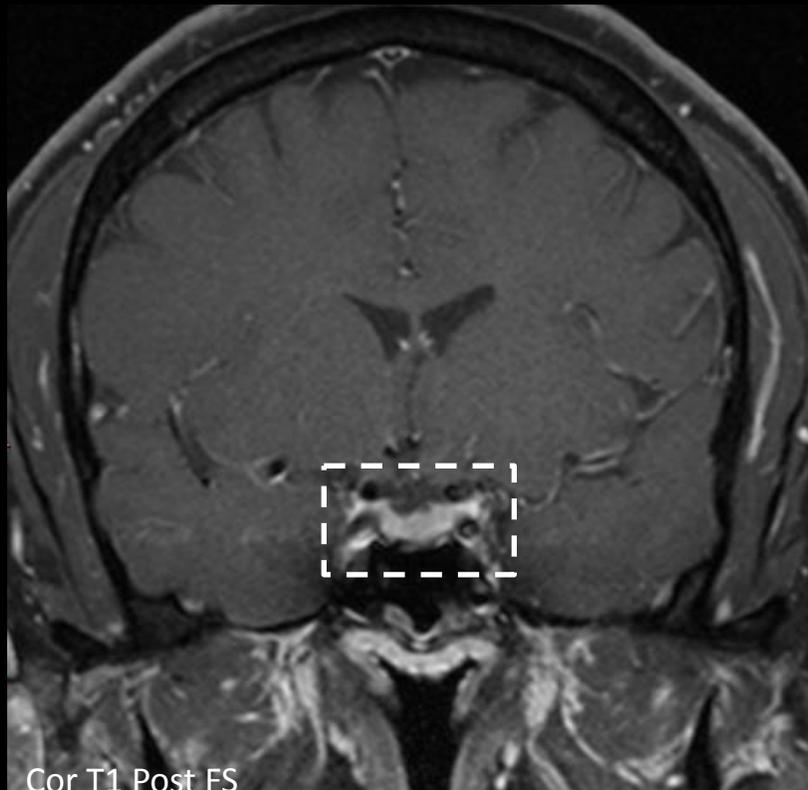
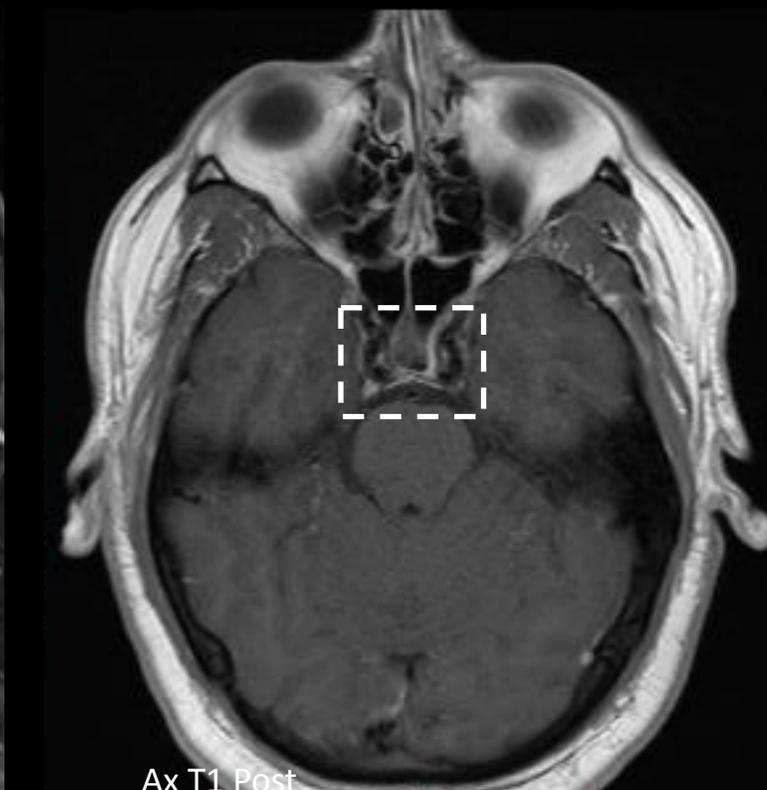


# Cavernous Sinus Lesions For Beginners



Cor T1 Post FS



Ax T1 Post

*The cavernous sinus is near the center of the image and the central skull base... in a “blindspot”*



