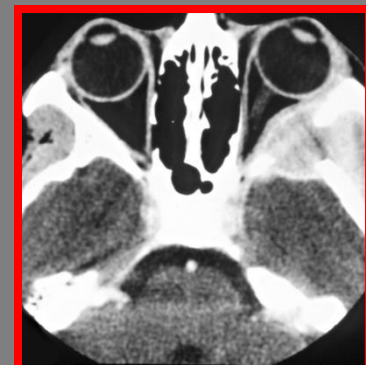
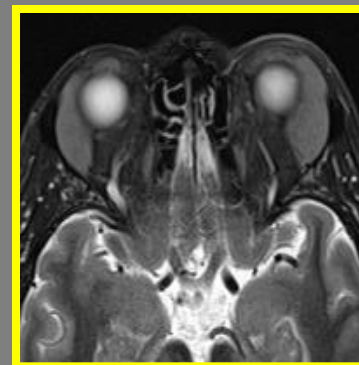
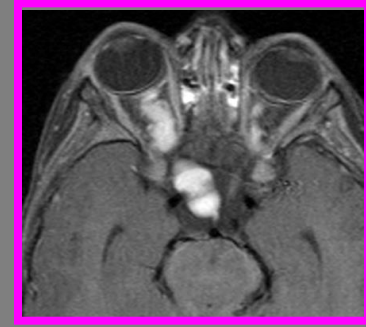
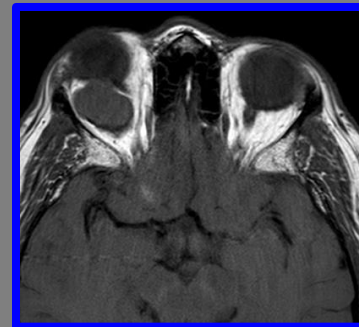
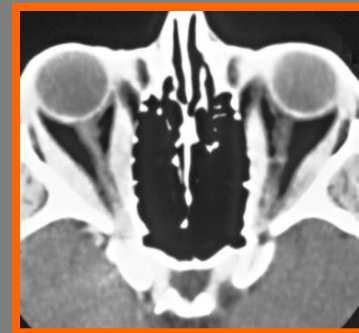


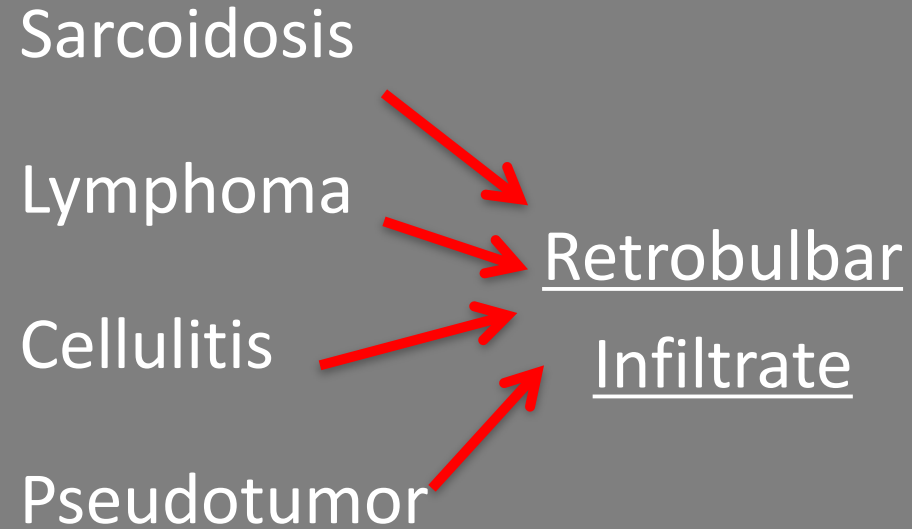
Orbital Imaging

Mahmud Mossa-Basha, MD
Professor of Radiology
University of Washington

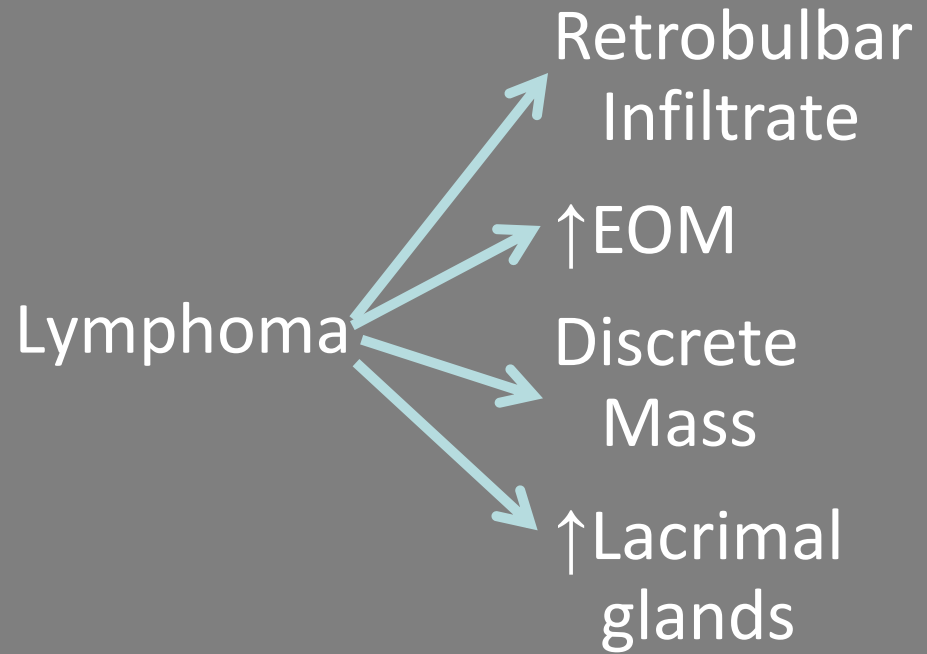
There is a limited number of patterns of orbital disease

1. EOM enlargement
2. Retrobulbar infiltrate
3. Discrete orbital mass
4. Optic nerve/sheath enlargement
5. Lacrimal enlargement
6. Lesion of the bony orbit
7. Orbital detachments



