Temporal Bone Lesions

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Division of Lesions

- External Auditory Canal
- Middle Ear and Mastoid
- Labyrinth
- Internal Auditory Canal & CPA
- Petrous Apex
- Ubiquitous Lesions
External Auditory Canal

Benign Tumors
- Exostosis
- Osteoma

Malignant Tumors
- SCCA
- BCCA
- Salivary Gland Tumors

Cholesteatoma
Keratosis Obturans
• Broad based lesion
• Multiple Lesions
• Cortex intact
• Exostosis
Exostosis

Location
- Frequently bilateral
- Along TS and TM suture lines
- Arises near the annulus

Radiographic appearance
- Broad base
- Cortex intact

Other
- Associated with prolonged cold water exposure
- Single Lesion
- Pedunculated
- Unilateral
- No cortical invasion
- Osteoma
Osteoma

Location
- Unilateral
- Arise anywhere lateral to IAC isthmus

Radiographic appearance
- Cortex intact
- Solitary pedunculated bony mass

Other
- No association with cold water exposure
• Single Lesion
• Destruction of bony cortex without remodeling
• Probable malignancy
Malignant Lesions

Location

- May arise within EAC or extend from pinna, post-auricular sulcus, or parotid

Radiographic appearance

- Involvement or invasion of soft tissue with destruction of bony cortex

Types

- Squamous cell CA
- Basal cell CA
- Salivary gland CA’s
- Single Lesion
- Soft tissue density
- Erosion of adjacent bone with remodeling
- EAC Cholesteatoma
Cholesteatoma of the EAC

**Location**
- Typically posterior EAC just lateral to the TM

**Radiographic appearance**
- Soft tissue mass
- Destruction and remodeling of adjacent bone

**Other**
- Exam may demonstrate pain, drainage, granulation, keratin debris, and even bony sequestra
- Circumferential lesion
- Expansion of bony structures
- Cortex intact
- Keratosis Obturans
Keratosis Obturans

**Location**
- Involves majority of EAC

**Radiographic appearance**
- Circumferential expansion of bony EAC
- Soft tissue density occupies EAC

**Other**
- Patients usually < 40 yrs
- History of sinusitis or bronchiectasis
Middle Ear and Mastoid

- **Infectious**
  - Otitis Media
  - Mastoiditis

- **Paraganglioma**
  - Glomus Tympanicum
  - Glomus Jugulare

- **Cholesteatoma**
  - Congenital
  - Acquired
Otitis Media

Location
- Middle ear and mastoid

Radiographic appearance
- Soft tissue density in middle ear with possible extension into mastoid cavity
- Bony septae intact
- Mastoid cortex intact
- Air / fluid interface may be seen

Other
- Offending organisms commonly S. pneumoniae, M. catarrhalis, H. influenzae.
• Soft tissue density in mastoid
• Destruction of bony septae
• Cortex intact
• Coalescent Mastoiditis
• Soft tissue opacity in mastoid
• Disruption of bony septae
• Mastoid cortex erosion
• Mastoiditis with possible Bezold’s abscess
Mastoiditis

Location
- Mastoid, middle ear, possible extension to adjacent tissues

Radiographic appearance
- Soft tissue density in mastoid cavity
- Destruction of bony septae
- Destruction of overlying bony cortex

Other
- Offending organisms commonly S. pneumoniae, H. influenzae, S. pyogenes, S. aureus
Complications

- Bezold’s abscess
- Dural sinus thrombosis
- Abscess (intracerebral, subdural, epidural)
- Meningitis
• Soft tissue opacity
• Small scutum erosion
• Ossicles intact
• Prussak’s space cholesteatoma
• Soft tissue opacity

• Ossicles involved

• Minimal extension to mastoid

• No tegmen, facial nerve, or HSCC involvement

• Middle ear cholesteatoma with early mastoid involvement
- Soft tissue opacity
- Scutum erosion
- Ossicles eroded
- Tegmen intact
- Erosion into HSCC
- Cholesteatoma with fistula
• Soft tissue opacity
• Scutum erosion
• Ossicles eroded
• HSCC intact
• Tegmen dehiscent
• Herniation of temporal lobe into mastoid cavity
• Cholesteatoma with herniation of brain through tegmen defect
Cholesteatoma

Location
- May occur in EAC, mastoid, or petrous apex

Radiographic appearance
- Soft tissue density
- Usually arises in Prussak’s space
- Erosion of adjacent bony structures
  - Scutum
  - Ossicles
  - Tegmen
  - Mastoid cortex
  - Labyrinth
Glomus Tympanicum

Clinical
- Presents with pulsatile tinnitus, conductive hearing loss, and middle ear lesion on otoscopy

Location
- May be confined to the middle ear space
- Larger tumors grow into areas of least resistance with late bone erosion.