LOYOLA  
MEDICINE

B Ploussard, J Kus, S Ramasamy, G Okur, A Mallik

Loyola University Medical Center

Department of Radiology

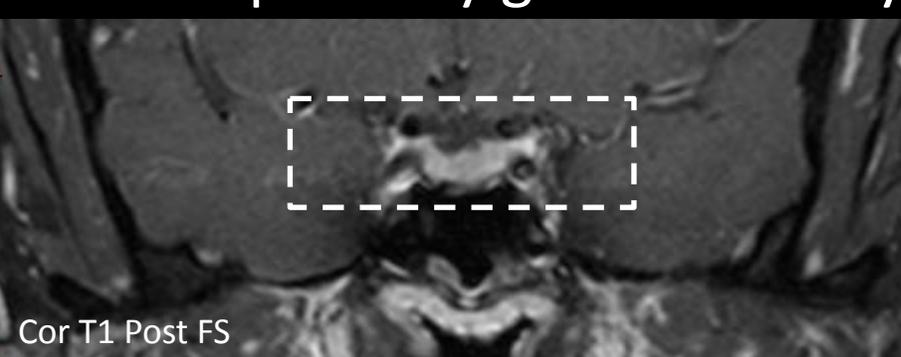
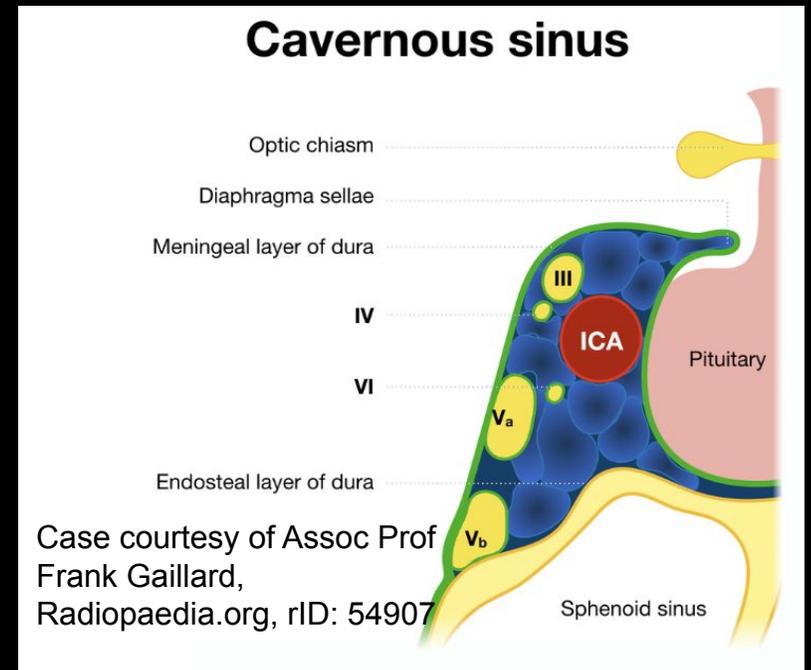
Maywood IL

No Disclosures



# Anatomy Review

- The cavernous sinus is a venous space on either side of the sphenoid sinus and sella turcica
- Contains the internal carotid artery, cranial nerves (CN) III, IV, V1, VI and V2
  - CNVI travels more medially than the others and is more easily affected by cavernous sinus pathology
- Cavernous sinus is also filled with venous blood, fat and fibrous tissue
- Continuous with the epidural space of the spine and orbital space.
- Borders the sphenoid sinus superiorly and pituitary gland medially.



# Cavernous Sinus Lesions

## Most common:

- Meningioma
- Schwannoma

## Rare lesions:

- Hemangiopericytoma
- Hemangioma

Nearby tumors that may invade the cavernous sinus:

