Prevention of Skull Base CSF Leaks

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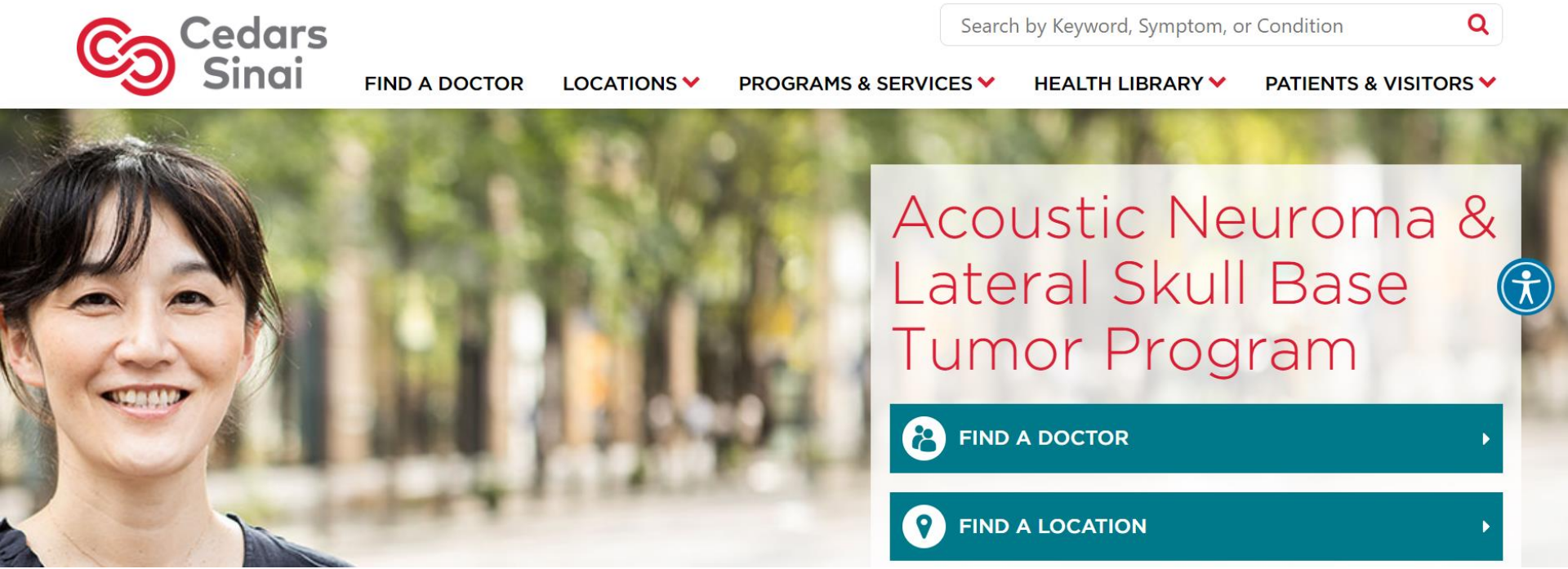
Disclosures

- **I have no disclosures relevant to this presentation.**

Introductions



www.cedars-sinai.org/programs/neurology-neurosurgery/clinical/acoustic-neuroma-and-lateral-skull-base-tumor.html

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High-Risk Procedures Where Prevention is Critical

- **Skull base surgery (e.g., meningioma, pituitary adenoma resection)**
- **Acoustic neuroma (vestibular schwannoma) removal**

Background

- Acoustic neuromas (AN) constitute 8% of all brain tumors and are diagnosed in roughly 1 to 3.5 of every 100,000 people per year in the United States.
- Recent research has suggested that approximately one in 2,000 adults, and up to one in 500 adults over the age of 70, will be diagnosed with an acoustic neuroma during their lifetime.
- Symptoms can be mild or severe and generally develop slowly, although occasionally symptoms might develop rather rapidly.
- The first signs or symptoms usually are related to ear function and can include hearing loss and tinnitus (ear noise/ringing in the ear) on one side.

Goals of Care

- Avoid complications associated with large tumors.
- Control symptoms (vertigo).
- Preserve function (hearing).
- Minimize complications associated with treatment.

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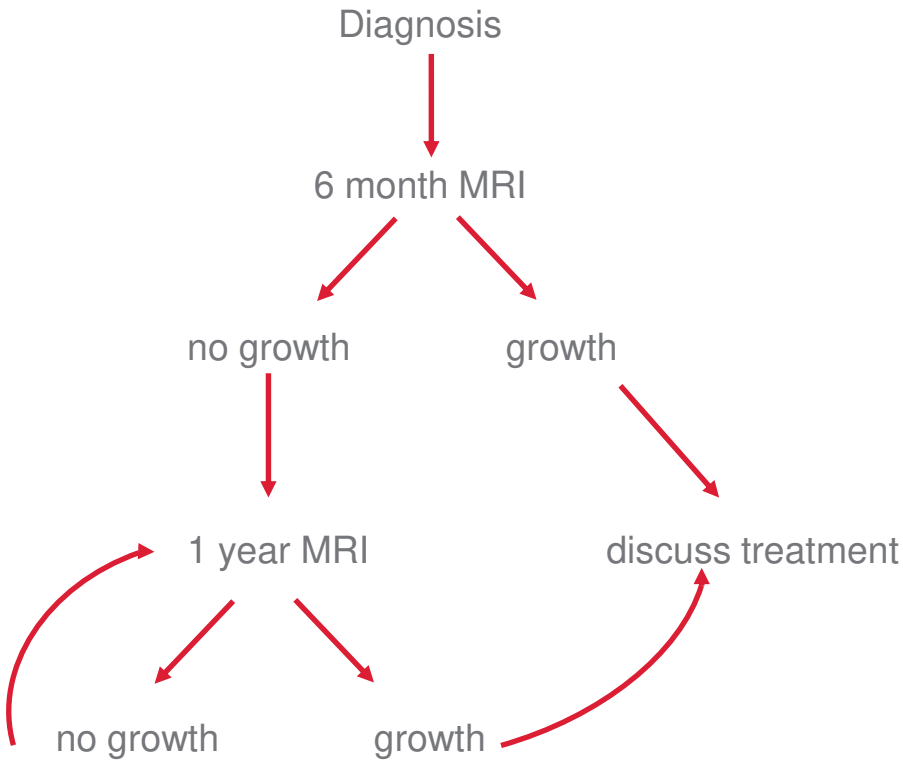
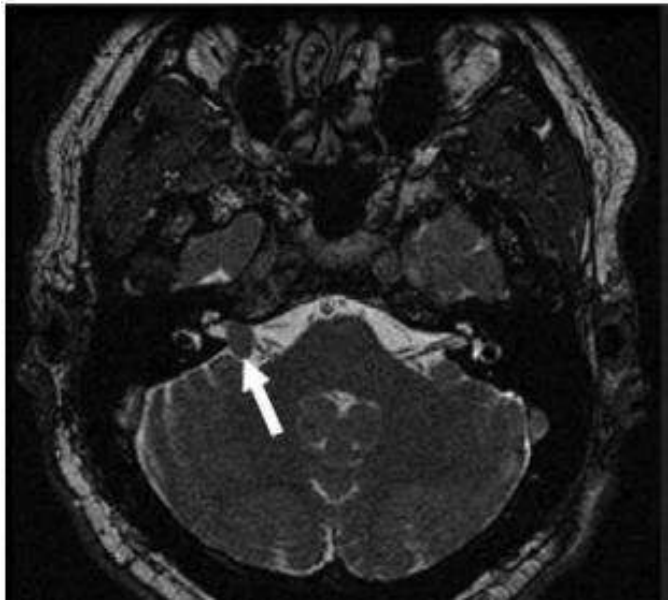
Observation