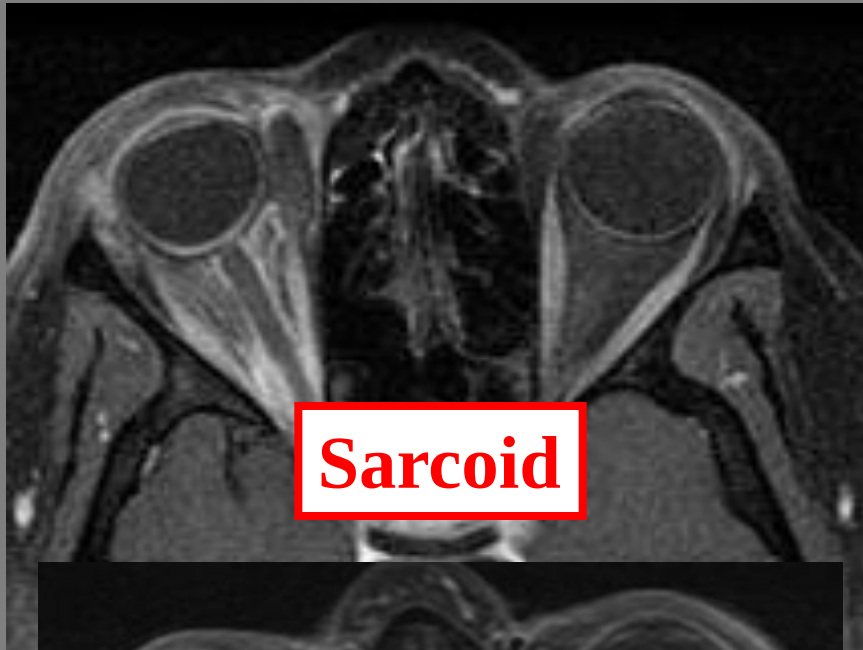


An imaging pattern
may be caused by
many diseases



A single disease can
produce multiple
imaging patterns

Retrobulbar Infiltrate



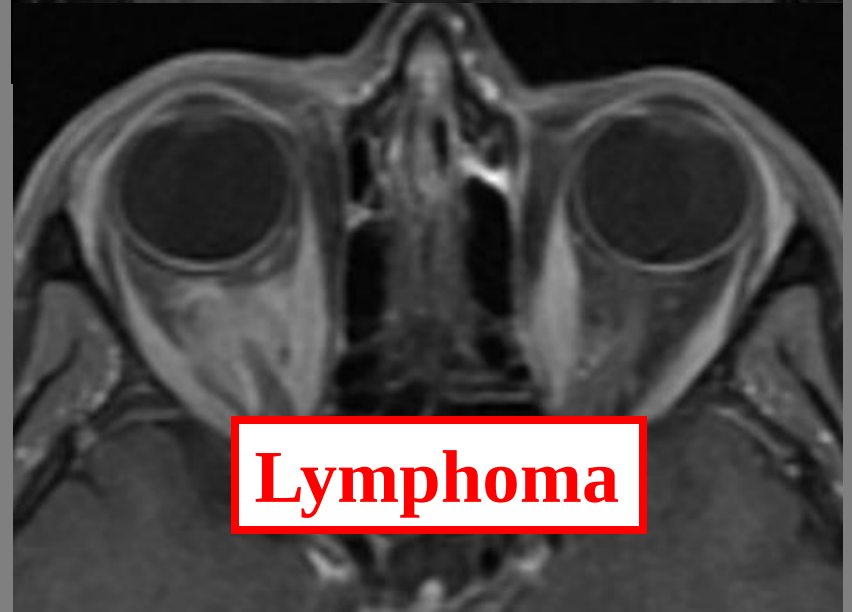
Sarcoid



Metastatic breast ca

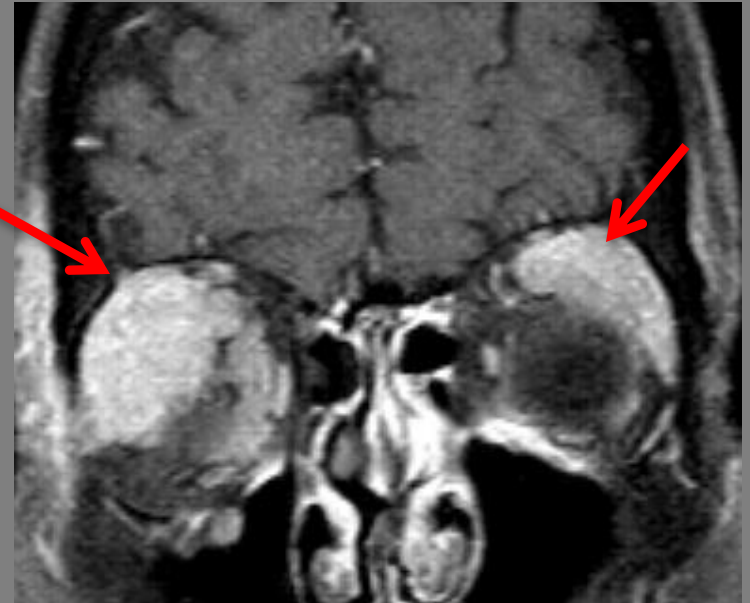


NSOI



Lymphoma

Lymphoma



Challenges: **Hard to make definitive dx**

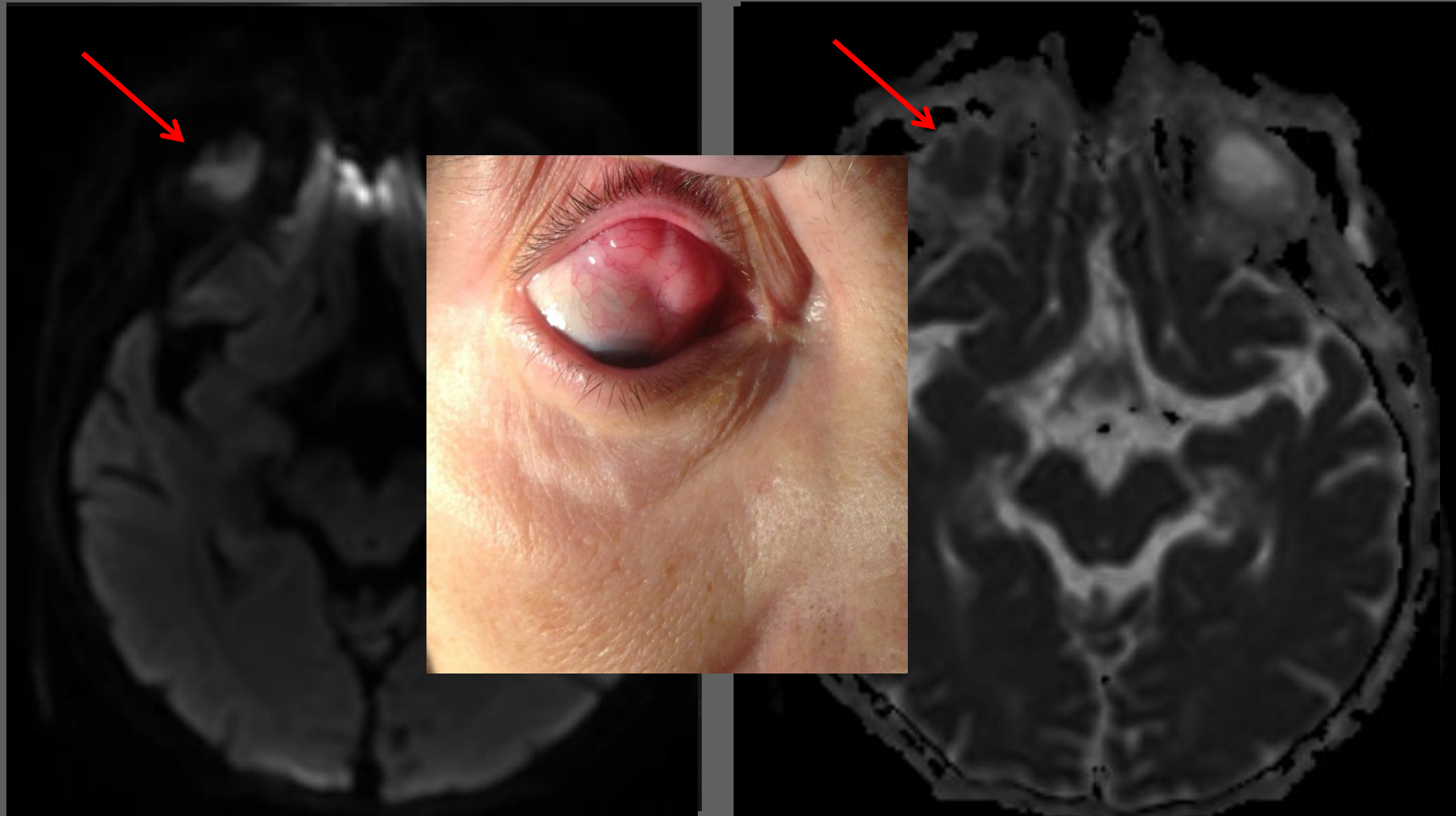
However, **Some entities show up on many lists**

- 1. Lymphoma**
- 2. Nonspecific Orbital Inflammation**
- 3. Sarcoid**
- 4. Metastatic disease**