## *Relatively common:*

- Pituitary Macroadenoma

## *Less common:*

- Adenoid cystic carcinoma
- Chondrosarcoma
- Nasopharyngeal carcinoma

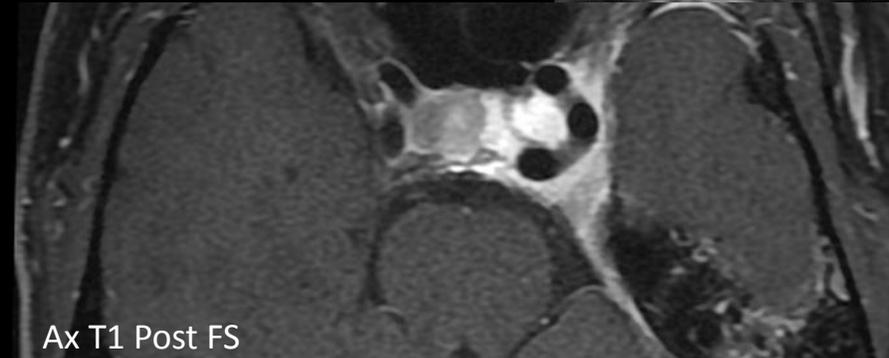
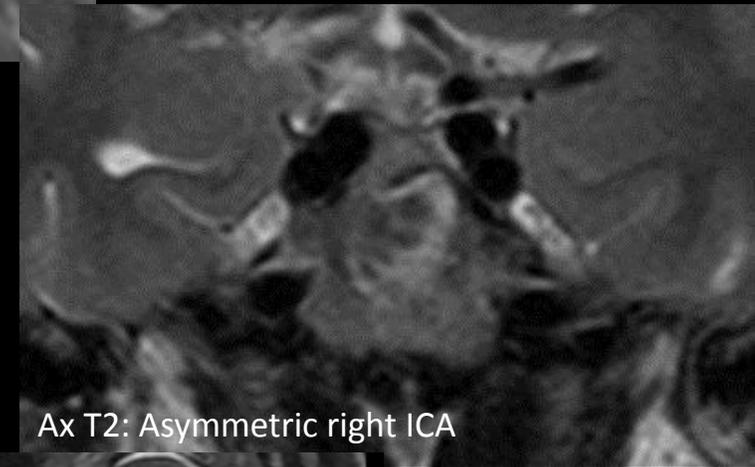
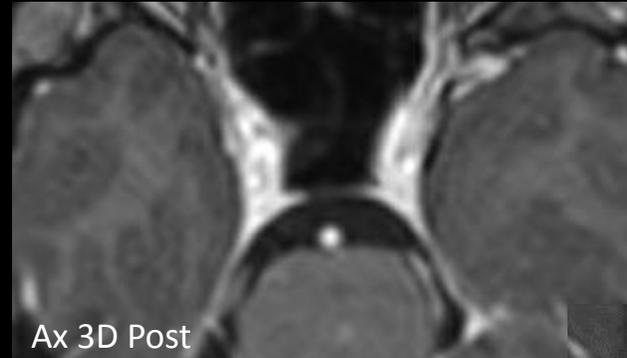
# Imaging Protocol for Suspected Cavernous Sinus Lesions

- MRI is the main modality for cavernous sinus imaging due to superior soft tissue contrast
- Thin-sections in coronal T2 and fat-suppressed T1 with contrast allows the best imaging of the cavernous sinus



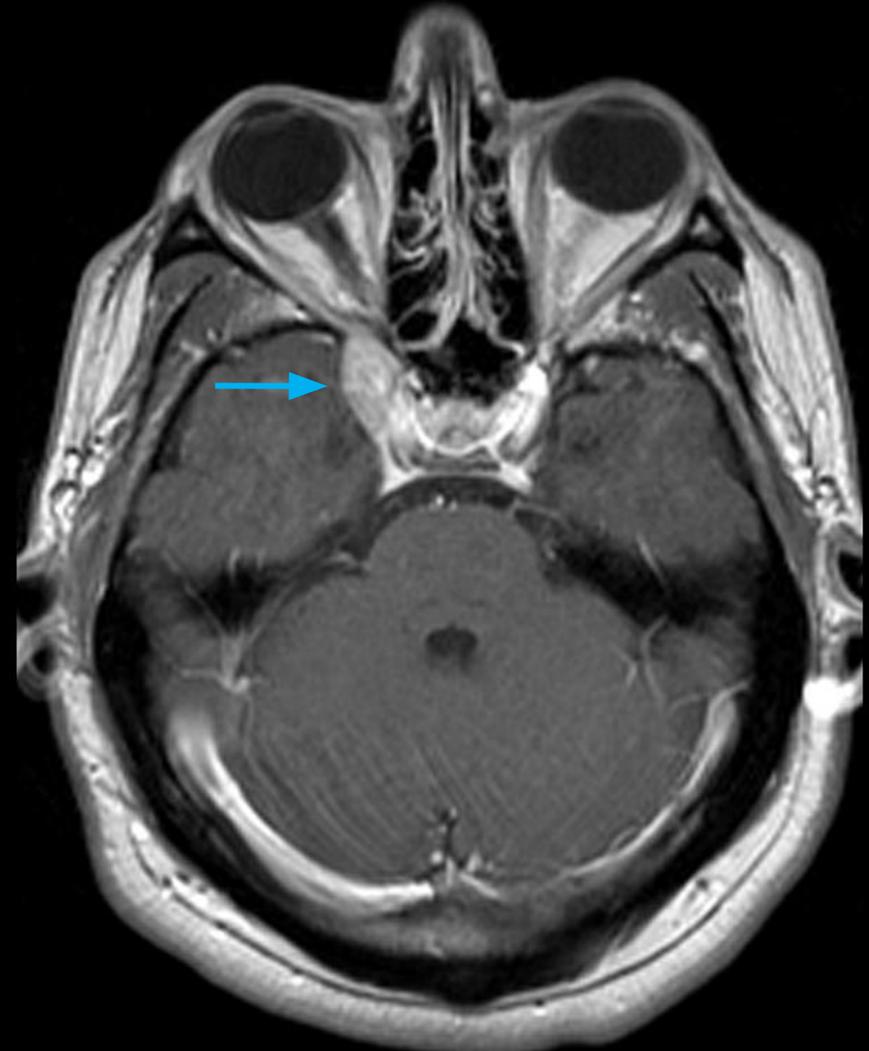
# Cavernous Sinus: Normal versus Abnormal