Observation

- Hearing loss can occur during observation even if the tumor is not growing.
- Sudden loss may be recovered with oral or intratympanic steroids.
- It is important to contact your doctor for any sudden changes in hearing during observation.



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Observation: Goals of Care

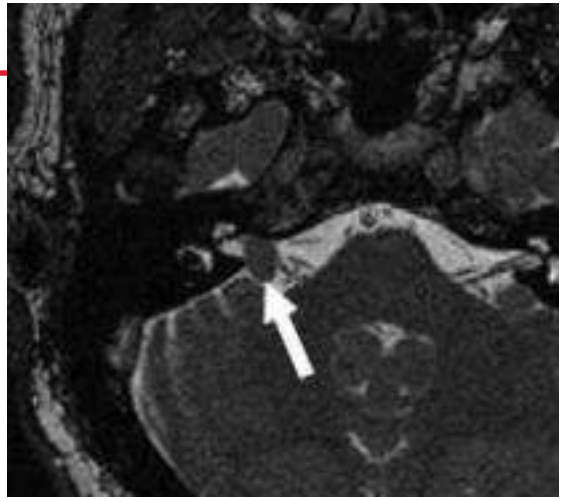
- To avoid complications associated with large tumors, we treat relatively soon after establishing the tumor's growth rate.
- To control vertigo and imbalance, we recommend evaluation by a balance expert. If the tumor is the cause, we recommend treatment. Otherwise, treatment (e.g. VT) is initiated.
- To preserve hearing during observation, we treat sudden loss with steroids.
- To minimize complications associated with treatment, we treat relatively soon after establishing the tumor's growth rate.

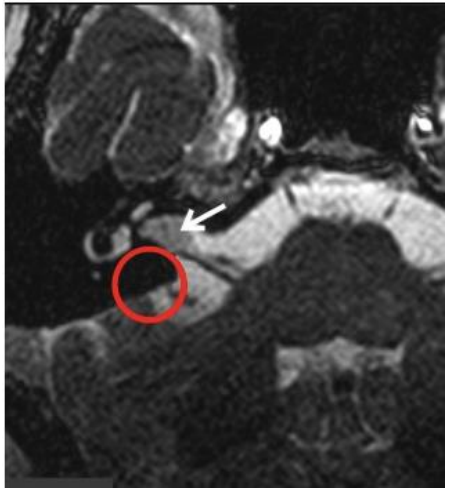
Microsurgery: Approaches

- Translabyrinthine Approach:
  - Sacrifices hearing
  - Minimizes retraction on the brain
  - Used for larger tumors or those with poor hearing

- Retrosigmoid (Suboccipital) Approach:
  - May preserve hearing
  - Used for more medial tumors (closer to brain)
  - May be associated with postoperative headache

- Middle Fossa Approach:
  - May preserve hearing
  - Used for more lateral tumors (closer to the ear)
  - Does retract temporal lobe of brain





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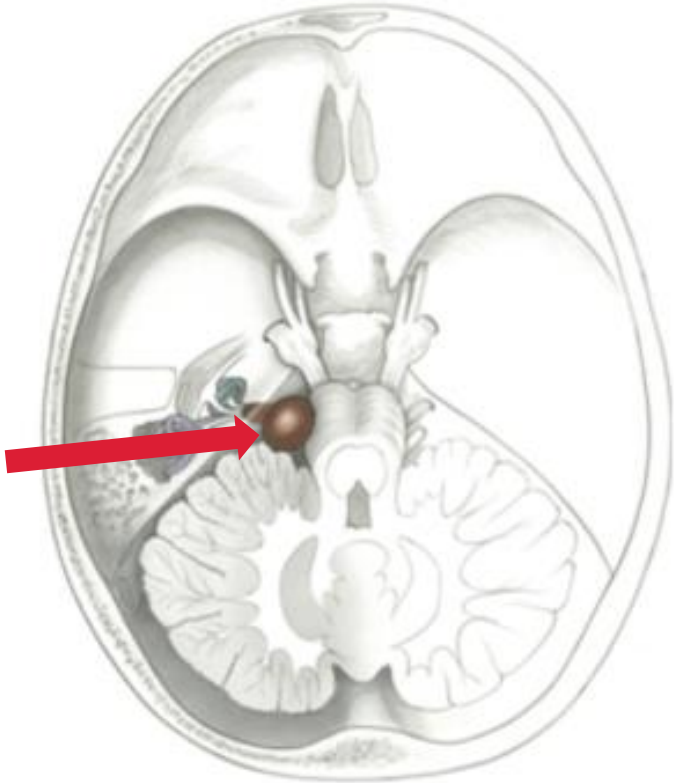
Translabyrinthine Approach

- Sacrifices hearing
- Minimal cerebellar retraction
- Early identification facial nerve
  - Because of these surgical advantages, often used even in small tumors with poor hearing
- Used when hearing is not useful
  (PTA 50 dB, 50% SDS)



