

CSF Leaks

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CSF Leaks

- Abnormal communication between the subarachnoid space and the tympanomastoid space or nasal cavity.
- Presenting symptoms:
 - Middle ear effusion, hearing loss
 - Unilateral rhinorrhea
- Risk of meningitis is high
 - 2-88%

CSF Rhinorrhea

- Diverse etiology

Idiopathic

Trauma-Surgical

<1%

Trauma-Nonsurgical

3% of all closed head injuries

30% of skull base fractures

Frontal>Ethmoids>Sphenoids

Inflammatory

Congenital

Neoplasm

Testing of Nasal Secretions

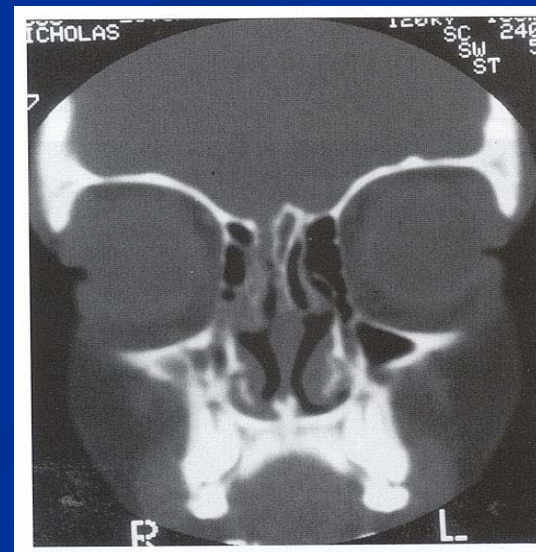
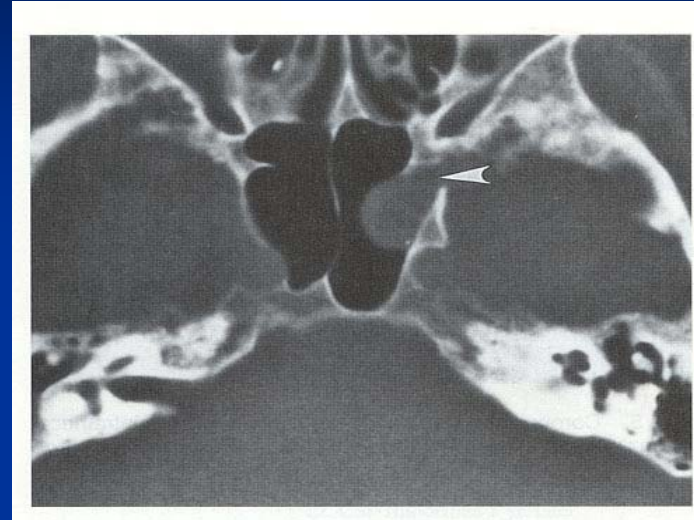
- Beta-2-transferrin is highly sensitive and specific
 - 1/50th of a drop
- Electronic nose has shown early success

Imaging

- High resolution CT
- CT Cisternography
- MRI
 - Heavily weighted T2
 - Slow flow MRI
 - MRI cisternography
- Radionuclide cisternography
- Intrathecal fluorescein