- Usually, symmetric enhancement and shape
- **However,** Asymmetry can be caused by normal variant tortuosity of one internal carotids
- Generally, the lateral cavernous sinus margin on axial images should not be convex. Concave or flat may be within normal limits.
  - If the lateral margin is convex, consider a space occupying lesion.



# Schwannoma: Basics

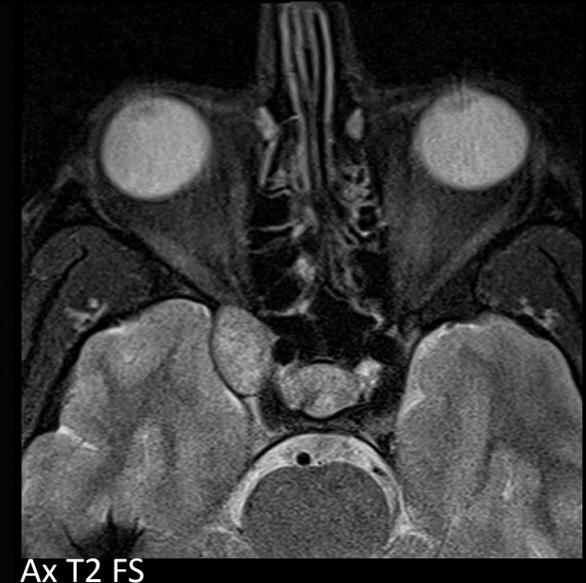
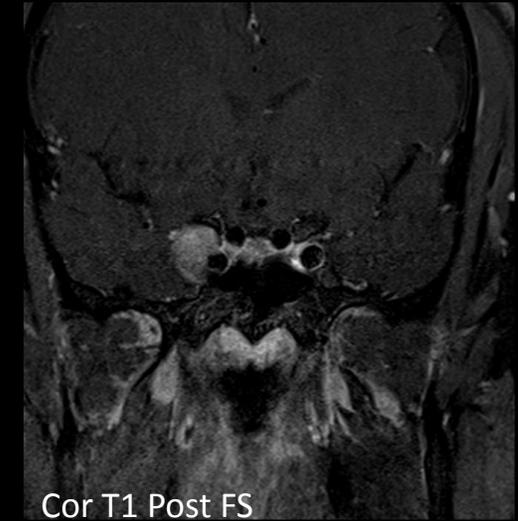
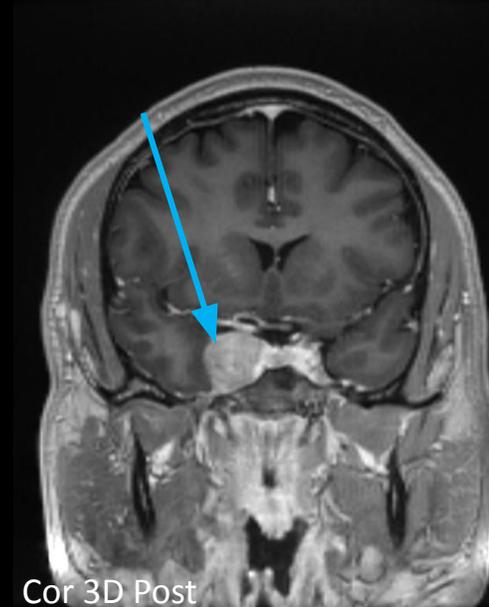
- Benign nerve sheath tumors that arise from schwann cells
- Most schwannomas in the cavernous sinus originate from the trigeminal nerve
- Usually sporadic, solitary and occur in the 5th and 6th decades of life
- Exception is neurofibromatosis type 2 (Better named as Multiple Inherited **Schwannomas**, Meningiomas, Ependymomas; MISME) leading to earlier development