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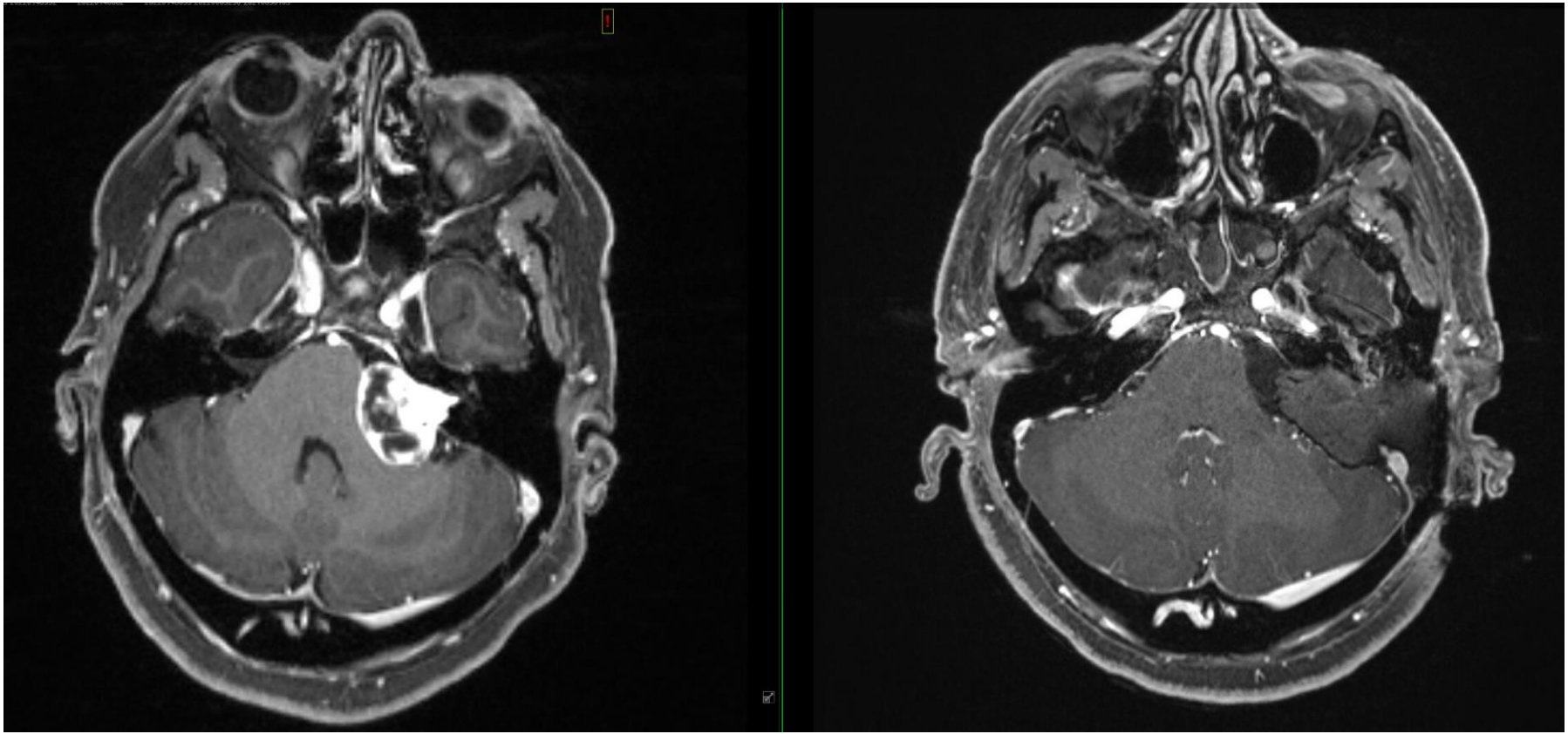
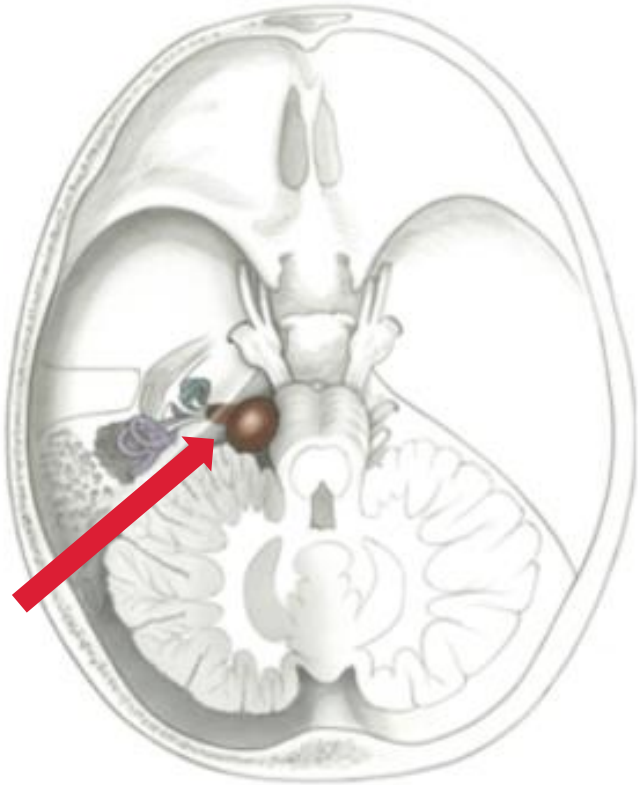
Translabyrinthine approach at Cedars



Retrosigmoid Approach

- Can preserve hearing
- May be difficult to visualize lateral tumor (close to cochlea)
- Cerebellar retraction
- Risk postoperative headache (10% long-term)