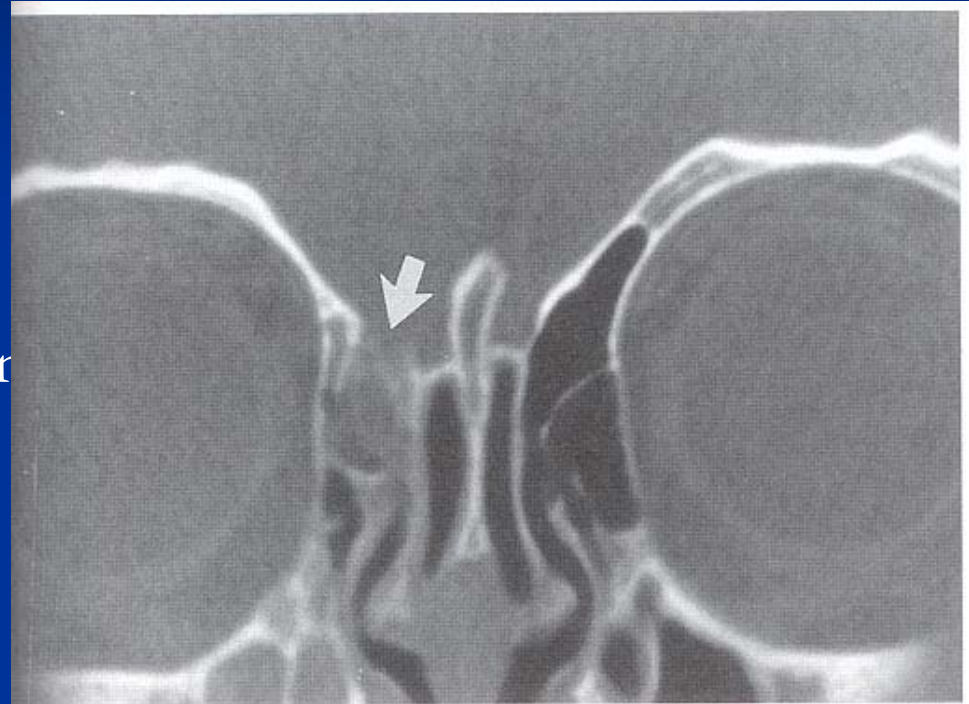
Imaging

- HRCT
 - Volume averaging
 - Congenital dehiscences of Sphenoid/cribiform niche.



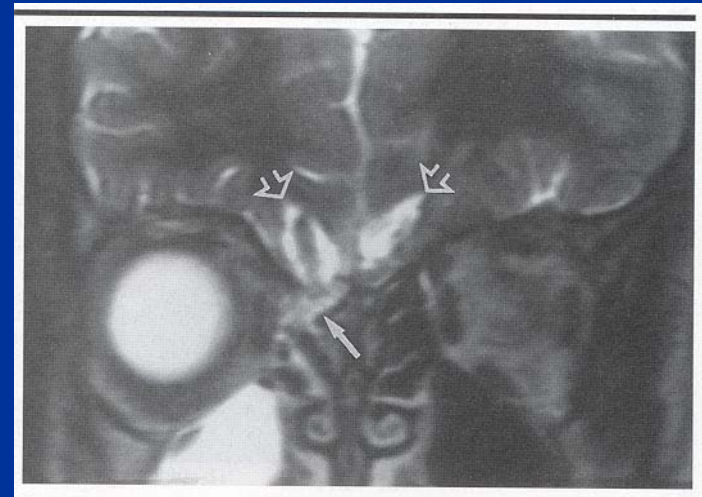
Imaging

- CT cisternography
 - Currently the optimal imaging modality (85% sensitive)
 - Intrathecal administration of iodine, prone 6hrs
 - 0% for inactive leaks
 - Substantial radiation exposure
 - ?neurotoxic potential