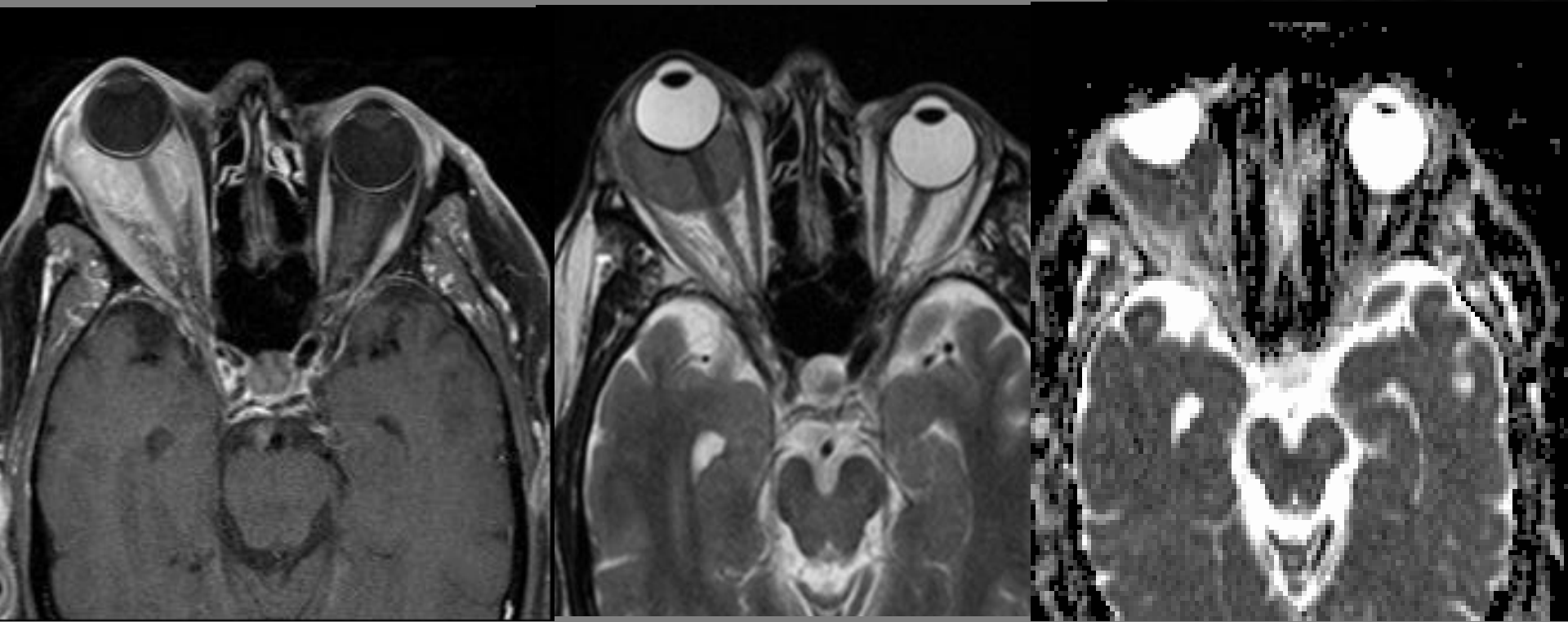
Orbital Lymphoma

- Lymphoproliferative disease: lymphoid hyperplasia (polyclonal) to lymphoma (monoclonal)
- Most common primary orbital malignancy in adults
- 70% associated with systemic disease
- Most commonly MALT marginal zone B-cell lymphoma
- Predilection for preseptal ST (lids, conjunctiva)
- Soft lesions that mold

Conjunctival Lymphoma



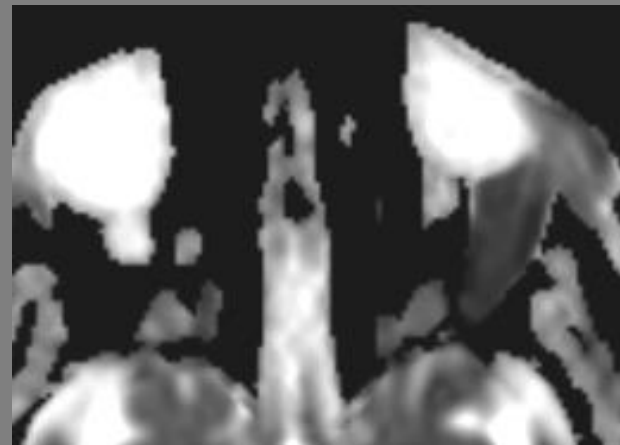
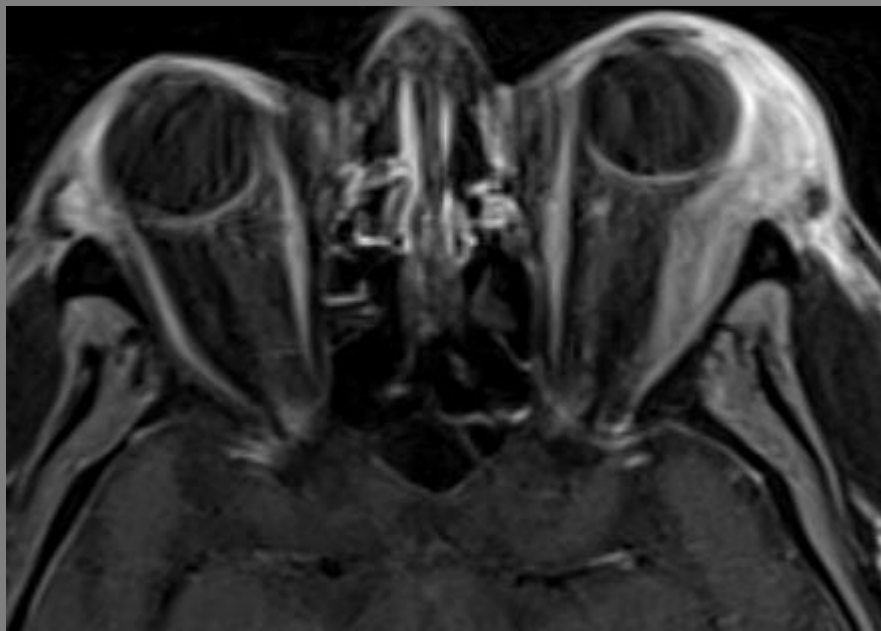
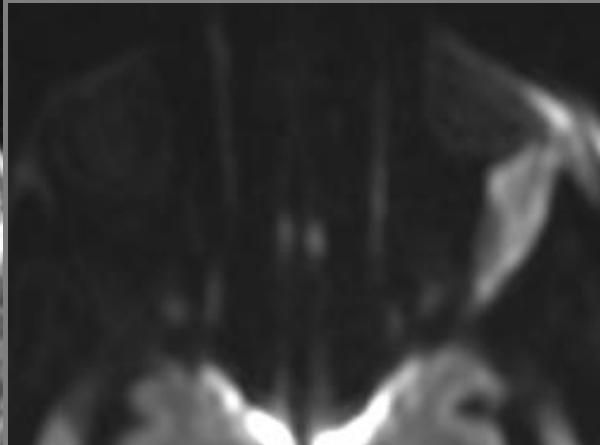
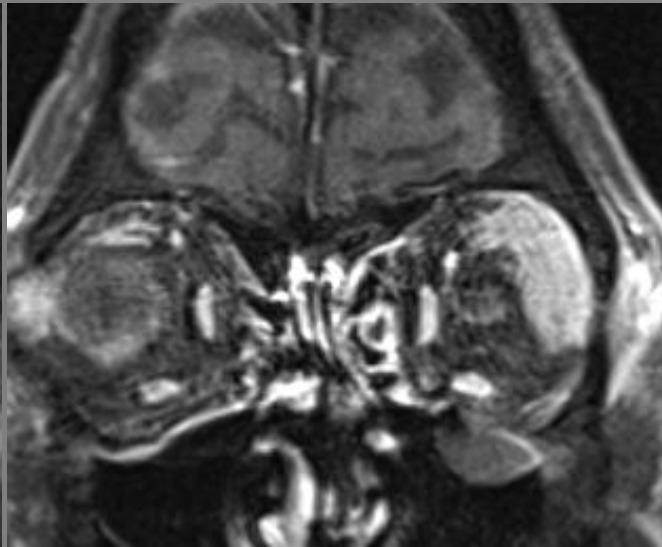
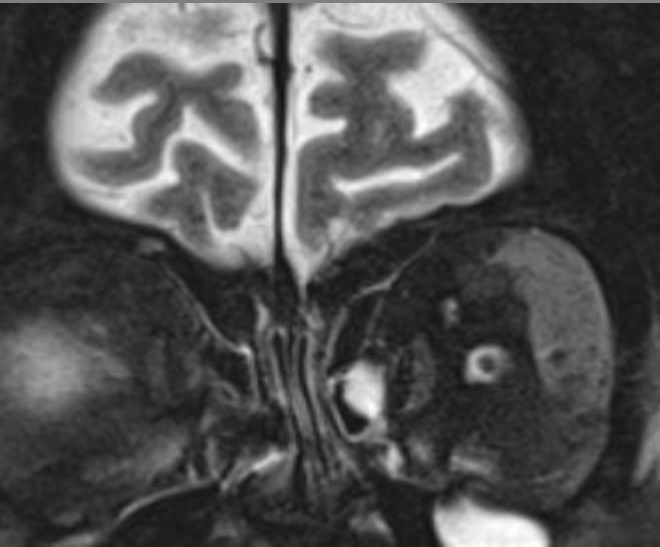
MALT Lymphoma