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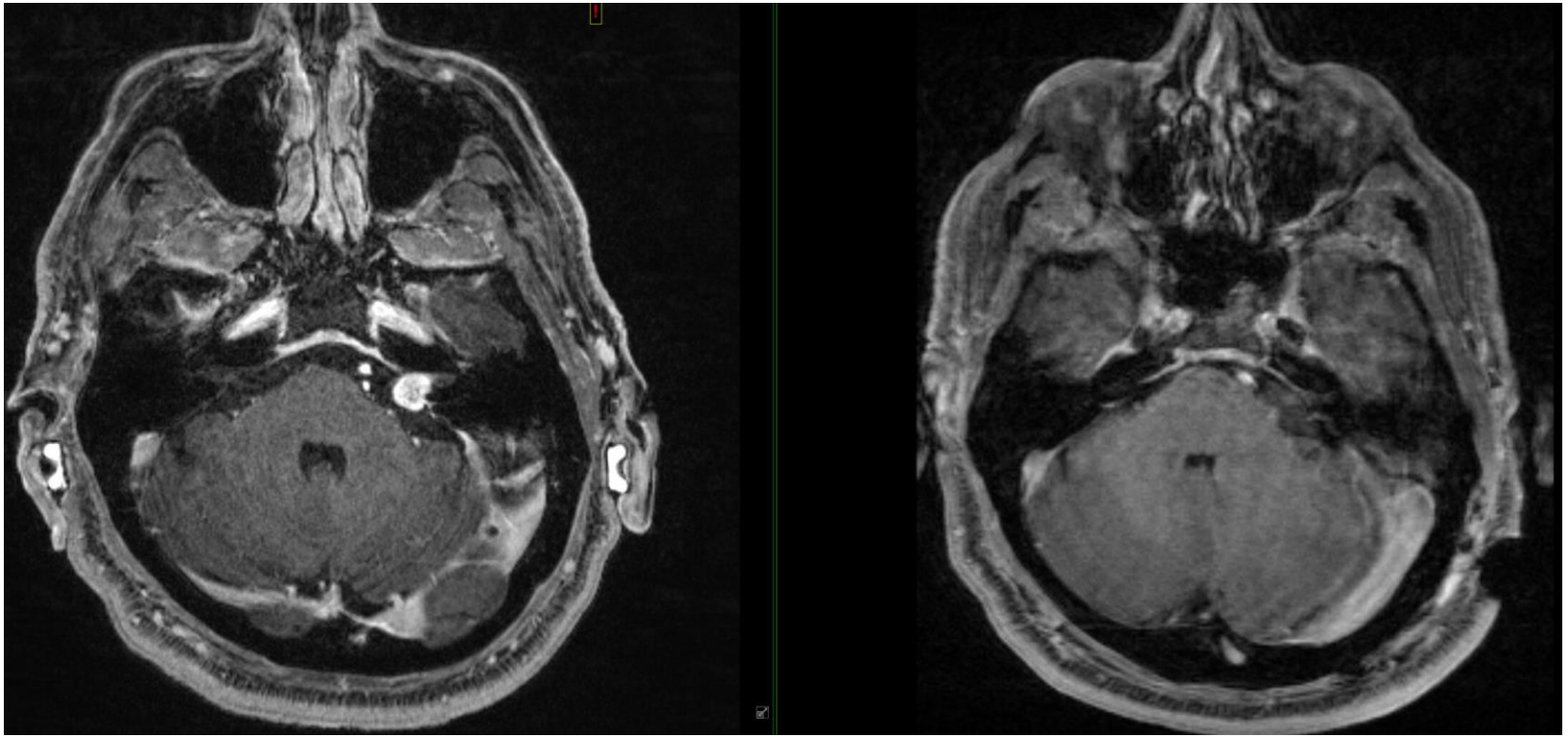
Retrosigmoid approach



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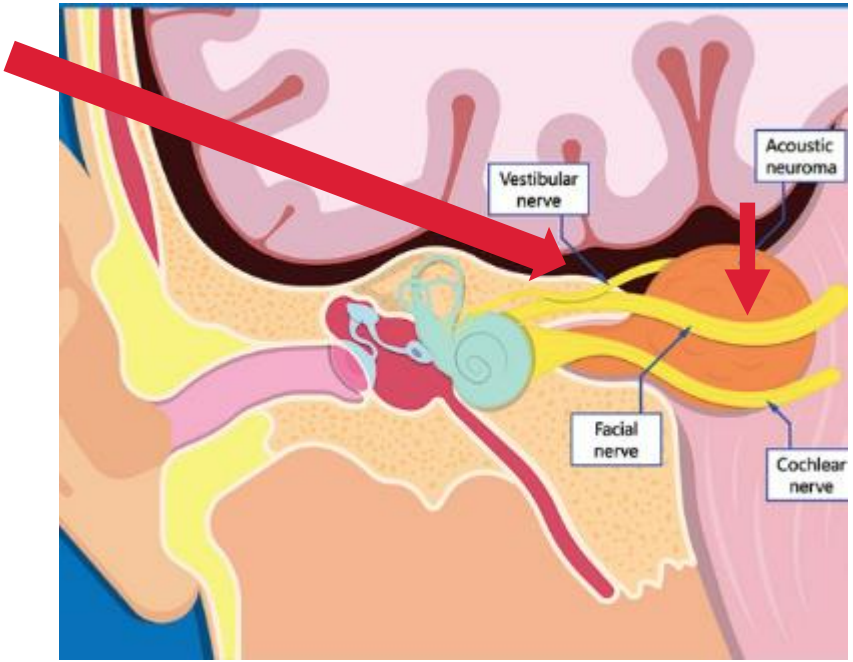
Middle Fossa Approach

- May preserve hearing
- Good for lateral exposure (close to cochlea)
- Smaller tumors (< 2cm)
- Retract temporal lobe (speech centers)
- Challenge: facial nerve is superiorly located: must work around it



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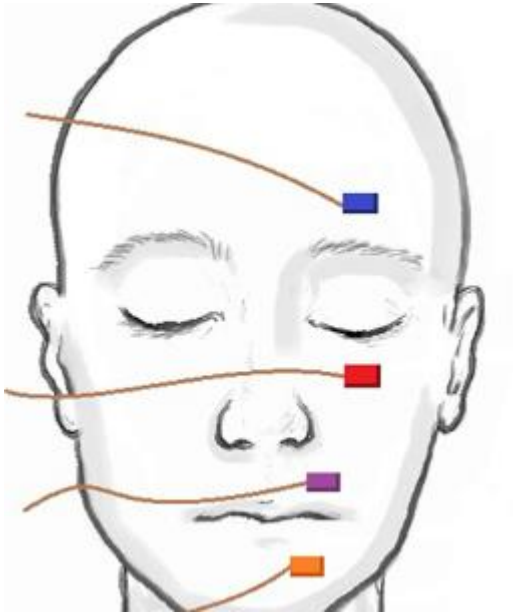
Microsurgery: Goals of Care

- To avoid complications associated with large tumors, we treat relatively soon after establishing the tumor's growth rate.
- To control vertigo and imbalance, we minimize cerebellar retraction in retrosigmoid approaches.
- To preserve hearing at surgery, we choose a hearing preservation approach and monitor hearing during surgery.
- To minimize complications associated with treatment, we monitor the facial nerve and minimize temporal lobe or cerebellar retraction.