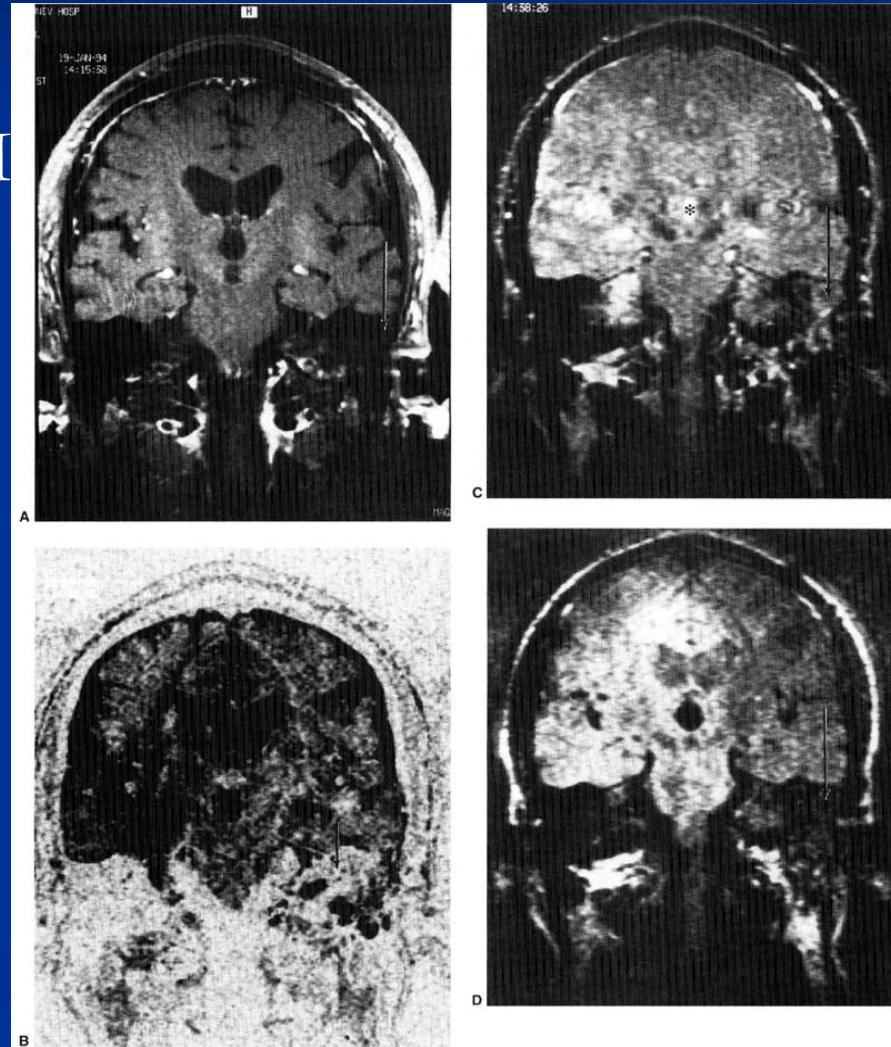
Imaging

- MRI cisternography
 - heavily weighted T2
- Intrathecal gadolinium



Imaging

- Slow flow MRI
- Diffusion weighted MRI
- Fluid motion down to 0.5mm/sec
- Ex. MRA/MRV

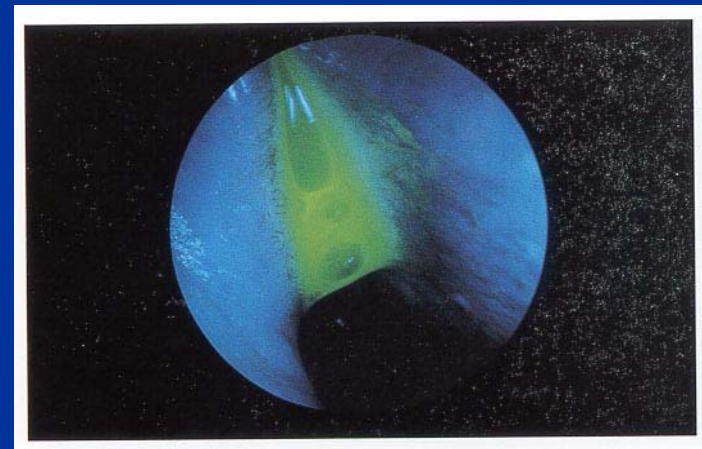


Imaging

- Radioisotope cisternography
 - Intrathecal administration of technetium 99m
 - Less spatial resolution and specificity
 - Largely abandoned due to false positive and false negative results

Intrathecal Fluorescein

- 0.1ml of 10% fluorescein solution mixed in 10cc of CSF
- Blue light may enhance the fluorescein
- Complications are low



Treatment of CSF Rhinorrhea

- Conservative measures
 - Bed rest/Elev HOB>30
 - Stool softeners
 - No sneezing/coughing
 - +/- lumbar drains
- Early failures
 - Assoc with hydrocephalus
 - Recurrent or persistent leaks

Treatment of CSF Rhinorrhea

- Prophylactic antibiotics:
 - Two conflicting meta-analysis regarding basilar skull fractures.
 - Proponents argue less meningitis.
 - Opponents argue organism resistance.

Surgical Options

- Intracranial
 - Direct visualization
 - Success rates 50-73%
 - Significant morbidity
 - Anosmia
 - Cerebral edema
 - Seizures

Surgical Options

- Extracranial approach
 - Improved success rates (80%)
 - Significant morbidity
 - Frontal osteoplastic flap/infratemporal approach

