Temporal bone fractures

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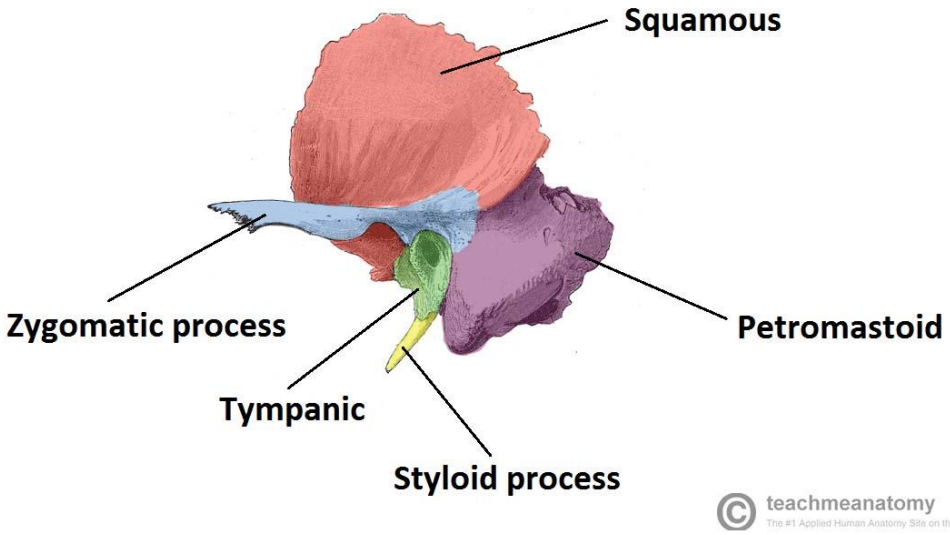
Temporal bone fractures
Introduction

- The temporal bone is the most complex bone in the human body
- Trauma of the intratemporal structures
  - cochlear and vestibular end organs
  - facial nerve
  - carotid artery
  - jugular vein
- Trauma of the extratemporal structures
  - Other cranial nerves (VI [abducens], IX [glossopharyngeal], X [vagus], and XI [spinal accessory])
  - Head, spine, maxillo-facial region



Usually polytraumatic patients where TB fracture may not be the most important

Temporal bone fractures
Introduction

- Multiple foramina and canals in the temporal bone and surrounding skull base
- Areas of decreased resistance susceptible to traumatic injury
- Usually ENT doctor evaluates the patients many hours-days after the trauma
- The initial workup (in emergency) is very important
  - Imaging
  - Facial nerve function in relation to trauma
  - Subjective hearing and balance
  - Nystagmus (if available)

Temporal bone fractures

Clinical symptomatology – not all of them must be present

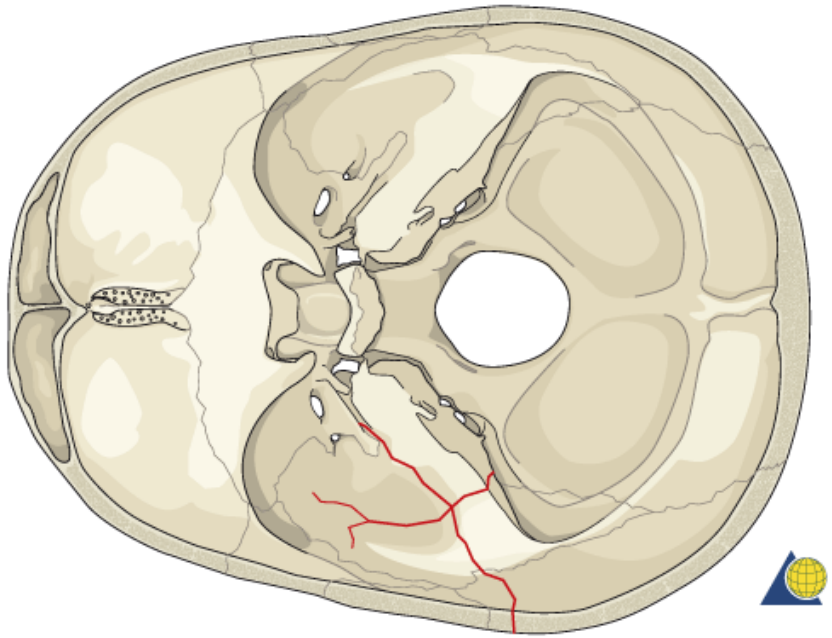
- Facial nerve paralysis (partial or complete),
- Hearing loss (conductive, sensorineural, or mixed),
- Vertigo, diziness
- Otorrhagia
- CSF otorrhea, rhinorrhea,
- Tympanic membrane perforation
- Hemotympanum
- Ear canal skin laceration