Orbital Lymphoma



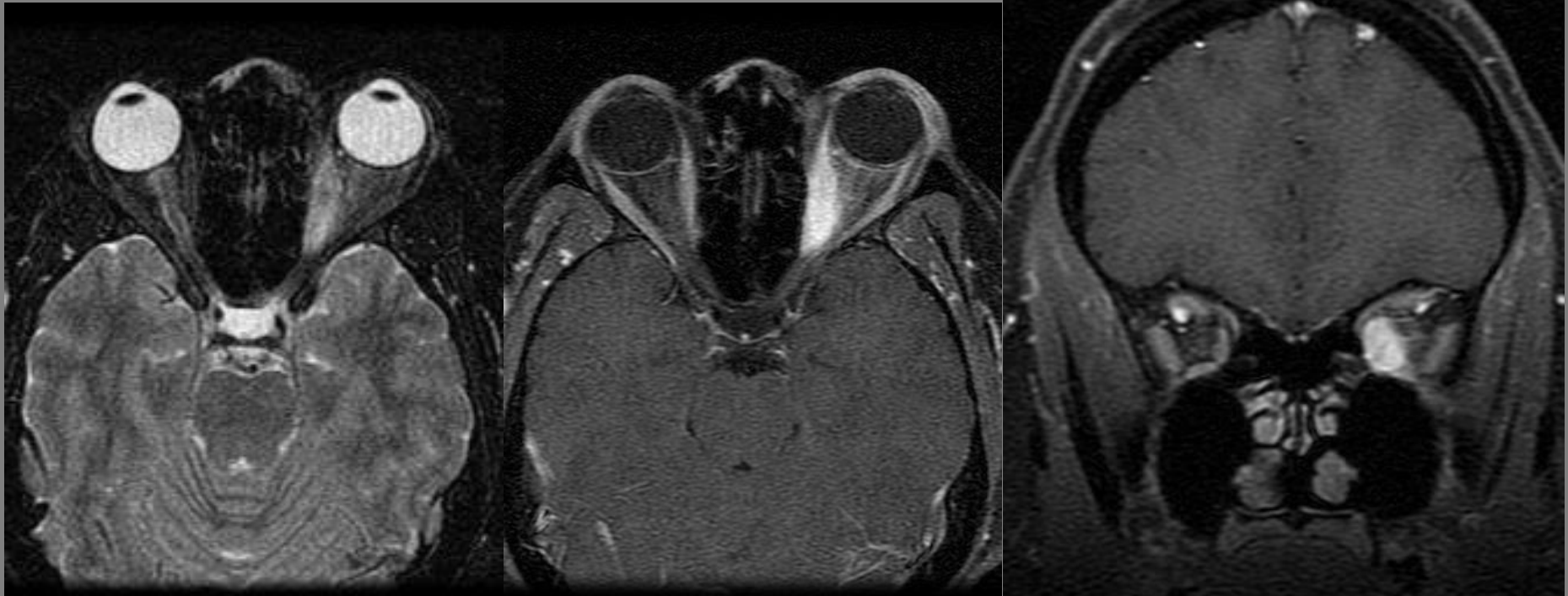
Orbital Chloroma



Idiopathic Orbital Inflammation

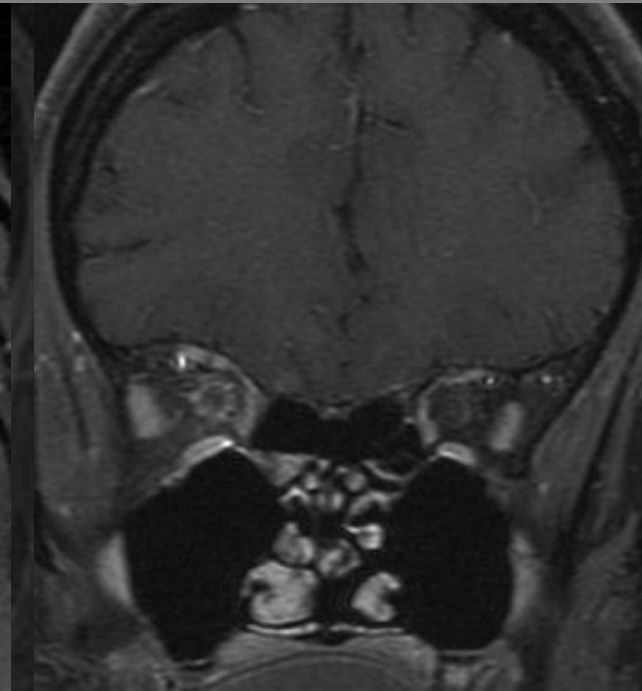
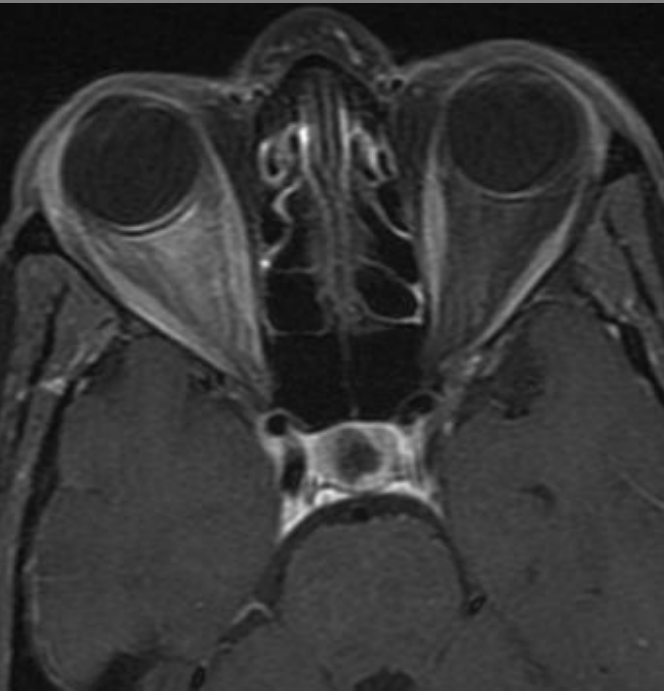
- Previously pseudotumor, also Nonspecific orbital inflammation
- **Classic clinical presentation:** Acute onset of **painful** ophthalmoplegia, highly steroid sensitive (80%)
- Diffuse (infiltrative) or focal
- Most common form is “myositic”
- Polymorphous infiltrate; biopsy non-diagnostic