Endoscopic repair

■ Endoscopic intranasal repair

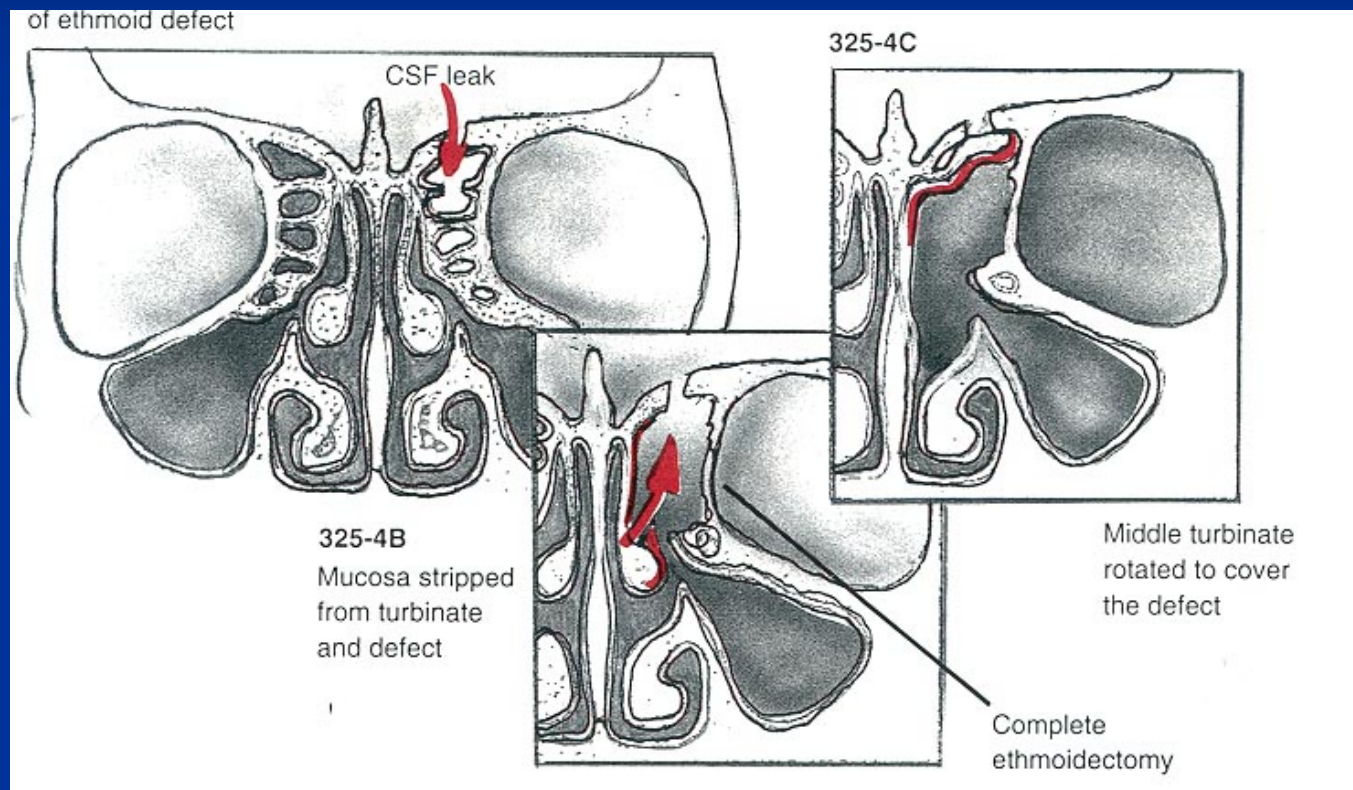
■ Overall success rates:

- 90% 1st attempt
- 52-67% for 2nd attempt
- Overall 97%

■ Complications:

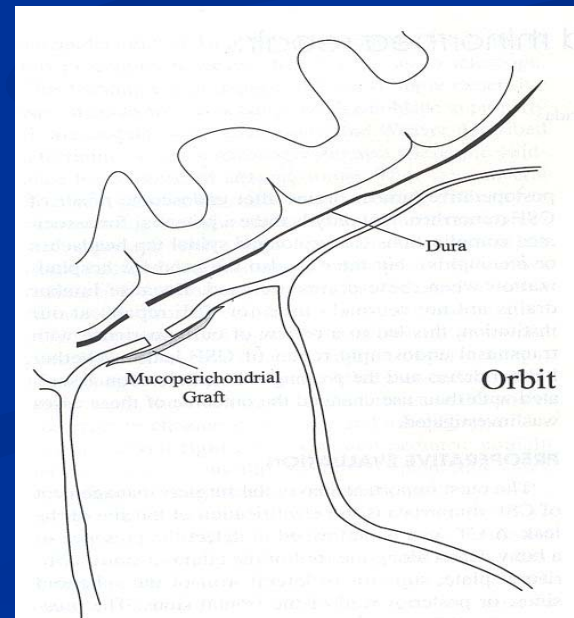
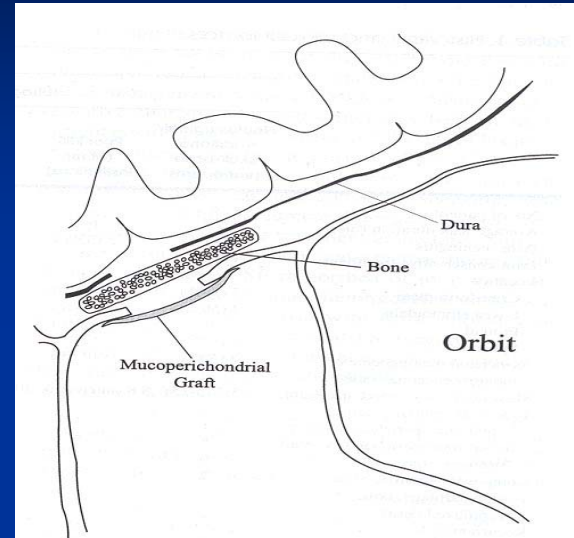
- Meningitis (0.3%)
- Brain abscess (0.9%)
- Subdural hematoma (0.3%)
- Headache (0.3%)