Temporal bone fractures
Classification (according to the fracture line)

- In 1926 Ulrich:
  - Longitudinal fractures
  - Transverse fractures

  (Ulrich K. Verletzungen des Gehorlorgans bel Schadelbasisfrakturen
  (Ein Histologisch und Klinische Studie). *Acta Otolaryngol Suppl*. 1926. 6:1-150.)
- In fact majority of TB fractures are:
  - Oblique
  - Mixed

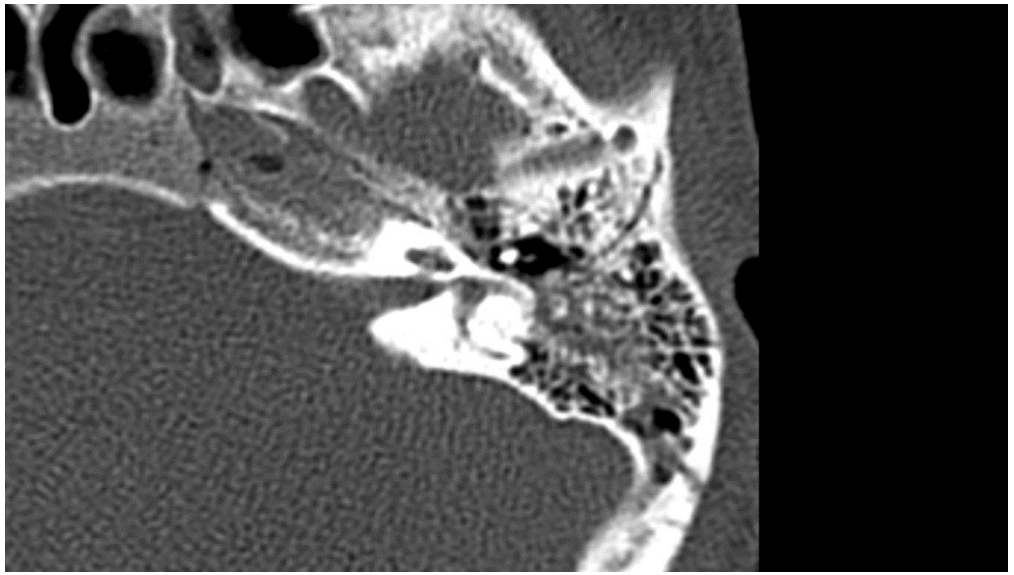
  (Ghorayeb BY, Yeakley JW. Temporal bone fractures: longitudinal or oblique?
  The case for oblique temporal bone fractures. *Laryngoscope*. 1992 Feb. 102(2):129-34.)

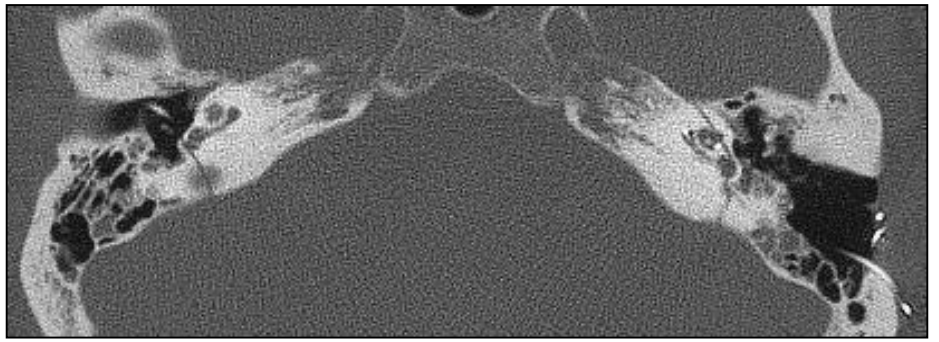


Temporal bone fractures

Classification (according to the otic capsule involvement)