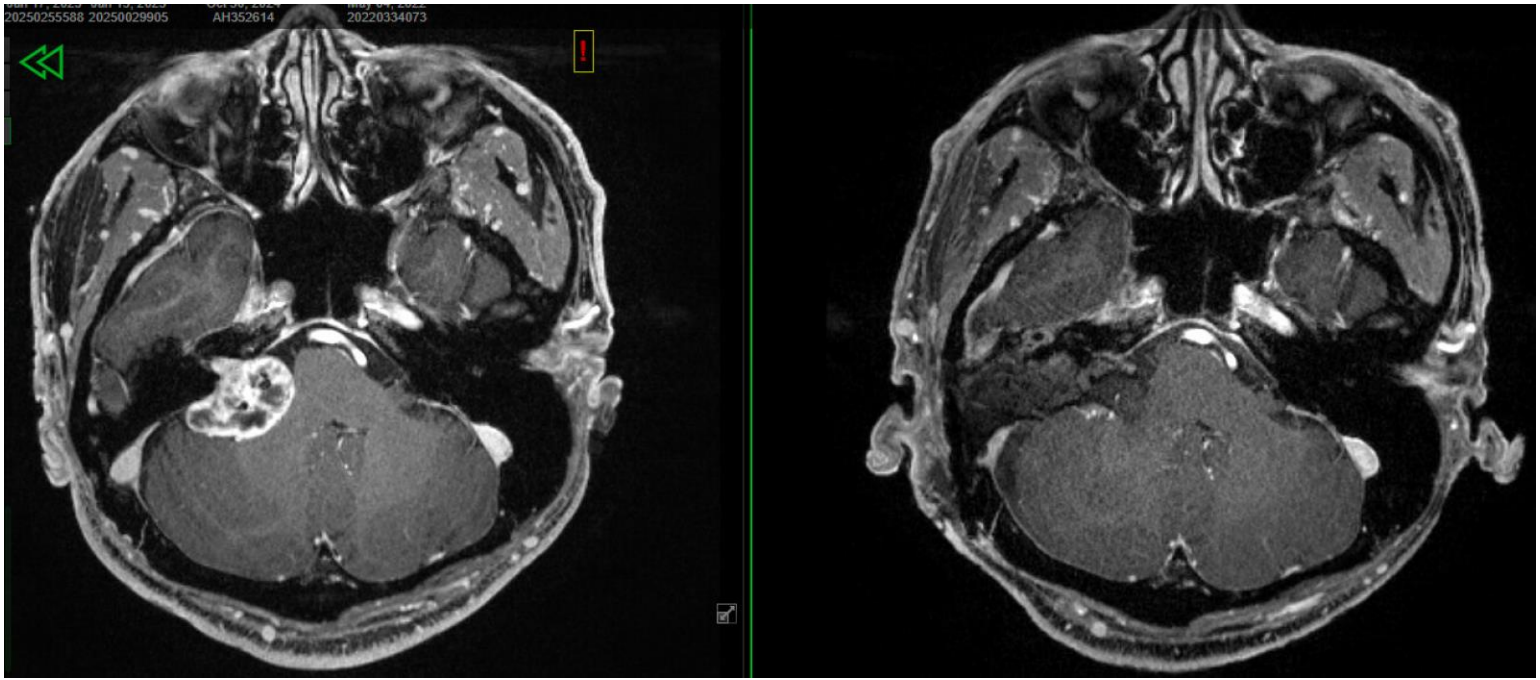
Neurosurgical methods to prevent cerebrospinal fluid (CSF) leaks

- Meticulous technique
- Closure strategies
- Materials used during surgery of the skull base
- These strategies aim to maintain the integrity of the dura mater (the protective membrane surrounding the brain and spinal cord), especially when it's been intentionally or accidentally opened.

Meticulous Dural Closure

- **Primary watertight closure using sutures whenever possible.**
- **Microsurgical techniques are used to avoid tension or gaps in the dural suture line.**
- **When primary closure isn’t possible, surgeons use:**
  - Autologous grafts (e.g., fascia lata, pericranium), Allografts (e.g., cadaveric dura), Synthetic materials (e.g., DuraGen, Gore-Tex patches)
  - Fibrin glue or synthetic sealants are applied over the suture line or graft to reinforce the seal. Examples: Tisseel, BioGlue, DuraSeal.

59 yo male s/p translab removal of acoustic neuroma developed CSF otorrhea 2 weeks after resecion



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Conservative treatment of CSF leak

CSF was actually tracking and dissecting between the ear canal bone and skin and exiting the ear canal opening.

Resolved with simple conversative measure; I placed an expandable sponge (ear wick) to pack the ear canal and push the EAC skin against the EAC bone.

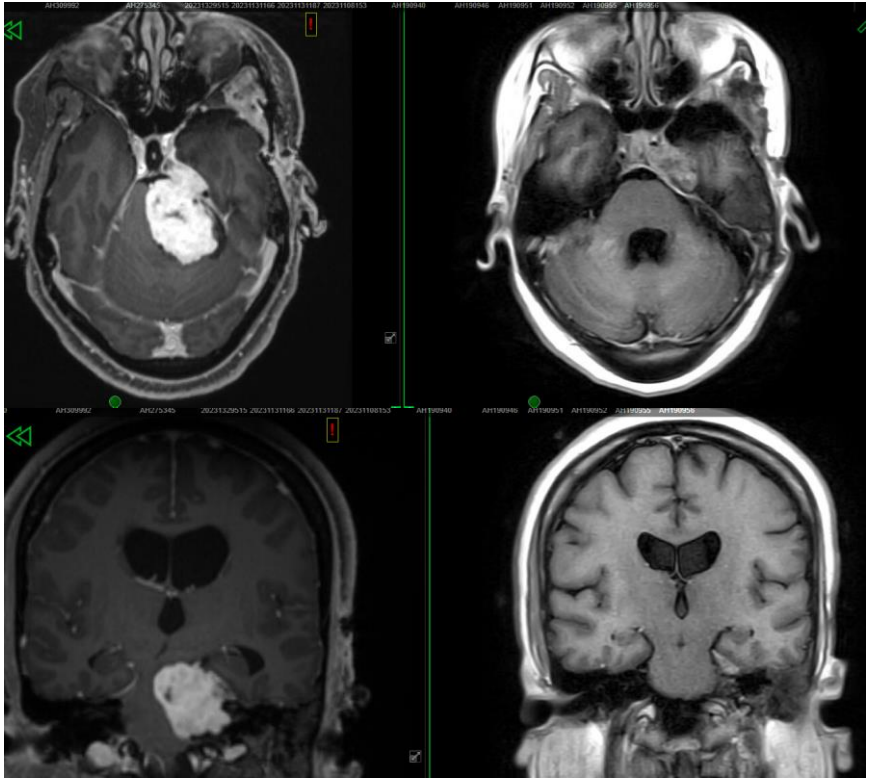
Took diamox during that time. No more CSF leak after removal ear wick packing.

Prevention of Elevated Intracranial Pressure (ICP)

•Management of conditions like hydrocephalus or pseudotumor cerebri reduces strain on the dural repair.

•Shunts or ICP-lowering medications may be needed in select patients.