Endoscopic techniques



Overlay vs Underlay technique

- Meta-analysis showed that both techniques have similar success rates
- Onlay: adjacent structures at risk, or if the underlay is not possible



Surgical Techniques

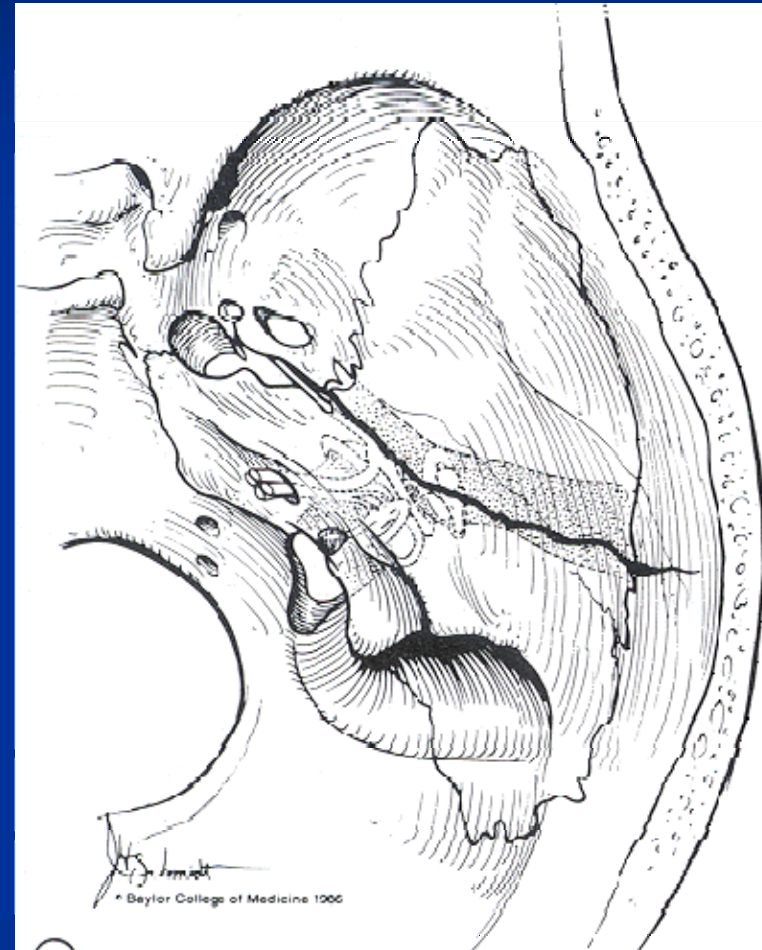
- Use gelfoam and gelfilm (>90%)
- Use nasal packing (100%)
- Consider fibrin glue (>50%)
- Consider lumbar drain for idiopathic/posttraumatic assoc with increased ICP
 - 3-5 days
 - Not required
- BR, stool softeners, antibiotics

CSF Otorrhea

- Acquired
 - Postoperative (58%)
 - Trauma (32%)
 - Nontraumatic (11%)
- Spontaneous
 - Bony defect theory
 - Arachnoid granulation theory