Nonspecific Orbital Inflammation



- Unilateral in 75%
- May involve any portion of the muscle
- Muscles have ill-defined margins with adjacent inflammation

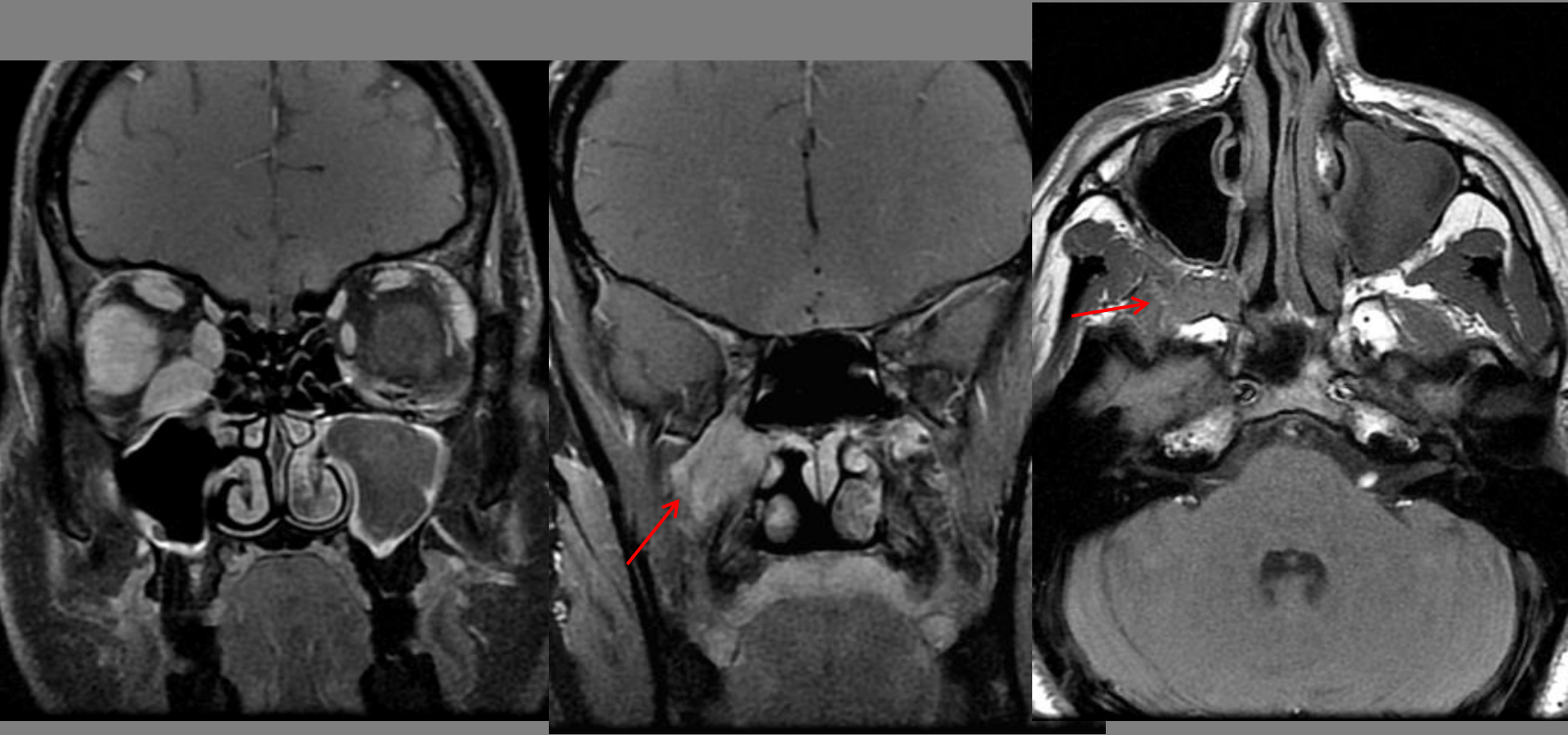
NSOI



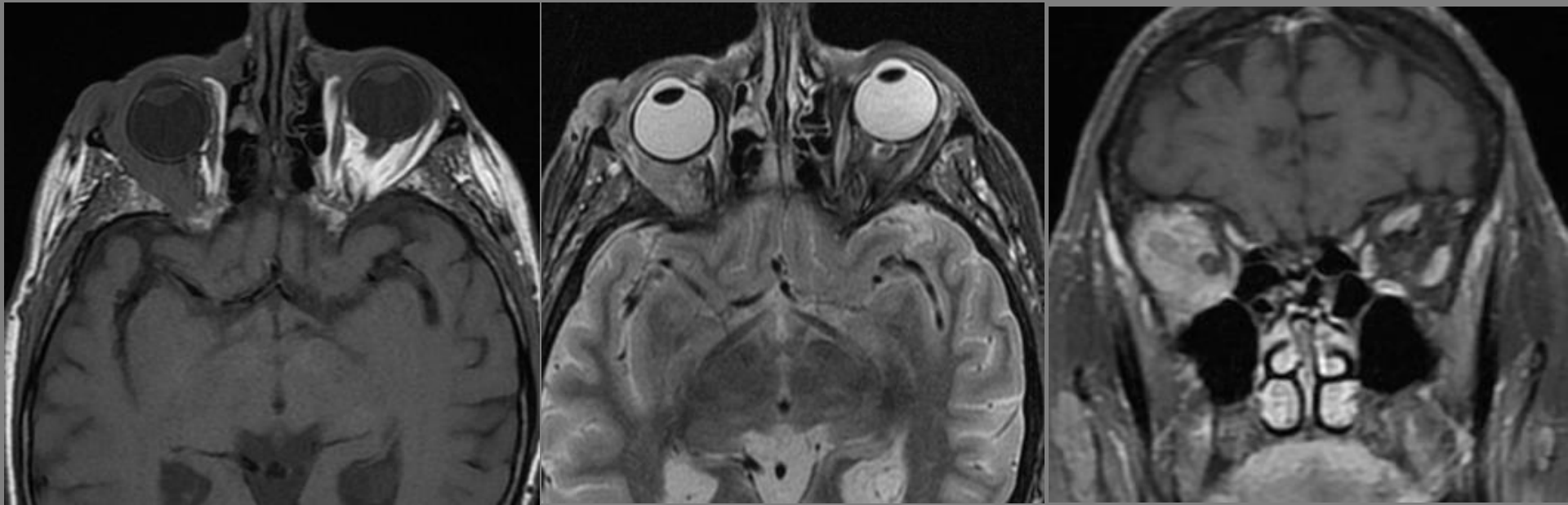
Orbital Sarcoidosis

- Idiopathic systemic disorder characterized by non-caseating granulomas
- Orbital involvement in 80%
- Uveitis most common, followed by lacrimal enlargement
- Uveitis and lacrimal enlargement most common
- Often involves adjacent fissures

Orbital sarcoidosis



Metastatic Disease



- Virtually any primary can metastasize to orbital bone or soft tissue
- Breast ca most common (also lung, melanoma, renal)
- Scirrhous variant of breast ca causes intense desmoplastic reaction and enophthalmos