41 yo female with left face numbness, weakness, left extremity weakness following subtotal resection at outside hospital



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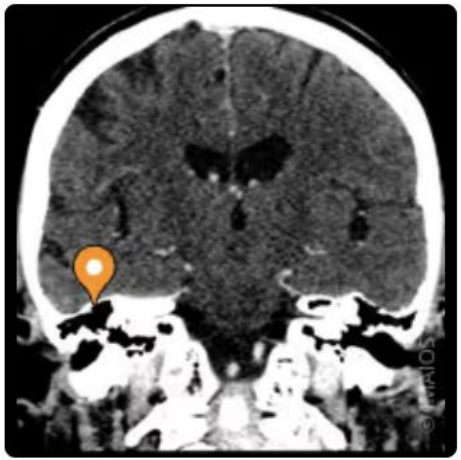
Tegmen tympani

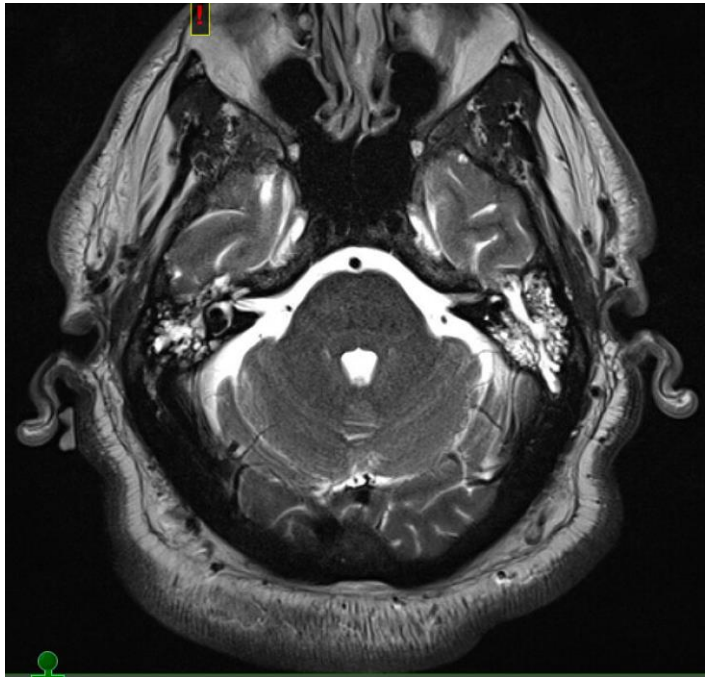
A shallow bony region on the anterior surface of the petrous part of the temporal bone. This structure serves as the roof overlying the tympanic cavity and the mastoid antrum, keeping these parts of the ear separate from the middle cranial fossa of the skull above.

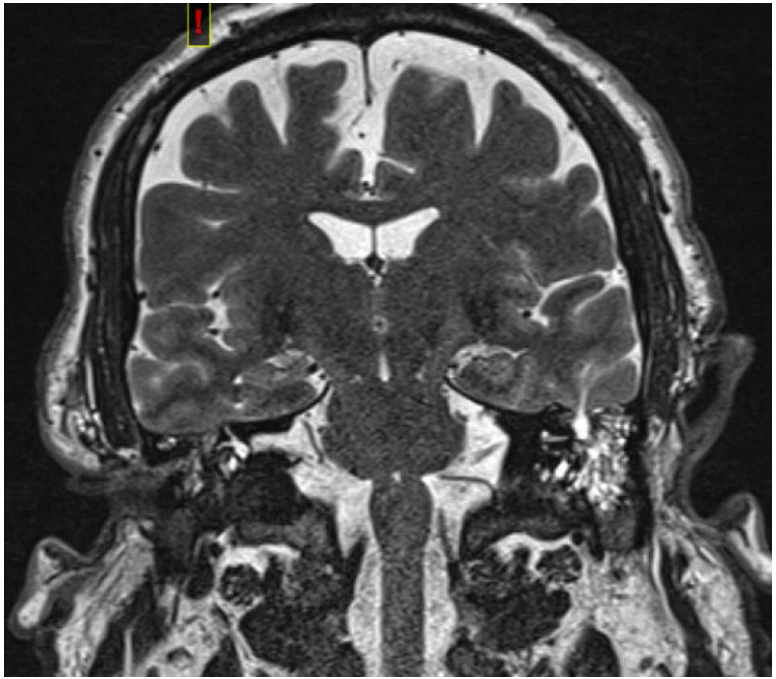


61 yo male with bilateral deafness secondary to CSF leak

- H/O recurrent ear infections with pain and drainage
- H/O Eustachian tube balloon dilation 12/2024
- H/O LEFT myringotomy 1/2025
- Left mucopurulence MRSA, resolved with Bactrim
- Persistent bilateral middle ear effusion

MRI showed bilateral Tegmen defect and encephaloceles





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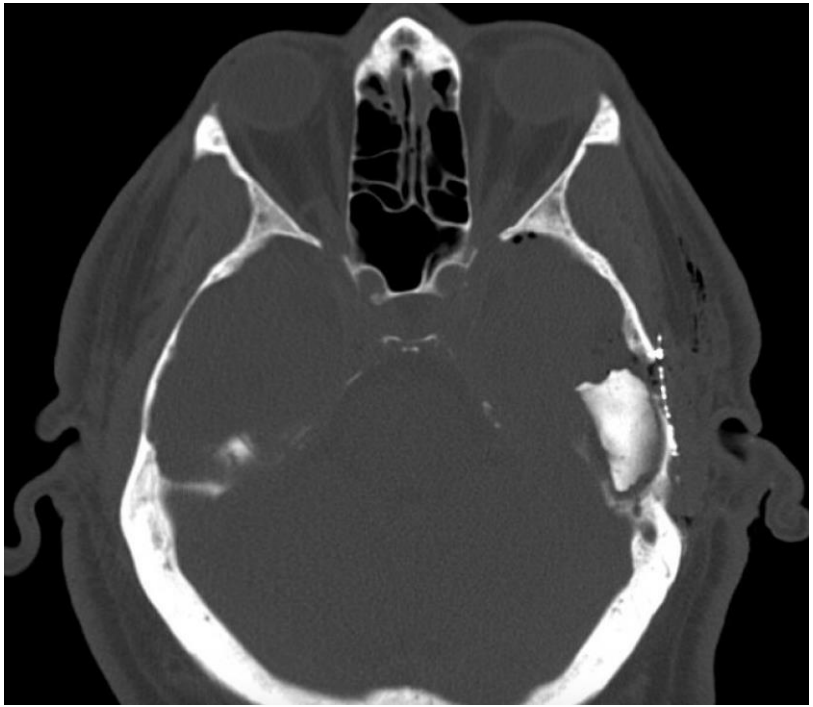
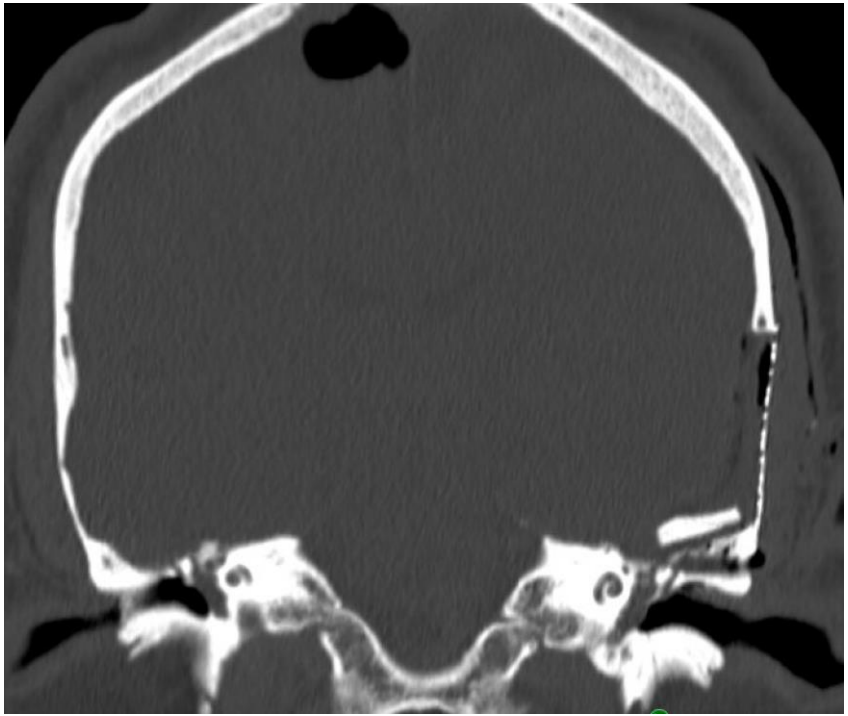
Left middle fossa craniotomy, repair of dural defect with duragen, tisseal, calvarial graft to bolster dural patch, and elevate brain over cochlea