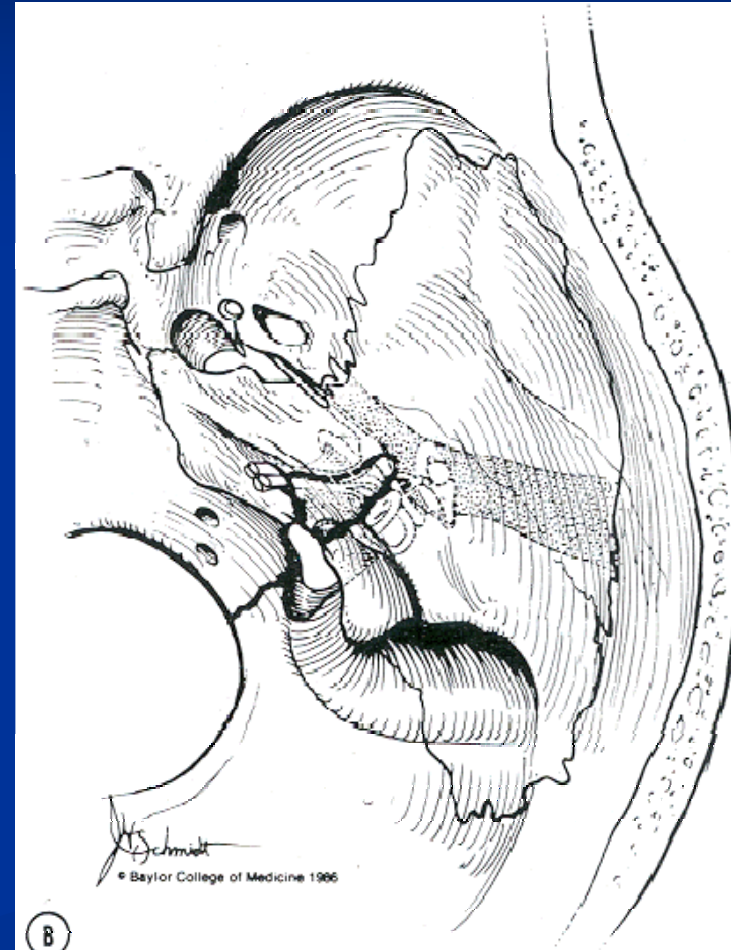
Temporal bone fractures

- Longitudinal
 - 70%
 - Anterior to otic capsule
 - 15-20% facial nerve involvement



Temporal bone fractures

- Transverse
 - 20%
 - High rate of SNHL
 - 50% facial nerve involvement



Temporal bone fractures

- HRCT will demonstrate the fracture line and the likely site of CSF leak.
- Beta-2-transferrin
- Treatment
 - Bedrest
 - Elev HOB
 - Stool softeners
 - +/- lumbar drain

Temporal bone fractures

- Brodie and Thompson et al.
- 820 T-bone fractures/122 CSF leaks
- Spontaneous resolution
 - 95/122: within 7 days
 - 21/122: between 7-14 days
 - 5/122: Persisted beyond 2 weeks

Temporal bone fractures

- Meningitis
 - 9/121 (7%) developed meningitis.
- A later meta-analysis by the same author did reveal a statistically significant reduction in the incidence of meningitis with the use of prophylactic antibiotics.