- Otic capsule–sparing fracture
  - Usually longitudinal line that stops before the otic capsule
  - Fracture line runs anterolateral to the otic capsule
  - Trauma mechanism: blow to the temporo-parietal region.
- Otic capsule–involvement fracture
  - Usually transverse or oblique line
  - Fracture line runs directly into the otic capsule (cochlea and semicircular canals)
  - Trauma mechanism: blow to the occipital region





Temporal bone fracture - Diagnosis

Diagnosis is usually known before the ENT investigation

- Patient is stabilised, conscious
- Inspection (pinna, surrounding skin)
- Otoscopy
- Audiology – orientational (subjective level of hearing, tuning fork tests)
- Vestibular tests – orientational (history, vomitus, nystagmus)
- Facial nerve function
- Bleeding (from the nose, from the ear)
- Oto-, Rhino-rrhea
- Complete audiologic and vestibular tests can be done later

Longitudinal and transverse fractures Symptoms

Fracture line	Longitudinal Fractures	Transverse Fractures
Incidence	Approximately 80%	Approximately 20%
Mechanism	Temporal or parietal trauma	Frontal or occipital trauma
CSF otorrhea	Common	Occasional
Tympanic membrane perforation	Common	Rare
Facial nerve damage	20% (most often temporary and frequently delayed in onset)	50% (severe, usually permanent, and immediate in onset)
Hearing loss	Common (conductive type and possibly high tone neurosensorial secondary to concomitant inner ear concussion)	Common (severe sensorineural or mixed)
Hemotympanum	Common (associated with otorrhagia)	Possible (not associated with otorrhagia)
Nystagmus	Common (usually spontaneous, usually less intense [first or second degree] or positional; nystagmus absence also possible)	Common (intense [third degree], spontaneous, fast component beating to the opposite ear, long lasting; positional nystagmus also possible before and after compensation period)
Otorrhagia	Common	Rare
Vertigo	Common (less intense, and/or positional; absence is also possible)	Common (intense, usually associated in the acute phase with nausea and possibly vomiting)

Temporal bone fractures Management

Medical treatment (immediate)

- Antibiotics
  - General
    - Passing through the Blood Brain Barrier (good concentration in CSF)
  - No local treatment (sterile management)
- Corticosteroids

Surgical intervention (delayed)

- Facial nerve
  - Decompression
  - Grafting
- Myringotomy
- Mastoidectomy

Antibiotics and concentration in CSF

Good concentration in CSF	Adequate concentration in CSF	Poor cocentration in CSF
Chloramphenicol Sulfonamides Cephalosporins Cefotaxime Ceftriaxone Ceftazidime Moxalactam Metronidazol Isoniazid Trimethropin-sulfamethoxazol	Penicillin Ampicillin Methicillin Oxacillin Naficillin Carbenicillin Ticarcillin Tetracycline Erythromycine Ethambutol Rifampin Vancomycin Meropenem	Cephalosporins 1st Gen Cephalotine Cefoxidin Aminoglycosides Gentamicin Tobramycin Amikacin Clindamycin