Middle ear effusion resolved bilaterally and regained hearing bilaterally

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Skull base reconstruction

- Especially important in endoscopic endonasal skull base surgery.
- Use of nasoseptal flaps, fat grafts, or mucosal grafts to reconstruct the defect.
- Multilayer closure is standard in high-risk areas (e.g., cribriform plate, clivus).

Minimally Invasive Techniques

- Endoscopic approaches minimize disruption to tissues and bone, reducing leak risk.
- Example: transnasal endoscopy for pituitary tumors with careful closure of the sellar floor.

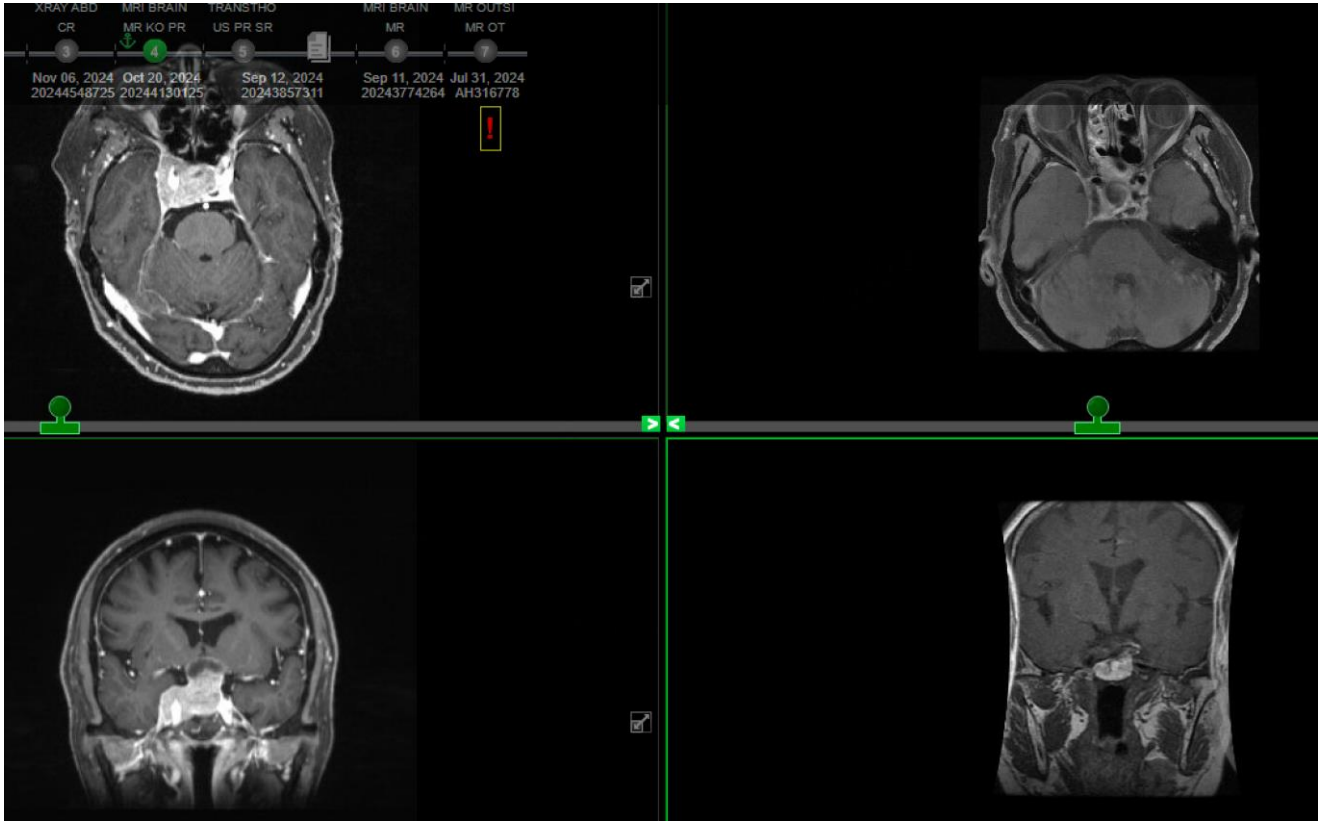
Intraoperative CSF Leak Testing

- Use of Valsalva maneuvers (increased intrathoracic pressure) to test the repair.
- Fluorescein dye may be used to detect subtle leaks.