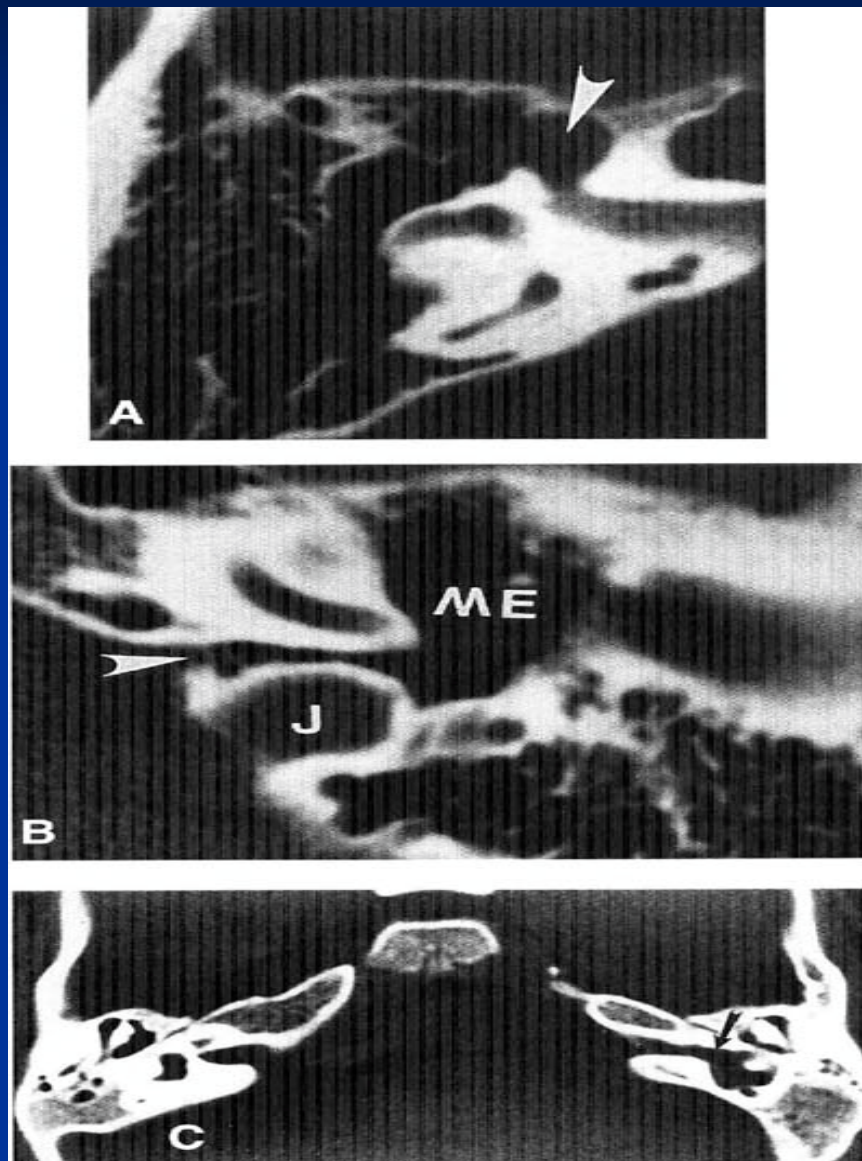
Pediatric temporal bone fractures

- Much lower incidence (10:1, adult:pedi)
 - Undeveloped sinuses, skull flexibility
- otorrhea >> rhinorrhea
- Prophylactic antibiotics did not influence the development of meningitis.

Spontaneous CSF otorrhea

- Congenital Defect Theory:
 - 1) enlarged petrosal fallopian canal
 - 2) patent tympanomeningeal (Hyrtl's) fissure
 - 3) Communication of the IAC with the vestibule (Mondini's dysplasia)-most common
- Childhood presentation
 - 82% SNHL
 - 93% Meningitis
 - 83% Mondini Dysplasia

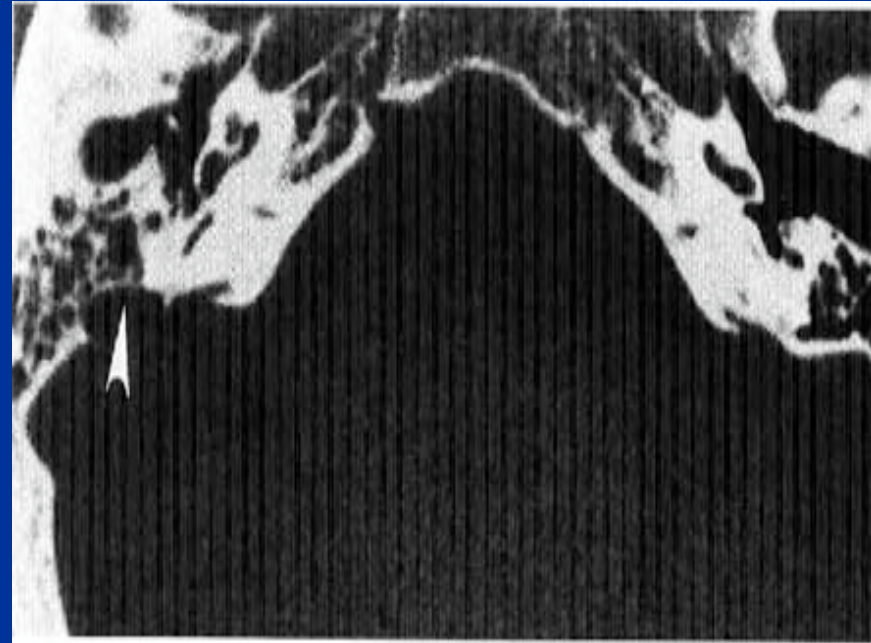
Congenital bony defect



Spontaneous CSF otorrhea

- Arachnoid granulation theory
 - Enlargement of arachnoid villi due to congenital entrapments/pressure variations
- Presentation
 - Unilateral serous otitis media
 - Meningitis (36%)
 - No SNHL or Mondini dysplasia
 - Sites are multiple, floor of the middle fossa most common