Ax T1 Post

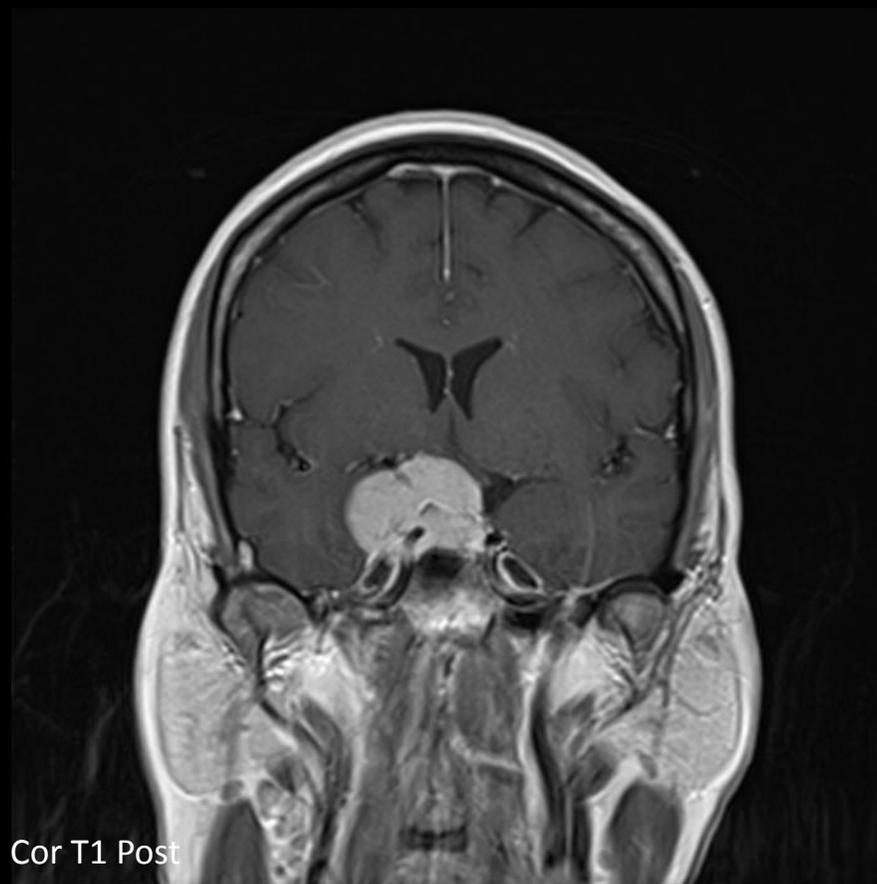
# Schwannoma: Morphology and Features

- **On T2**
  - heterogeneously hyperintense
  - Thin-section coronal images can help depict origin of schwannoma
- **On T1**
  - hypointense
  - Exhibit heterogeneous enhancement with gadolinium contrast
- Often ovoid shaped when occurring in the cavernous sinus