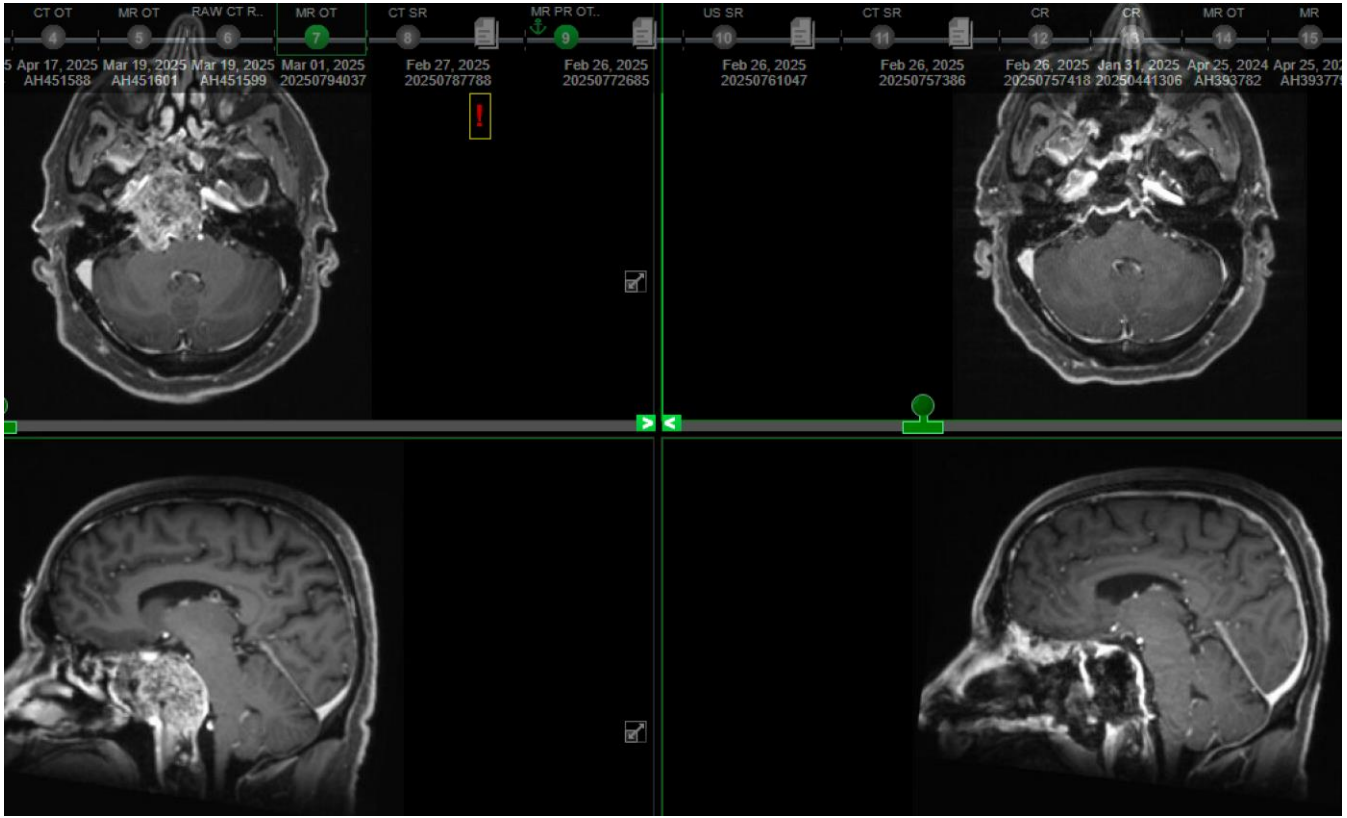
Lumbar Drainage (Temporary)

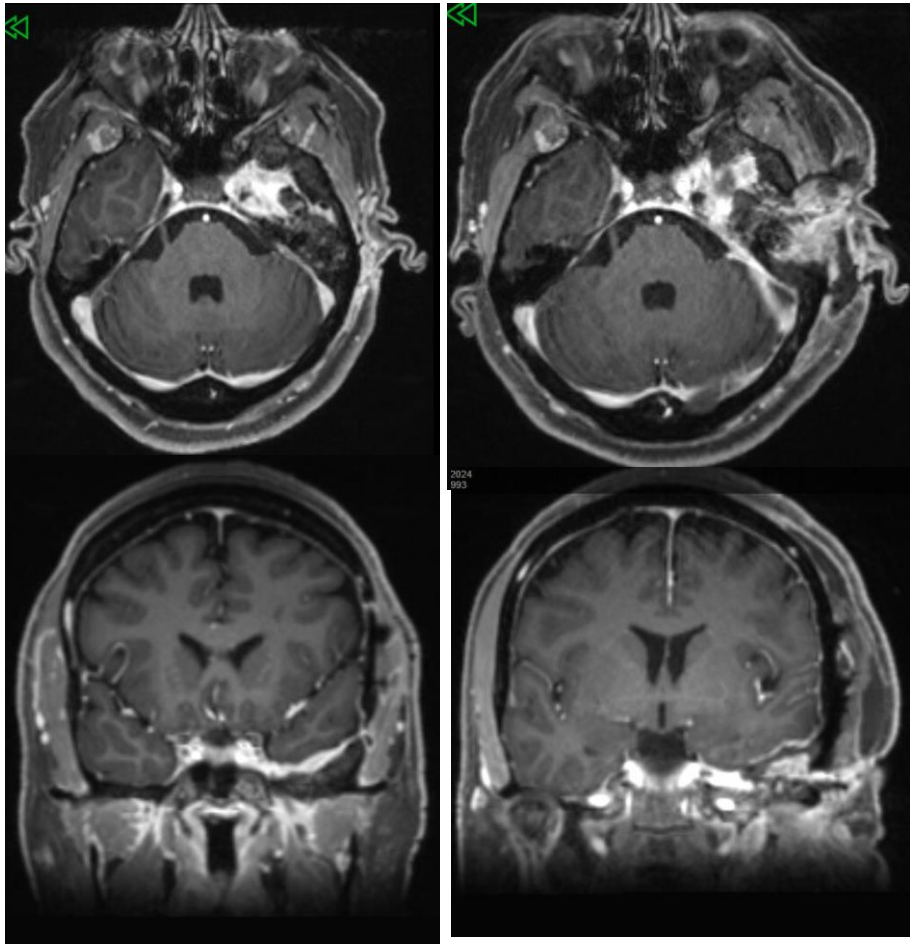
- Postoperatively, a lumbar drain may be used to lower intracranial pressure and divert CSF, allowing the repair to heal.
- Typically used for high-risk repairs or when a small persistent leak is suspected.

73 yo female with vision loss, macroadenoma with cavernous sinus invasion



57 yo male from Saudi Arabia with double vision, facial numbness and weakness on right, loss of right hearing, vision loss with clival chordoma





45 year old female with a history of right-sided CSF leak with with biopsy of external ear canal mass showing meningioma

Right temporal craniotomy, middle fossa approach for repair of CSF leak and removal of meningioma repair of tegmen defect with temporalis flap with plastic surgery

Stable serviceable hearing post op and stereotactic radiation therapy

Thank you!

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