Temporal bone fractures
Complications

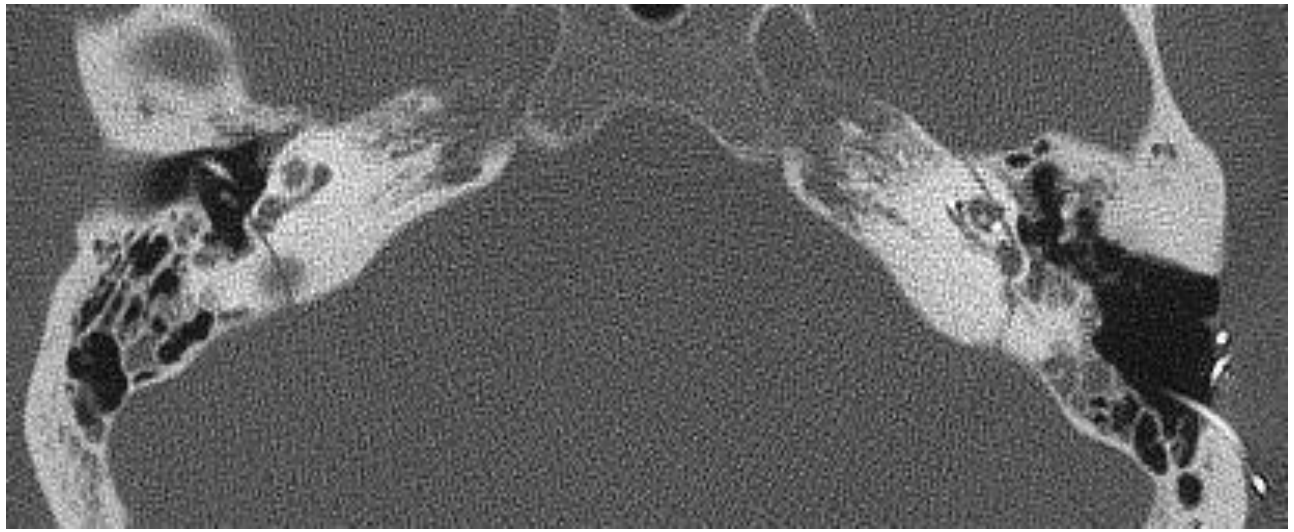
- Hearing loss
  - Conductive
  - Sensorineural
  - Mixed
- CSF fistula (perilymphatic fistula)
- Facial nerve paralysis
- External auditory canal stenosis
- Cholesteatoma formation
- Vascular injuries
- Meningitis