Pattern 1: EOM Enlargement

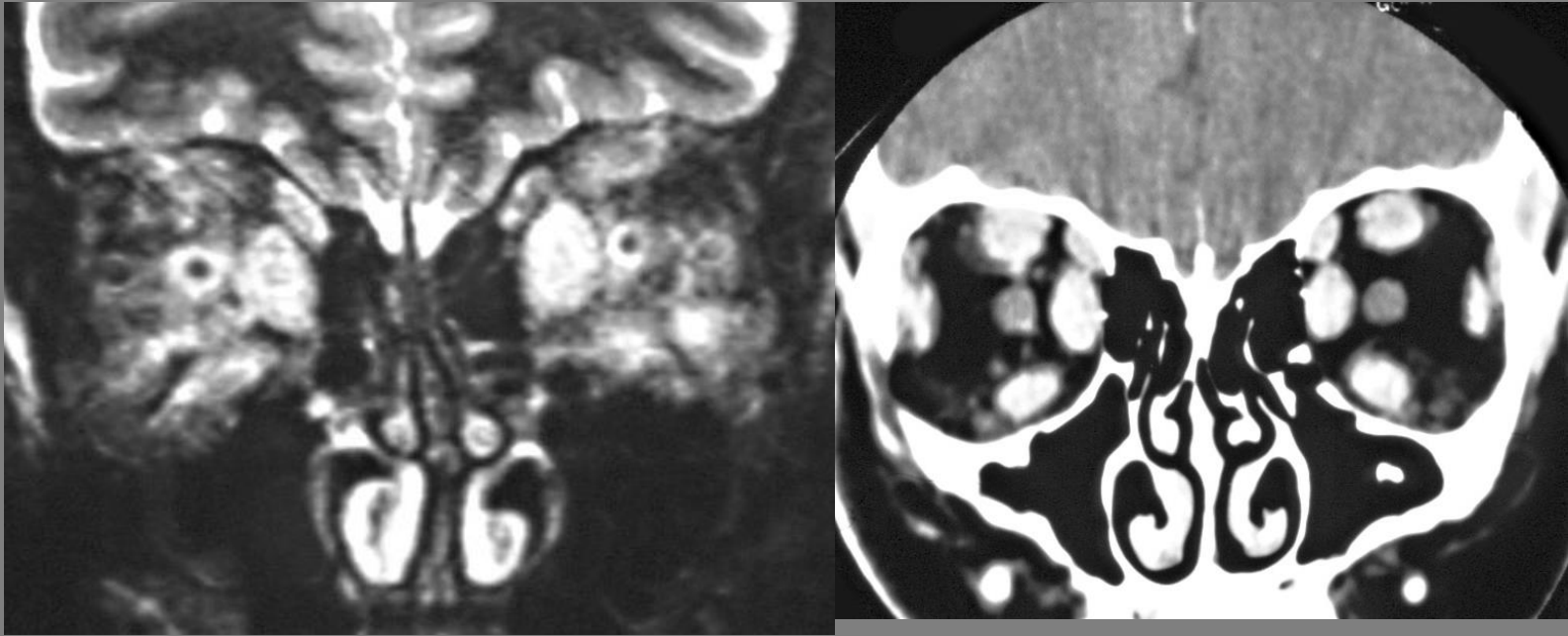
- Thyroid orbitopathy
- Lymphoma
- NSOI
- Sarcoid
- Metastatic disease
- CCF/SOV thrombosis
- Infection

Thyroid Orbitopathy (TO)

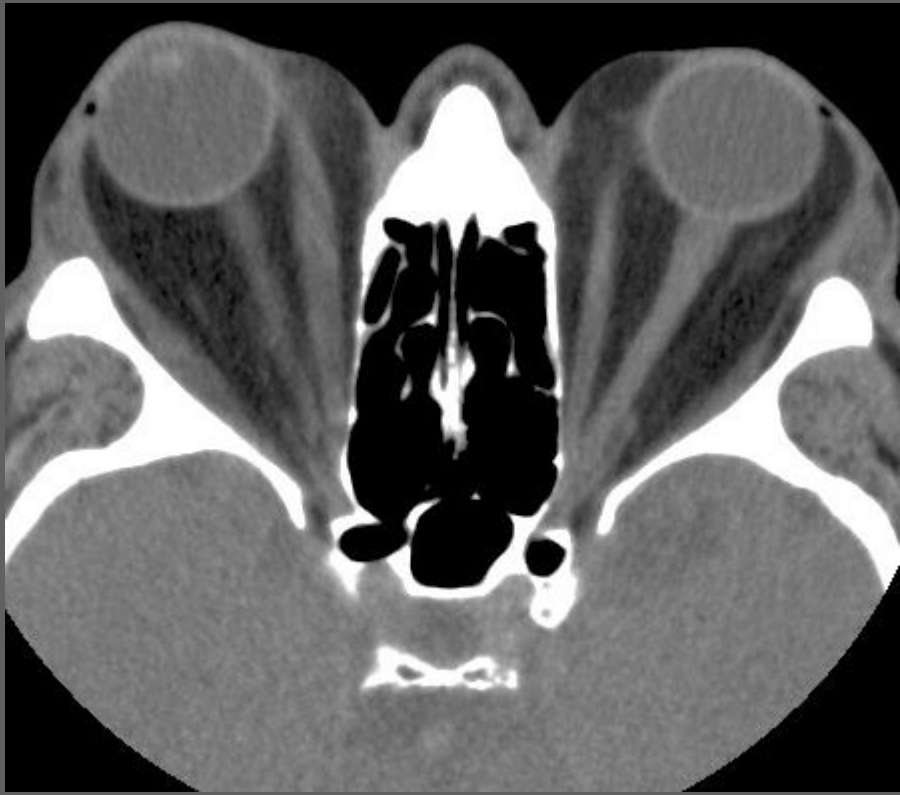
- Most common cause of proptosis in adults
- Autoimmune disorder: Anti thyroid antibodies attack both thyroid **and** orbital ST depositing glycosaminoglycan (GAG)
- Most, but not all, TO patients are hyperthyroid (check thyroid stimulating immunoglobulin [TSI])
- Visual loss secondary to apical compression or extreme proptosis



Thyroid Orbitopathy on CT

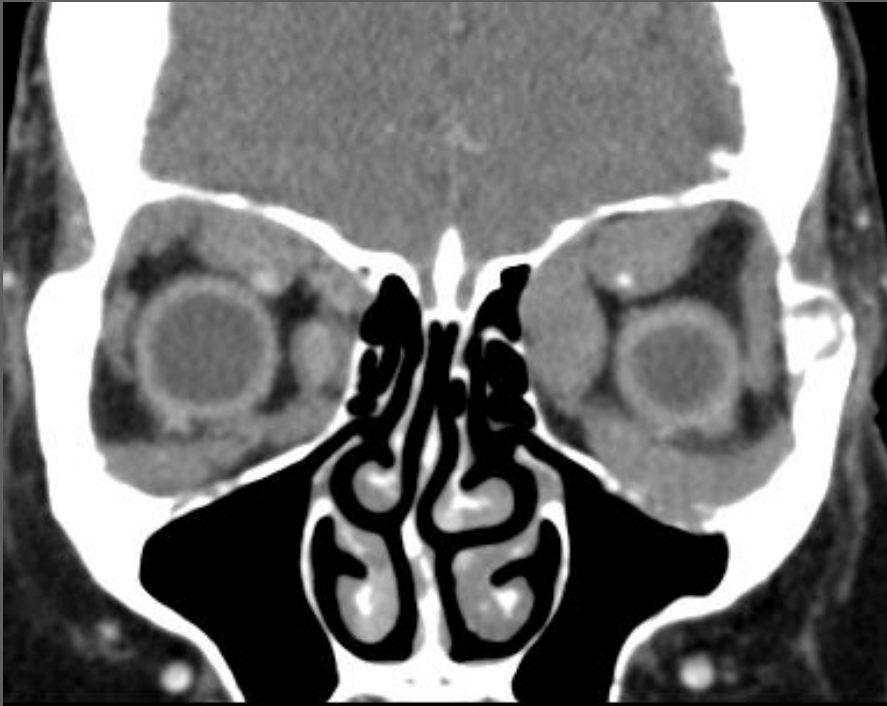


- Enlargement of EOM, expansion of orbital fat
- Multiple >> single EOM affected, “I M S Low”
- Bilateral in 85%
- Fusiform enlargement of muscle belly, sparing tendinous insertions