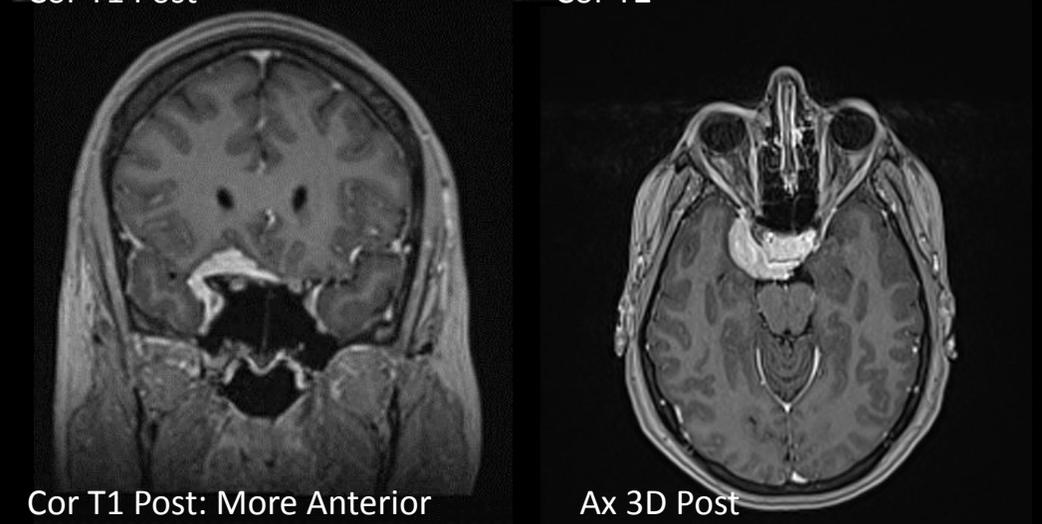
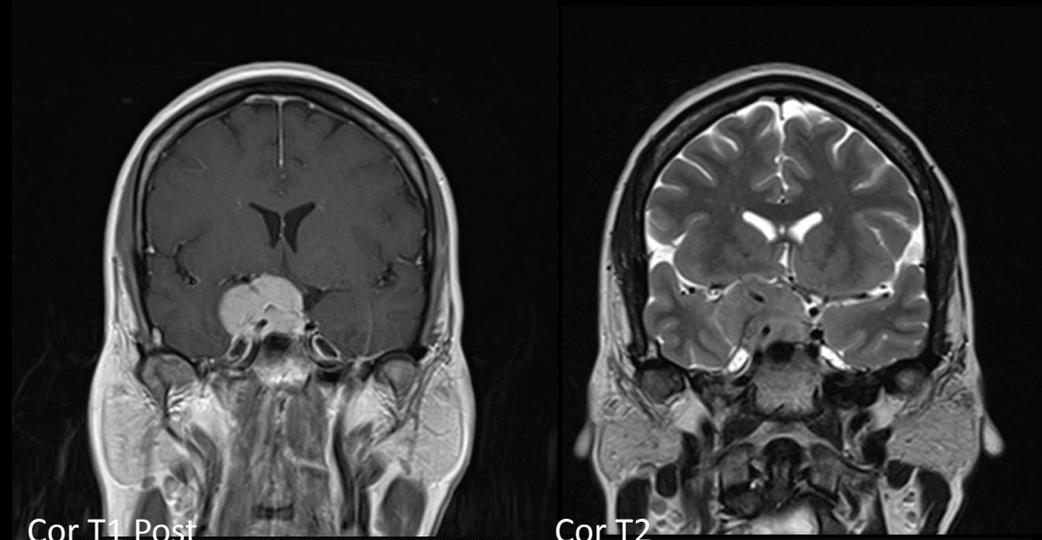
# Meningioma: Basics

- Constitute 41% of all cavernous sinus lesions
- Usually occur in the 5th to 7th decade of life
- More common in females
- In the cavernous sinus, typically arise from the dura of the lateral wall
- Meningiomas that invade the cavernous sinus can encase the cavernous segment of the internal carotid artery



