Trauma to the Ear

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Mechanisms of Trauma

- Barotrauma (implosive/explosive, diving, slap, kiss, injury).
- Lightning.
- Burns and frostbite.
- Noise (impulse, steady state).
- Iatrogenic (otologic surgery, syringing, cochlear implants).
Auricle injuries

- Hematomas separate the perichondrium (blood supply) from the cartilage; excise fibrous tissue, apply pressure dressing, drain
- Avulsion: reimplantation requires favourable circumstances and possibly microvascular anastomosis
Case

- 36 y/o female
- Slapped on L ear
- Bleeding
- Decreased hearing
- Dizziness
- ?Dx

Traumatic TM perf
with cochlear damage
Barotrauma

- Diving, Valsalva, Sneezing….
- 60mmHg → Otalgia
- 90mmHg → ET dysfunction
- 120mmHg → TM perforation
- Implosive/explosive
- Caisson disease (Decompression sickness, the bend) ?
  - Compression N → soluble
  - Decompression N → Gas emboli → back, joint, muscles → bend
  - Rx hyperbaric O2
Pressure on Tympanic Membrane
Eustachian Tube is Blocked
Round window fistula
Eustachian Tubes Suddenly Opens

Politzer Maneuver is Performed by Diver
Rapid Change in Middle Ear Pressure

Politzer Maneuver is Performed by Diver
Round Window is Pulled In By Negative Forces of Inner Ear Fluids

Politzer Maneuver is Performed by Diver
Politzer Maneuver is Performed by Diver

Round Window Implodes
Perilymph fistula

- **History – inciting event**
  - Blow to the head
  - Sneezing
  - Bending over
  - Lifting a heavy object
  - Exposure to sudden changes in barometric pressure
    - Flying, SCUBA diving
- **High risk population?**
  - Post stapedectomy
  - Inner ear anomalies
    - Mondini malformation
    - Large vestibular aqueduct
Perilymph fistula

- **Diagnosis**
  - **Definitive – intraoperative**
  - **Usually clinical**
    - Audio - Sudden or rapid progressive hearing loss
    - R/o inflammatory process, neoplasia
      - (MRI, ESR, syphilis test)
    - Exam – Hennebert’s sign (fistula test)
    - Tullio’s phenomenon
Perilymph fistula

- **Treatment**
  - Strict bed rest
  - HOB elevated 30 degrees
  - Avoid lifting > 10 lbs.
  - Avoid straining or hard nose blowing
  - +/- stool softeners
  - Some suggest daily audio

- **After 7 days**
  - If improvement – 6 weeks of light activity
  - If no improvement – surgery
    - Middle ear exploration
    - Patching of perilymph fistula
Temporal bone fractures

- 80% longitudinal, 20% transverse
- Defined with respect to the long axis of the petrous pyramid
- HRCT giving more detail
- Fractures have been shown to be complex, multiple and oblique
- Otic capsule sparing, or otic capsule violating
Longitudinal TB
Otic capsule sparing
Transverse TB

Otic capsule violating
# Temporal bone fractures

<table>
<thead>
<tr>
<th>Longitudinal</th>
<th>Transverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parietotemporal blows</td>
<td>Occipitofrontal blows</td>
</tr>
<tr>
<td>Run anterior to otic capsule</td>
<td>Cross otic capsule</td>
</tr>
<tr>
<td>Blood in EAC</td>
<td>Hemotympanum</td>
</tr>
<tr>
<td>TM perforation</td>
<td>Intact TM</td>
</tr>
<tr>
<td>CHL</td>
<td>Mixed HL</td>
</tr>
<tr>
<td>20% facial palsy</td>
<td>Vertigo</td>
</tr>
<tr>
<td></td>
<td>50% facial palsy</td>
</tr>
</tbody>
</table>
Battle’s sign

Retroauricular ecchymosis (Battle’s sign).

