against the mandibular condyle. **b, c** *Axial* CT-images (bone window). Soft tissue thickening in the canal is seen, with lysis of the anterior wall of the tympanic bone (expected position is indicated by *asterisks*, **b**). Some osteolysis is seen at the origin of the zygomatic process (*arrow*, **b**). More superiorly, lysis of the roof of the external ear canal and adjacent part of the squamous portion (*arrowheads*, **c**). **d** Sagittal CT-image (bone window) confirms extensive osteolysis of the tympanic bone (*arrowheads*) and superior extension in the squamous portion of the temporal bone (*arrows*). **e** Coronal gadolinium-enhanced T1-weighted image shows extension into middle cranial fossa (*arrow*) and into parotid gland (*arrowheads*).

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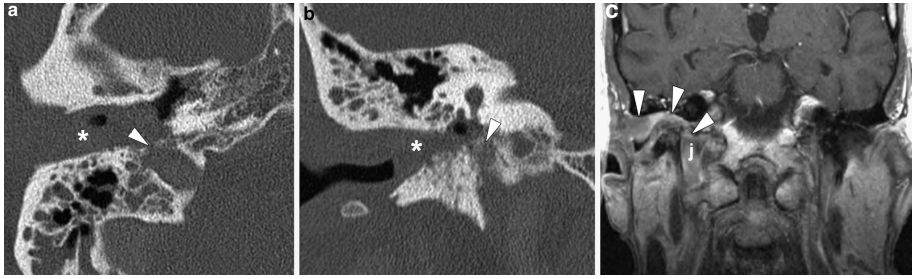
Patient with squamous cell carcinoma of right external ear canal



a, b *Axial* and *coronal* CT-image. Soft tissue thickening in the external ear canal (*asterisk*), extending into the middle ear and eroding the jugular plate, covering the jugular fossa (*arrowhead*). **c** Coronal gadolinium-enhanced T1-weighted spin echo image. The tumour mass (*arrowheads*) grows from the external ear canal into the middle ear, and appears to extend above the jugular bulb (**j**). During surgery, the tumour was invading the wall of the jugular vein.

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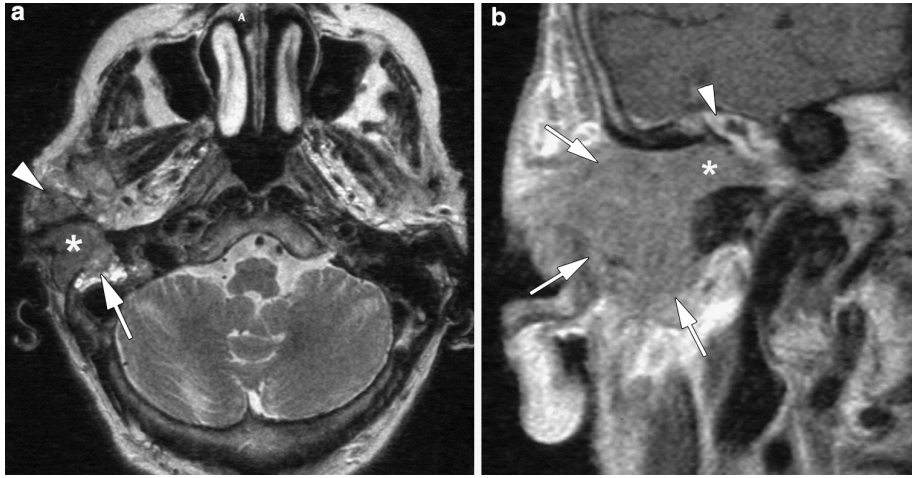
Tumour appears as a soft tissue mass with variable intensities on T2-weighted/T1-weighted images



Patient suffering from squamous cell carcinoma of right external ear canal. **a** Axial T2-weighted spin echo image shows large, relatively hypointense mass, extending posteriorly into the mastoid cells (*arrow*). Anteriorly, the mass (*arrowhead*) cannot be separated from the superior pole of the parotid gland. **b** Coronal gadolinium-enhanced T1-weighted spin echo image. The tumour (*arrows*) grows deep into the external ear canal (*asterisk*), reaching the tympanic membrane. The ossicular chain is visible as it is surrounded by enhancing tissue (*arrowhead*); this corresponded histologically to granulation tissue.

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