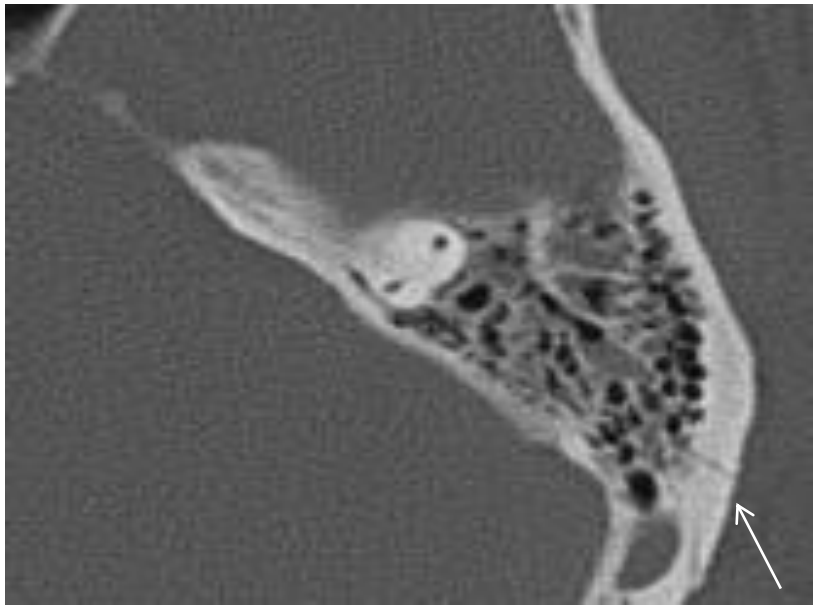
Conductive Hearing Loss

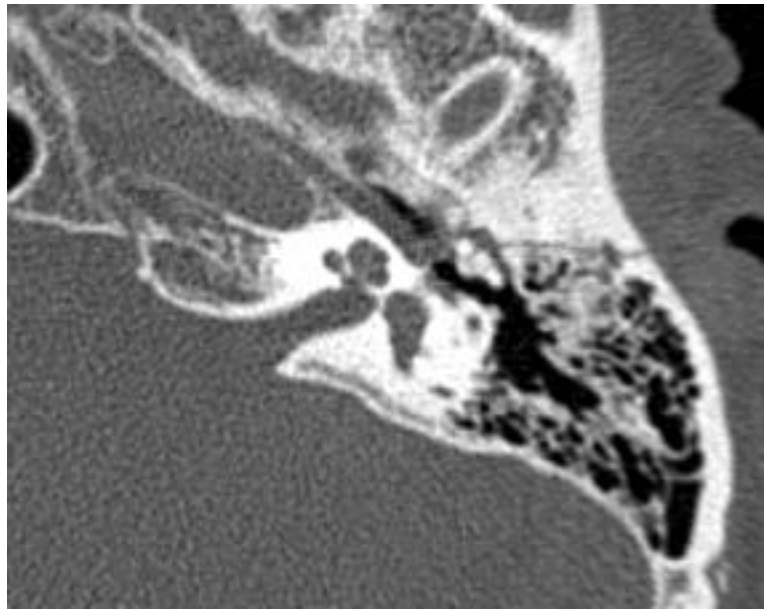
The following chain abnormalities have been identified with temporal bone fractures:

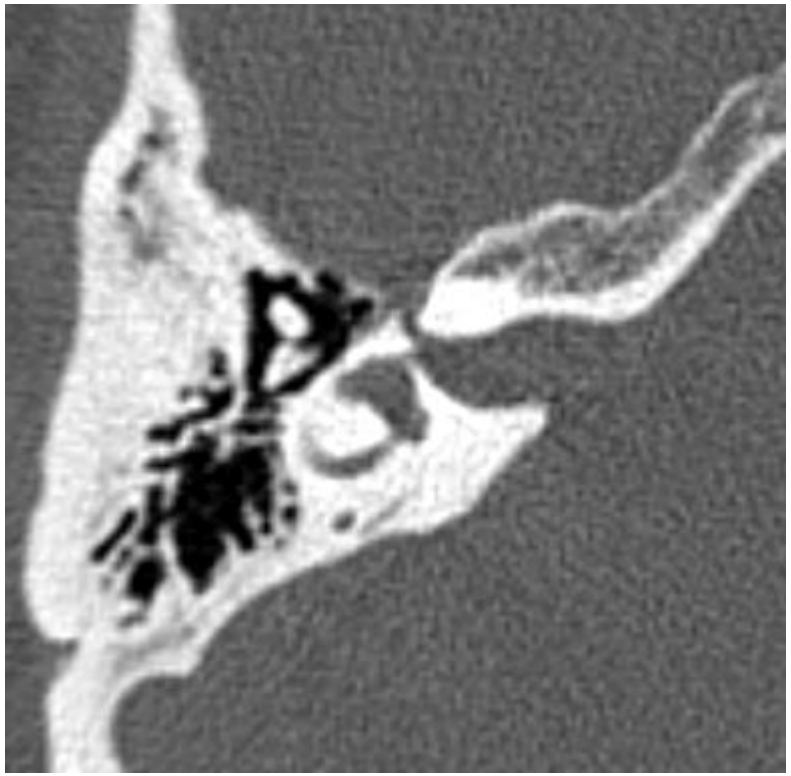
- Incudostapedial joint separation (82%)
- Incus dislocation (57%)
- Fracture of the stapes crura (30%)
- Fixation of the ossicles in the attic (25%)
- Incudomalleolar joint separation