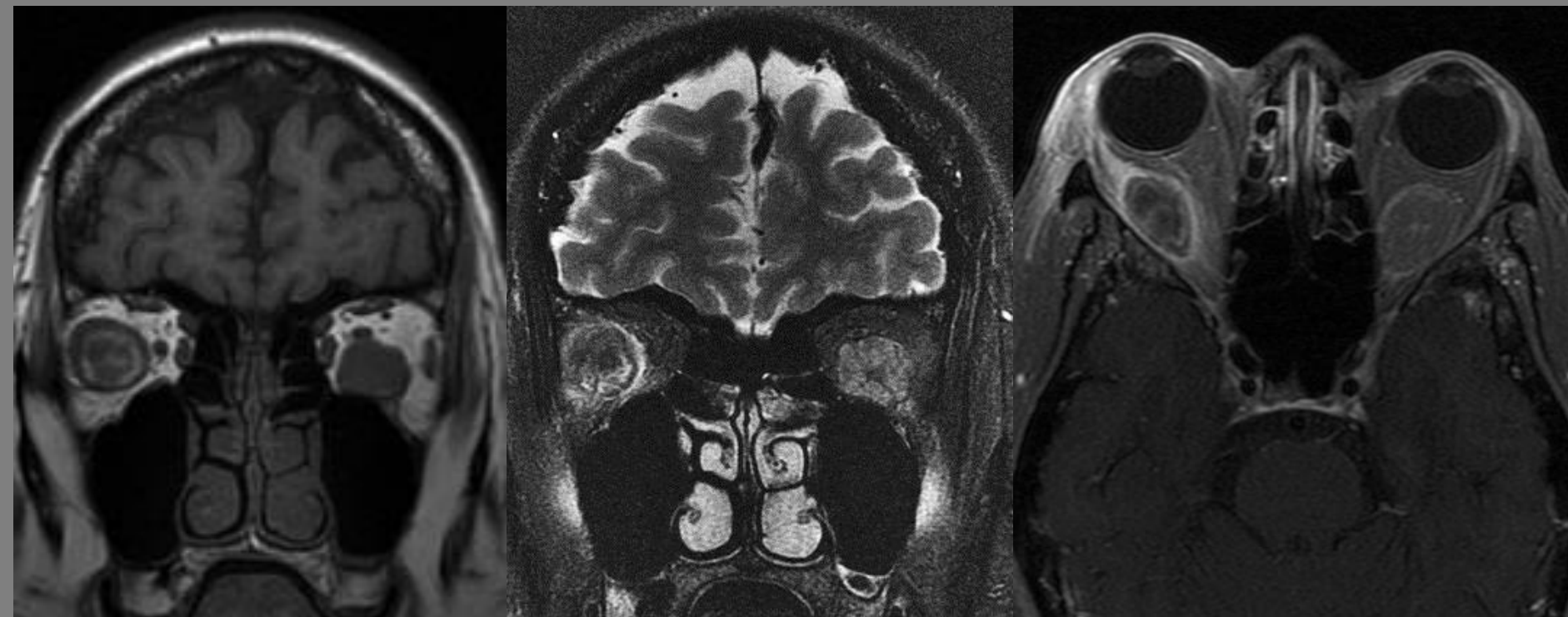


- Expansion of fat from deposition of GAG
- High muscle T2 signal- inflammation, responsive to steroids.

Sarcoidosis



45F with R proptosis



Metastatic Carcinoid Tumor
(breast, lung, melanoma)

Pattern 2: Orbital Infiltrative Processes

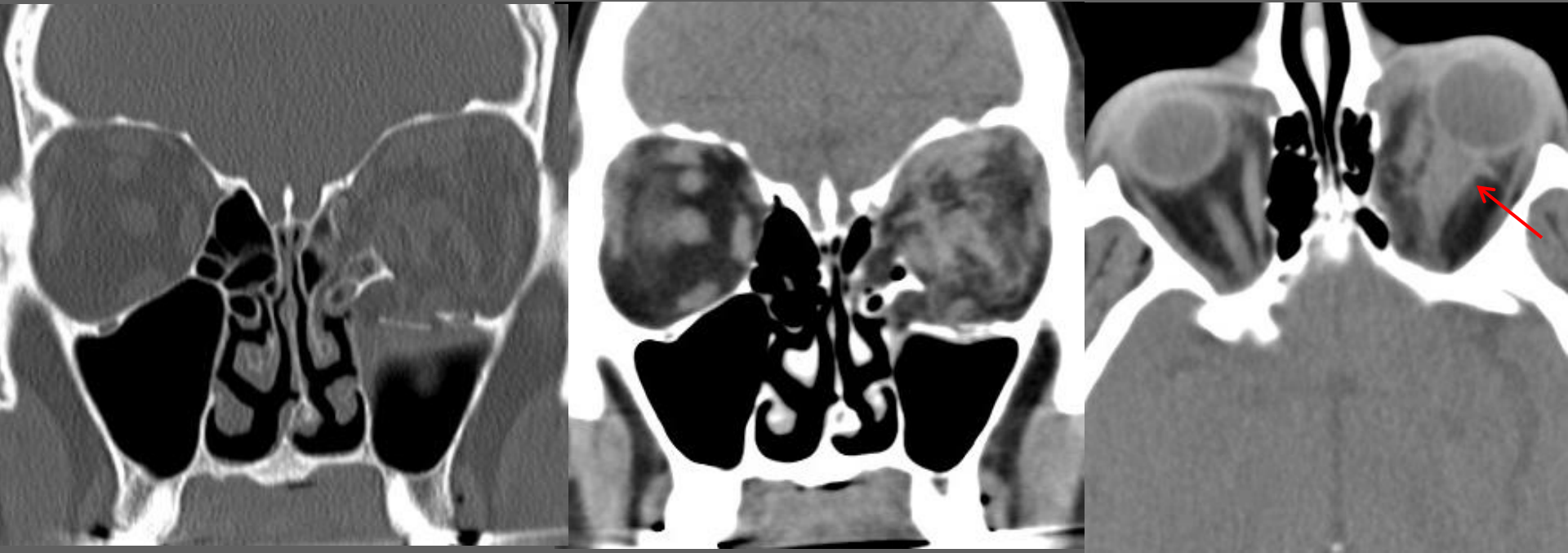
- Infection
- Lymphoma
- Pseudotumor
- Sarcoid
- Metastatic disease
- Hemorrhage
- Wegener/GPA
- IgG4
- CCF/SOV thrombosis
- Thyroid orbitopathy