Radiographic appearance
- Soft tissue density originating from middle ear space
- Expanding lesions may fill ME space without ossicle erosion
- Bone involvement may begin near the jugular plate
- Bone erosion has a moth-eaten appearance
- MRI T1 and T2 have a salt & pepper appearance
- Angiography reveals a blush, most often from the ascending pharyngeal artery
- Small GT tumors localized to middle ear cleft require only CT for diagnosis.
Glomus Jugulare

Location
- Tumor extension may involve infralabyrinthine area, carotid canal, dura, or cavernous sinus.

Radiographic appearance
- Soft tissue density
- Bone erosion has a moth-eaten appearance
- MRI may be necessary to evaluate for intracranial extension
- MRI T1 and T2 have a salt & pepper appearance
- Angiography reveals a blush, most often from the ascending pharyngeal artery, but may involve the posterior auricular, occipital, maxillary, or internal carotid arteries.
- Must rule-out an aberrant carotid artery or exposed jugular bulb.
• Bilateral cochlea and vestibule visible in non-contrast T1 image
• Right cochlea enhances on administration of Gadolinium on T1 image
• Labyrinthitis
Labyrinthitis

Clinical findings
- SNHL
- Vertigo

Radiographic findings
- Increased intensity of contrasted T1 images

Causes
- Viral
- Bacterial
- Autoimmune
- Post-traumatic (may show pre-contrast T1 intensity)
• Opacification of membranous labyrinth
• Labyrinthitis ossificans
Labyrinthitis Ossificans

Clinical
- Important to rule out when considering cochlear implantation

Radiographic findings
- CT shows increasing density of membranous labyrinth.
- MRI T2 may show a void instead of the normal fluid intensity within the cochlea

Causes
- Bacterial labyrinthitis
- Viral labyrinthitis
- Trauma
- Autoimmune
• Soft tissue density
• Located at anterior oval window
• Involves footplate of stapes
• Fenestral otosclerosis
- Soft tissue density
- Obscures oval window
- Involves entire bony labyrinth
- Retrofenestral otosclerosis
Otosclerosis

Clinical
- May present with tinnitus or hearing loss
- Female predominance
- Schwartze sign

Radiographic findings
- Fenestral vs. Retrofenestral pattern
- Small focus of soft tissue density anterior to the oval window
- Narrowing of the oval window
- Thickening of stapes footplate
- Evaluation of facial nerve position and involvement of the round window are necessary.
Internal Auditory Canal & Cerebellopontine Angle

- Acoustic Neuroma
- Meningioma
- Epidermoid
- Arachnoid Cyst
- Other neuromas
- Paragangliomas
Centered on Porus Acousticus
Acute angles to petrous bone
Often involves the IAC
Homogeneous enhancement
No dural tail
No calcifications

**Acoustic Neuroma**
Acoustic Neuroma

Clinical

- Symptoms may involve cochlea, vestibular apparatus, facial nerve, cerebellar or brainstem compression, or other cranial neuropathies.

Radiology

- CT
  - Non-contrast: usually isodense to brain, calcification is rare
  - IV Contrast: Over 90% of non-treated tumors enhance homogeneously

- MRI
  - T1 – isointense to brain, hyperintense to CSF
  - T2 – hyperintense to brain, iso/hypo-intense to CSF
  - Gadolinium – Intense enhancement of tumor on T1

- General Features
  - Centered on Porus Acousticus
  - Acute angles to temporal bone
  - Homogeneous enhancement
  - No dural tail
  - Rare calcifications
Arise from surface of petrous bone

Obtuse angles to petrous bone

Uncommonly involves the IAC

Frequently with dural tail

Calcifications common

Pial vessel flow voids

Meningioma
Meningioma

Clinical

- May present similar to AN with cochlear, vestibular, facial nerve, or cerebellar symptoms.