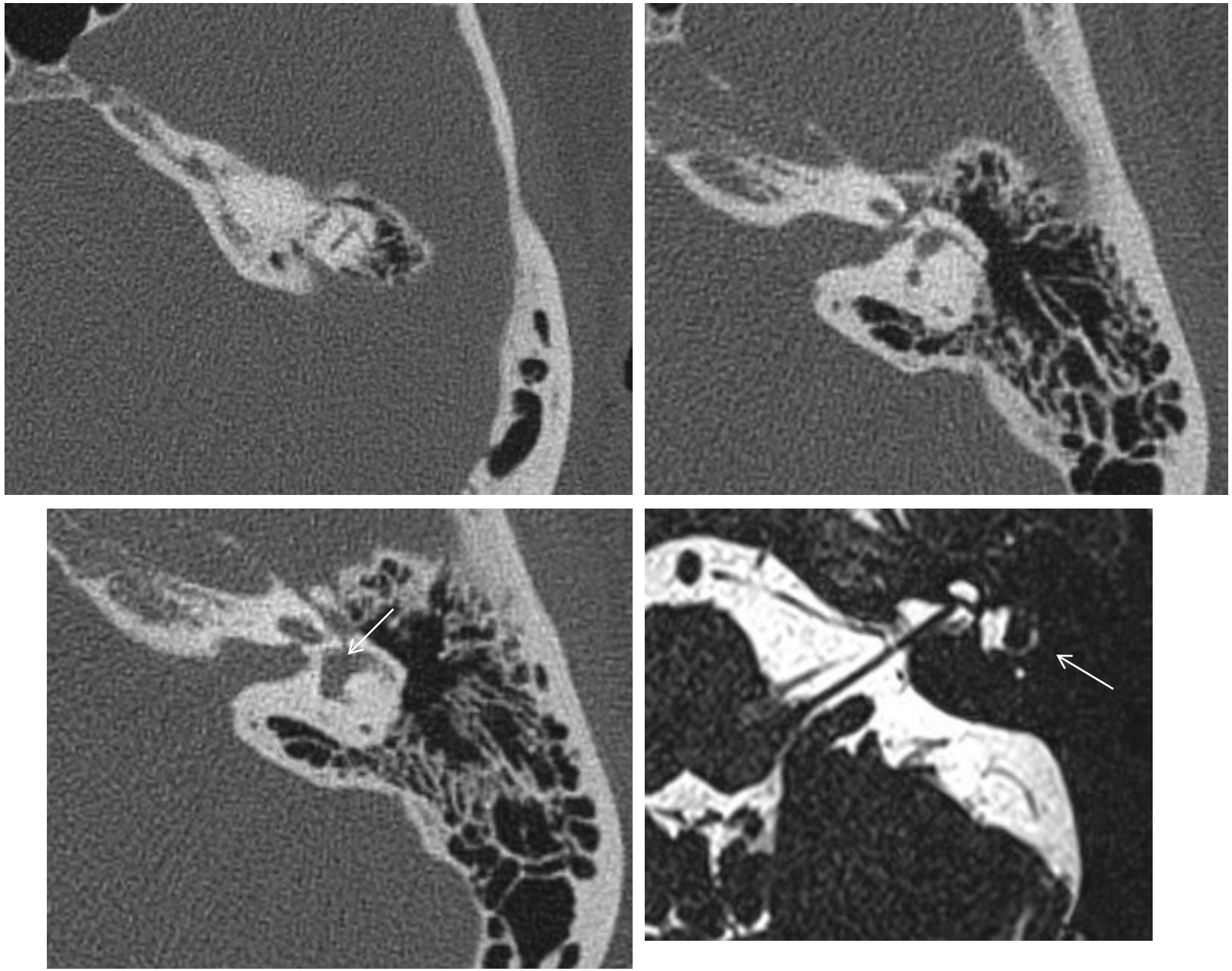
Hough JV, Stuart WD. Middle ear injuries in skull trauma. *Laryngoscope*. 1968 Jun. 78(6):899-937.











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Transverse fracture of the pyramid reaching anterior semicircular canal, Fallopian canal.
MRI shows attenuation of the signal in the lateral and anterior SCC

Temporal bone fractures
Take home message

- Thorough evaluation in emergency (teach your colleagues)
- Diagnosis based on CT (high resolution, bone window, 0,5mm slices)
- Do not apply local treatment, just sterile cleaning
- Corticosteroids and antibiotics (passing through the BBB)
- Vestibular and audiological testing may be delayed
- Surgical intervention for FN palsy
  - Fracture line reaching Fallopian canal
  - FN palsy immediately after trauma
  - Poor electrophysiological tests
- Surgical intervention to improve hearing after stabilization with the delay