Arachnoid Granulation

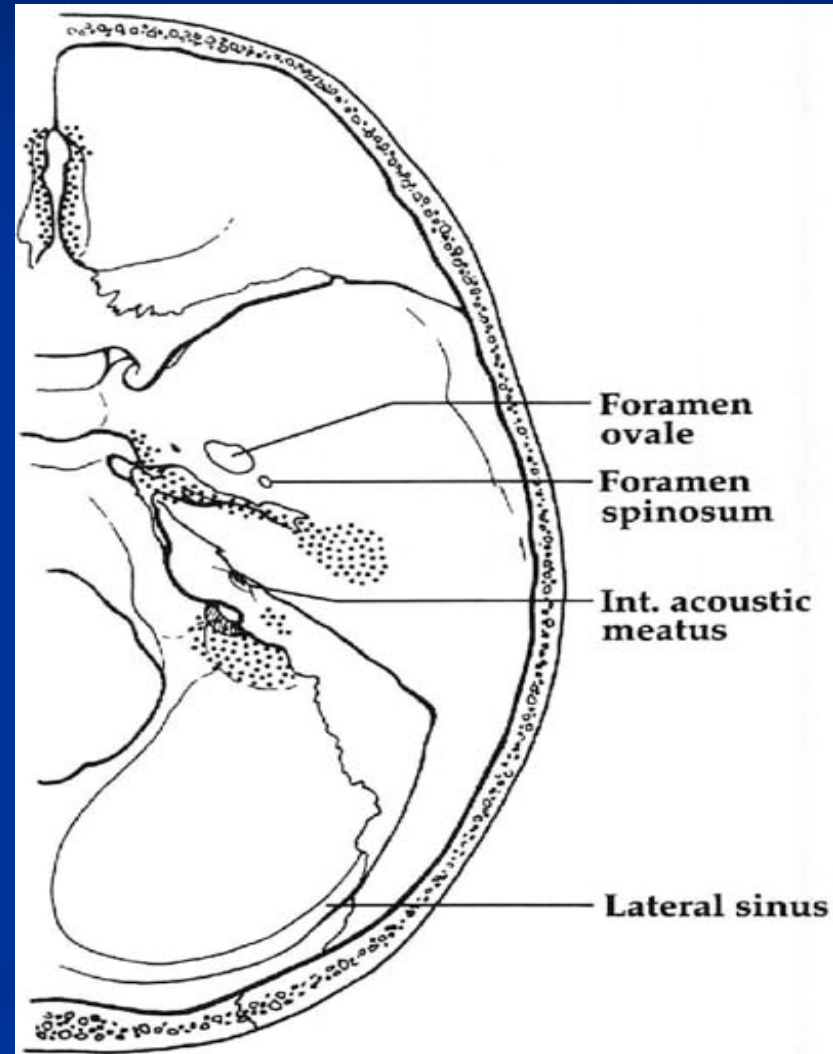


Spontaneous CSF otorrhea

- Stone et al.
- HRCT vs. CT cisternography/radionuclide cisternography.
 - HRCT showed bony defects in 71%.
 - 100% intraoperative findings correlated with HRCT.
 - HRCT significantly identified more patients with CSF leak than radionuclide cisternography or CT cisternography.

Surgical approaches

- Transmastoid
 - Not ideal for large defects (>2cm), multiple defects, or defects that extend anteriorly
- Middle cranial fossa
 - Technically challenging
 - Best exposure
- Combined approach



Technique of closure

- Muscle, fascia, fat, bone wax, etc..
- The success rate is significantly higher for those patients who undergo primary closure with a multi-layer technique versus those patients who only get single-layer closure.
- Refractory cases may require closure of the EAC and obliteration.

Conclusions

- The clinical presentations of CSF leaks may be very subtle.
- The clinician must keep a low threshold for further testing with Beta-2-Transferrin.
- Imaging studies should be performed to anatomically localize the site.
- Success rates may be over 90% with proper patient and surgical selection