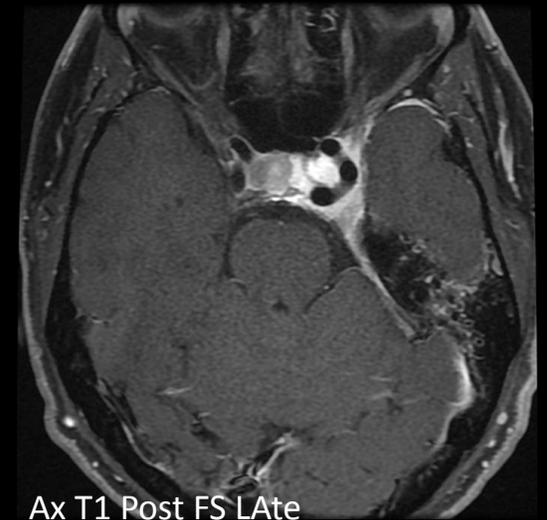
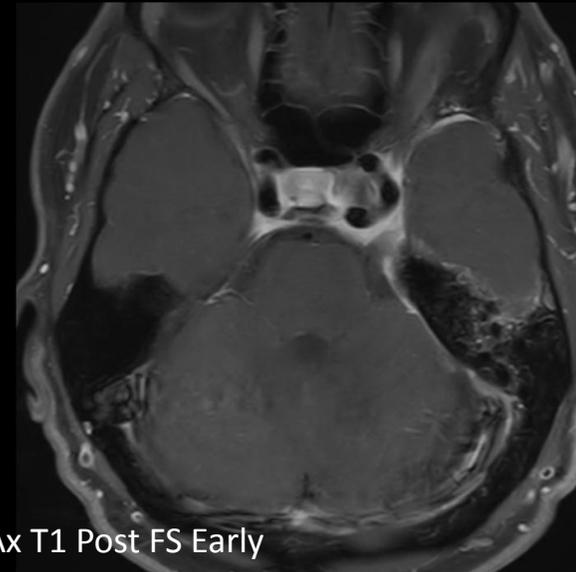
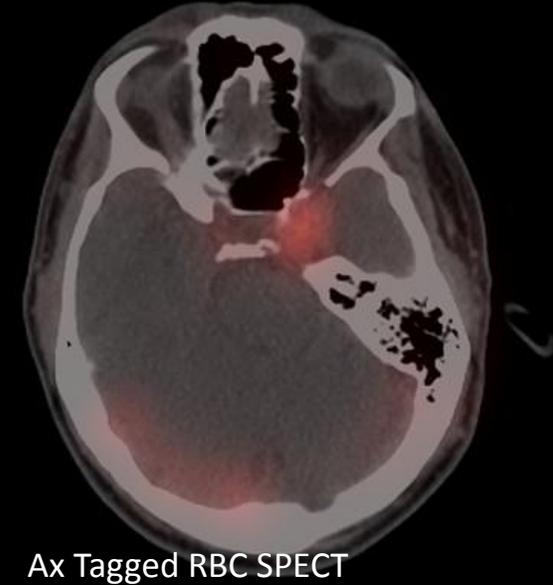
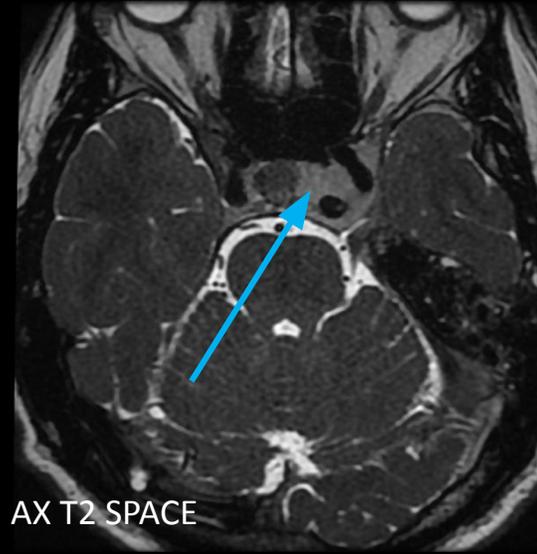
# Meningioma: Morphology and Features

- Usually isointense or hypointense to gray matter on T1 and T2 imaging
- Show intense homogeneous enhancement with gadolinium contrast
- Exhibit restricted diffusion
- Presence of calcification, vascularity or cystic areas can potentially lead to heterogeneous appearance on MRI
- Can also encase internal carotid artery, but more likely to narrow it

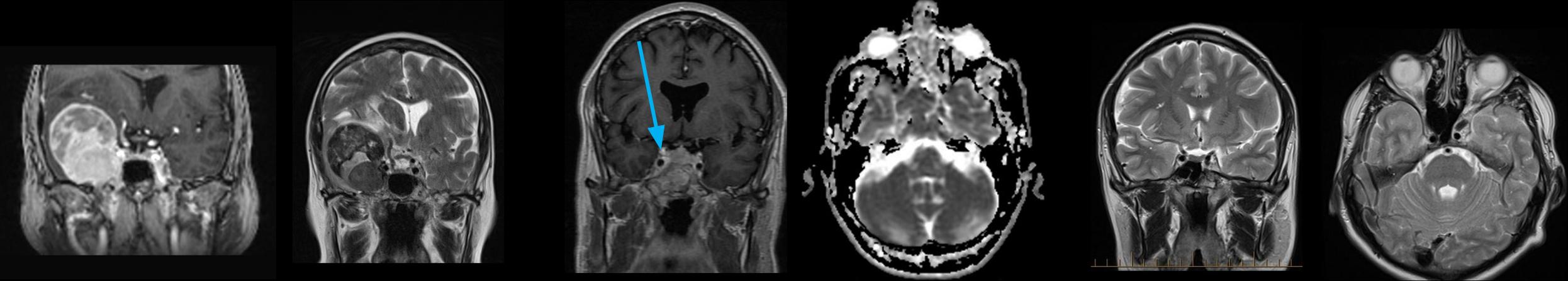


# Hemangioma Morphology and Features

- Better described as a vascular malformation
- Typically in the brain parenchyma, but occurs extra-axially in the cavernous sinus or cerebellopontine angles
- High signal T2 and FLAIR
- Progressive intense homogeneous enhancement with gadolinium
- Tc-99m Tagged Red Blood Cell SPECT and Fluciclovine PET can help support diagnosis