Bilateral periorbital ecchymosis (raccoon eyes).
Hemotympanum (transverse)
Imaging

- HRCT
- MRI (labyrinthine hemorrhage, cranial nerve,
- MRA conventional angiography
<table>
<thead>
<tr>
<th>Fractures</th>
<th>Sutures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 3 mm in width</td>
<td>Less than 2 mm in width</td>
</tr>
<tr>
<td>Widest at the center and narrow at the ends</td>
<td>Same width throughout</td>
</tr>
<tr>
<td>Runs through both the outer and the inner lamina of bone, hence appears darker</td>
<td>Lighter on x-rays compared to fracture lines</td>
</tr>
<tr>
<td>Usually over temporoparietal area</td>
<td>At specific anatomic sites</td>
</tr>
<tr>
<td>Usually runs in a straight line</td>
<td>Does not run in a straight line</td>
</tr>
<tr>
<td>Angular turns</td>
<td>Curvaceous</td>
</tr>
</tbody>
</table>
Longitudinal TB#
Longitudinal TB
Transverse TB#
Oblique TB#
pneumolabyrinth
Complications of TB

- Hearing loss
- Vertigo
- Tinnitus
- Facial paralysis
- CSF leak
- Carotid injury
Ossicular injuries RC

- Separation of the incudostapedial joints
- Dislocation of the incus
- Fracture of stapedial arches,
- Fracture of malleus handle
- Footplate fracture-dislocation
Incus inversion

Lenticular Process of Incus Rotated 180 Degrees
Capitulum of the Stapes
Stapedius Tendon
Large Vestibular Aqueduct Syndrome

- Inner ear malformation
- Early onset and progressive hearing loss (mixed in 90%, pure neurosensory in the rest) in children
- 80% are bilateral
- Progression may be associated with mild head injury
CSF otorrhea (longitudinal)

1- ? Dx

• 25 Y male
• MVA
• ABC is OK
• Eye open to pain, Inappropriate words and decerebrate rigidity

2- ? GCS 2+3+2 =7
3- ? Rx
<table>
<thead>
<tr>
<th>Eye Opening</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneous</td>
<td>4</td>
</tr>
<tr>
<td>To verbal command</td>
<td>3</td>
</tr>
<tr>
<td>To pain</td>
<td>2</td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Verbal Response</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oriented and converses</td>
<td>5</td>
</tr>
<tr>
<td>Disoriented and converses</td>
<td>4</td>
</tr>
<tr>
<td>Inappropriate words</td>
<td>3</td>
</tr>
<tr>
<td>Incomprehensible sounds</td>
<td>2</td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motor Response</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Obey verbal commands</td>
<td>6</td>
</tr>
<tr>
<td>Localizes pain</td>
<td>5</td>
</tr>
<tr>
<td>Withdraws from pain (flexion)</td>
<td>4</td>
</tr>
<tr>
<td>Abnormal flexion in response to pain (decorticate rigidity)</td>
<td>3</td>
</tr>
<tr>
<td>Extension in response to pain (decerebrate rigidity)</td>
<td>2</td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
</tr>
</tbody>
</table>
CSF leak

- CSF otorrhea or rhinorrhea
- All TB# should be assumed to have a CSF leak;
  - ear canal must not be syringed
  - ear canal cleaning must be done carefully (aseptically)
  - topical and systemic antibiotic prophylaxis
    - Immunosuppressed, CSF soilage is obvious and with device
  - usually subsides within 1 week.
- intervention including LP
-Leaks persisting beyond 1-2 weeks
  - localization studies → surgical intervention.
Diagnosis, Laboratory

- **Glucose** (have false-positives and false-negatives)
- **Beta-2-Transferrin**
  - Gold Standard
  - Found in CSF, perilymph, vitreous humor
- **Radiologic**
  - CT Cisternography
  - Radionuclide cisternography
  - MRI adjunctive if encephalocele
  - Fluorescein and Dye
Facial Nerve Injury

Acute Onset
- Complete paralysis at presentation
  - Serial EnoG
    - >95% degeneration within 14 days: Surgery, Facial nerve exploration
    - <95% degeneration

Delayed Onset (normal at presentation)
- Incomplete paralysis at presentation
  - Progression
    - Complete
    - Incomplete
      - >14 days elapsed: Observe
Delayed complications of TB

- Meningitis
- Pneumocranium
- Cholesteatoma
- BPV - the most common
- Labyrinthine concussion
- Meniere’s syndrome
- Migraine-associated dizziness
- Central vestibular disorders
- Mixed peripheral/central
- Psychogenic and malingering
- Cervical vertigo
Pneumocranium
Tinnitus post head/neck injury

- May be caused by inner ear or CNS injury
- younger than average tinnitus patient
- More severe
- co-symptoms than average tinnitus
Thank You