Radiologic features

- Tumors generally hemispherical with obtuse angles to petrous bone
- Dural tail often present (50-75%)
- May herniate into middle fossa (50%)
- May show calcification (25%)
- Pial blood vessels with flow voids may be present at the margins.
Epidermoid

Clinical
- Similar to acoustic neuroma and meningioma
- Facial nerve paresis and facial twitching may occur

Location
- May arise within the temporal bone or in the CPA

Radiologic Features
- May dumbell into middle fossa or contralateral cistern
- Highly variable in shape with a cauliflower surface appearance
- CT usually shows a mass hypodense to CSF
- MRI – homogeneous lesion
  - T1 – isointense to CSF
  - T2 – isointense to CSF
  - DWI - moderate intensity
  - FLAIR – heterogeneous with hyperintense foci
Arachnoid Cyst

Clinical
- Similar to acoustic neuroma and meningioma

Radiologic Features
- Lesion often has a smooth surface
- CT usually shows a mass isointense to CSF
- MRI – homogeneous lesion
  - T1 – isointense to CSF
  - T2 – isointense to CSF
  - CISS – homogeneous lesion isointense to CSF
  - DWI – low intensity lesion
Other Neuromas

**CN VII**
- Symptoms may be identical to acoustic schwannoma
- Differentiation from acoustic schwannoma may not be possible by radiography unless lesion extends distal to geniculate ganglion.

**CN IX – XI**
- Jugular Foramen syndrome
  - Dysphagia
  - Hoarseness
  - Shoulder weakness
- Enlargement of Jugular Foramen

**CN XII**
- Hemiatrophy of tongue
- Enlargement of hypoglossal canal
Petrous Apex

- Cholesterol Granuloma
- Cholesteatoma
- Petrositis
• Lesion arising from petrous apex

• MRI T1 intense

• MRI T2 intense

• Cholesterol Granuloma
Cholesterol Granuloma

Clinical
- Most common lesion of petrous apex
- Often history of OM and allergies

Radiology
- CT shows soft tissue density
- MRI – both T1 & T2 are bright due to presence of methemoglobin. A central hypointensity may be present.
- Soft tissue density of petrous apex
- Erosion of bony septae
- Cholesteatoma
Cholesteatoma

May result from congenital or acquired disease

Radiology

- Identical to middle ear disease
- Erosion of bony septae
- May erode apical cortex
- Primary CPA lesions may dumbell to contralateral side.
- Soft tissue density on CT

MRI
- T1 – low signal intensity (differs from cholesterol granuloma)
- T2 – high signal intensity
- Fluid or soft tissue density in petrous apex
- Possible erosion of bony septae of petrous apex
- Enhancement on contrasted MRI studies
- Petrositis
• Soft tissue or fluid density of petrous apex

• Possible bony septae erosion

• MRI shows enhancement of dura as well as abscess cavity within temporal lobe

• Acute petrositis with intracerebral abscess
Petrositis

Clinical
- Presentation may include deep ipsilateral pain, otorrhea, cranial neuropathies.
- Gradenigo’s syndrome
- Complications
  - Meningitis
  - Intracranial abscesses
  - Venous sinus thrombosis

Radiologic Features
- Debris or soft tissue density within petrous apex
- Possible destruction of bony septae
- Possible cortical disruption
- MRI may show enhancement of the lesion as well as surrounding meninges and cranial nerves.
Ubiquitous Lesions

- Dysplasia
- Sarcoma
- Metastasis
- Trauma
- Polyostotic
- Cortex appears intact
- Areas of patchy sclerosis and lucency (pagetoid pattern)
- Fibrous Dysplasia
Dysplasia

- Fibrous Dysplasia
- Paget's disease
- Hyperparathyroidism
- Osteogenesis Imperfecti
- McCune-Albright Syndrome
Sarcoma

**Rhabdomyosarcoma**
- Tumor of childhood
- May present with recurrent otorrhea
- Often rapidly progressive and fatal

**Chondrosarcoma**
- Usually occurs near petrous apex

**Osteosarcoma**

**Giant Cell Tumor**
Metastasis

**Solid organ metastasis**
- Breast
- Kidney
- Lung
- Prostate

**Hematologic metastasis**
- Melanoma
- Lymphoma
Bibliography