# Rare Tumors



## Hemangiopericytoma:

- Mesenchymal neoplasms
- on imaging, closely mimic meningiomas
- can have narrow dural attachment, bone erosion and flow voids
- Typically seen in younger patients compared to meningiomas

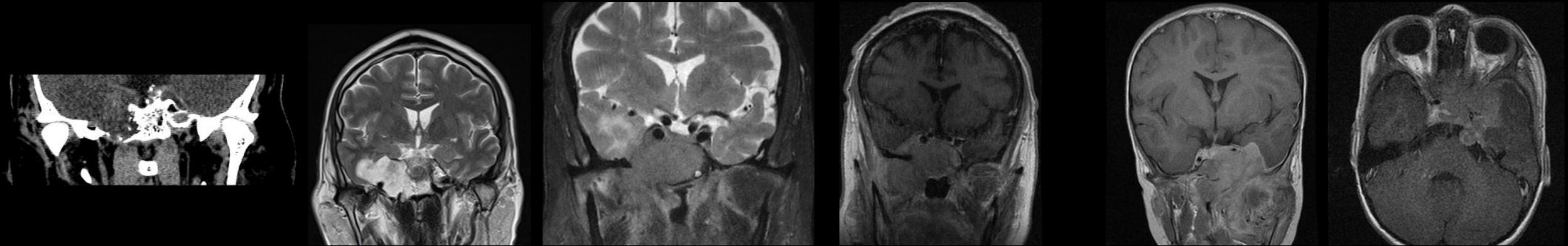
## Lymphoma:

- Can be from direct extension from adjacent bone marrow or the nasopharynx or hematogenous dissemination
- T2 hypointense with diffusion restriction
- Intense enhancement with gadolinium

## Neurofibroma:

- Almost always from neurofibromatosis type 1
- Seen in cranial nerve V1 & V2
- peripheral T2 hyperintense and central hypointensity
- Variable gadolinium enhancement

# Rare Tumors Continued



## Chondrosarcoma:

- Usually arise from skull base and extend into cavernous sinus
- Overall high T2 signal with region of lower signal due to calcifications in the tumor
- Typically show high enhancement with gadolinium

## Nasopharyngeal Carcinoma:

- Cavernous sinus involvement through perineural spread
- Usually in 5th or 6th decade
- Nasopharyngeal mass or non-specific MR with bulky cervical lymphadenopathy
- Tumor in the cavernous sinus represents late stage disease

## Rhabdomyosarcoma:

- Tumor seen in pediatric population
- Commonly in nasopharynx, masticator spaces, paranasal sinuses and orbits
- Bulky heterogeneous mass
- Invade cavernous sinus via bony destruction or perineural extension

# References:

1. Mahalingam HV, Mani SE, Patel B, Prabhu K, Alexander M, Fatterpekar GM, Chacko G. Imaging Spectrum of Cavernous Sinus Lesions with Histopathologic Correlation. *Radiographics*. 2019 May-Jun;39(3):795-819. doi: 10.1148/rg.2019180122. Epub 2019 Apr 12. PMID: 30978149.
2. Munawar K, Nayak G, Fatterpekar GM, Sen C, Zagzag D, Zan E, Hagiwara M. Cavernous sinus lesions. *Clin Imaging*. 2020 Dec;68:71-89. doi: 10.1016/j.clinimag.2020.06.029. Epub 2020 Jun 18. PMID: 32574933.
3. Salanitri GC, Stuckey SL, Murphy M. Extracerebral cavernous hemangioma of the cavernous sinus: diagnosis with MR imaging and labeled red cell blood pool scintigraphy. *AJNR Am J Neuroradiol*. 2004 Feb;25(2):280-4. PMID: 14970031; PMCID: PMC7974593.
4. Miyazaki Y, Yamamoto I, Shinozuka S, Sato O. Microsurgical anatomy of the cavernous sinus. *Neurol Med Chir (Tokyo)*. 1994 Mar;34(3):150-63. doi: 10.2176/nmc.34.150. PMID: 7516044.
5. Chen B, Wei P, Macapinlac HA, Lu Y. Comparison of 18F-Fluciclovine PET/CT and 99mTc-MDP bone scan in detection of bone metastasis in prostate cancer. *Nucl Med Commun*. 2019 Sep;40(9):940-946. doi: 10.1097/MNM.0000000000001051. PMID: 31343613.