Orbital Cellulitis



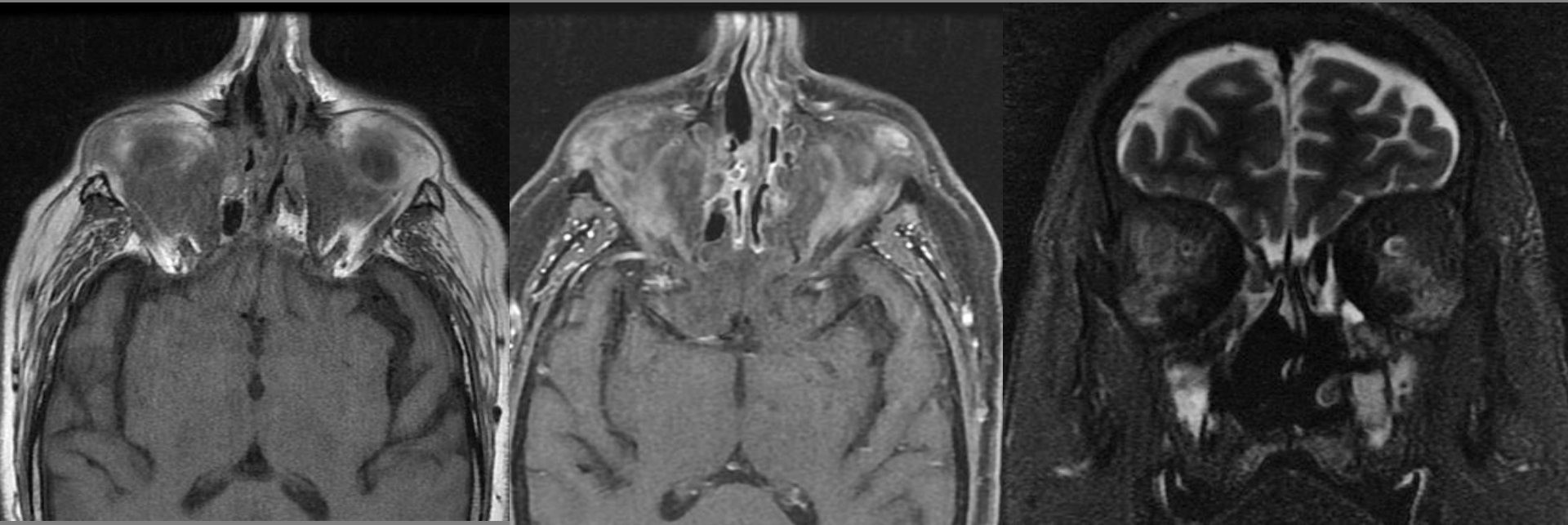
- Accounts for 60% of orbital disease processes
- PNS (ethmoid) or skin (trauma, insect bites) origin
- Map pre/post-septal, intra/extraconal

Orbital Hemorrhage



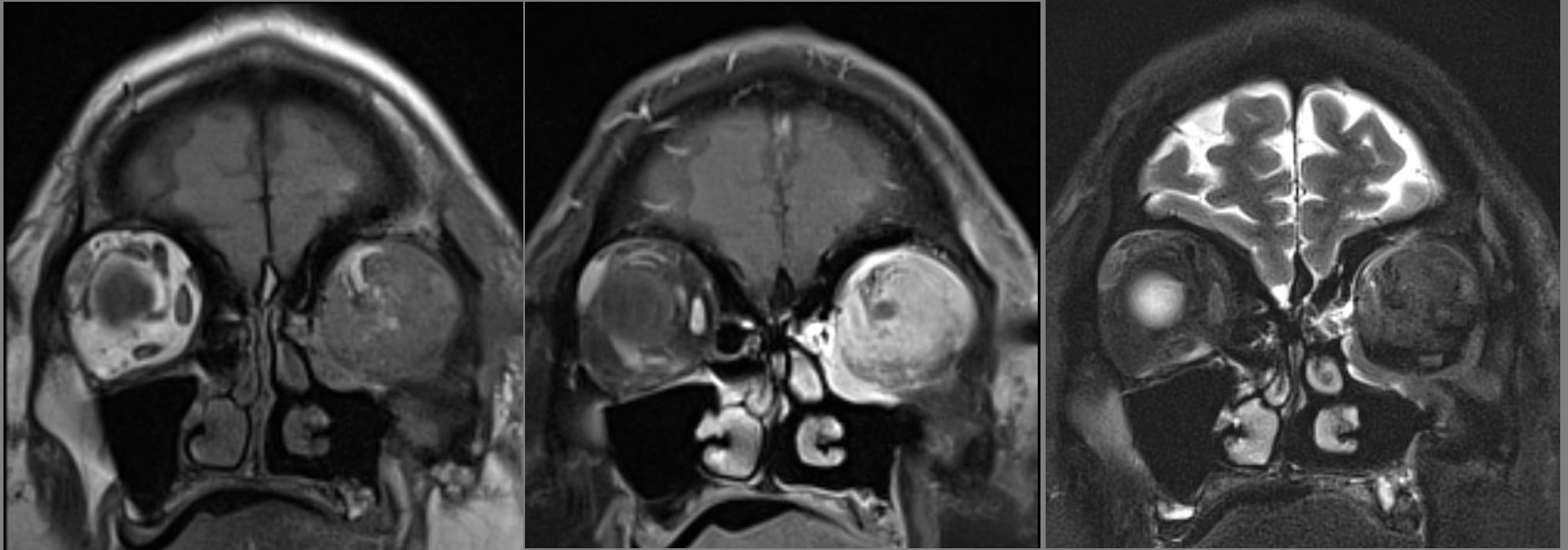
- Retrobulbar hemorrhage of more immediate concern than fractures
- Rarely see discrete hematoma
- Look for widening of optic nerve sheath

Granulomatosis with Polyangitis (Wegener Granulomatosis)



- Granulomatous vasculitis affecting orbits, PNS, salivary glands, lymph nodes
- Look for concurrent severe sinusitis (also **sarcoid**)

IgG4 Disease

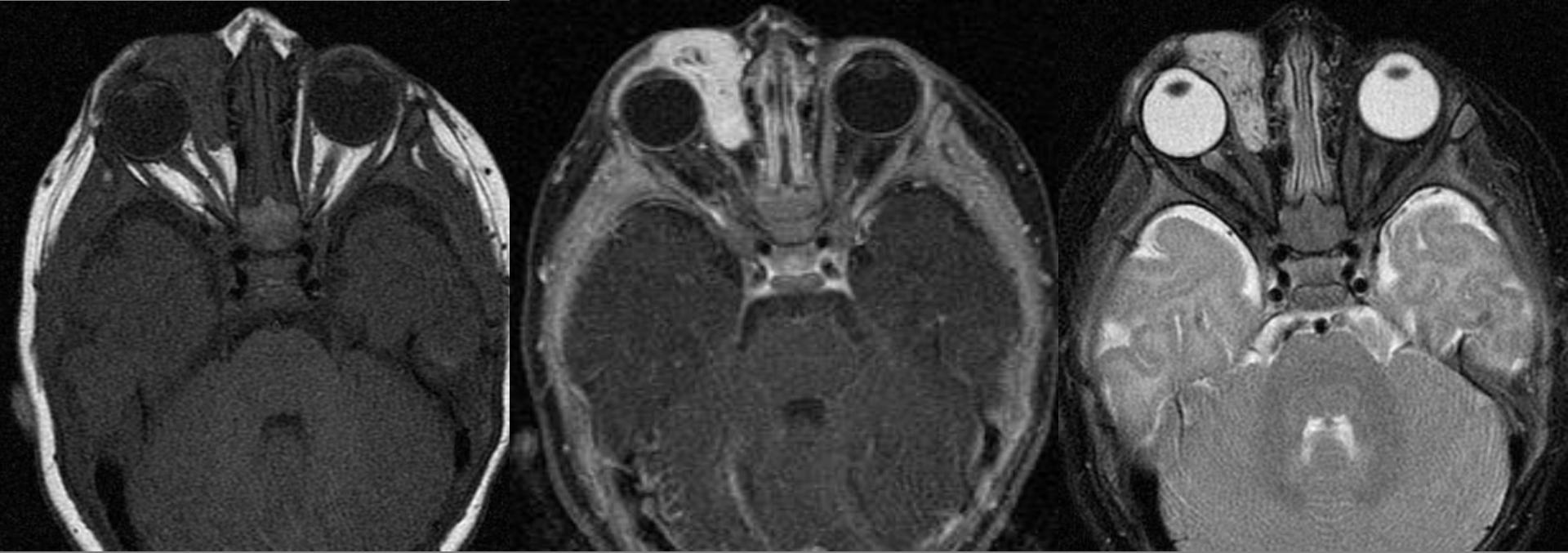


- Immune mediated disorder with ↑ tissue and serum IgG4
- H&N: orbits and salivary glands
- Diffuse swelling/infiltration
- Avid enhancement, **very low T2 signal**

Pattern 3: Discrete Orbital Mass

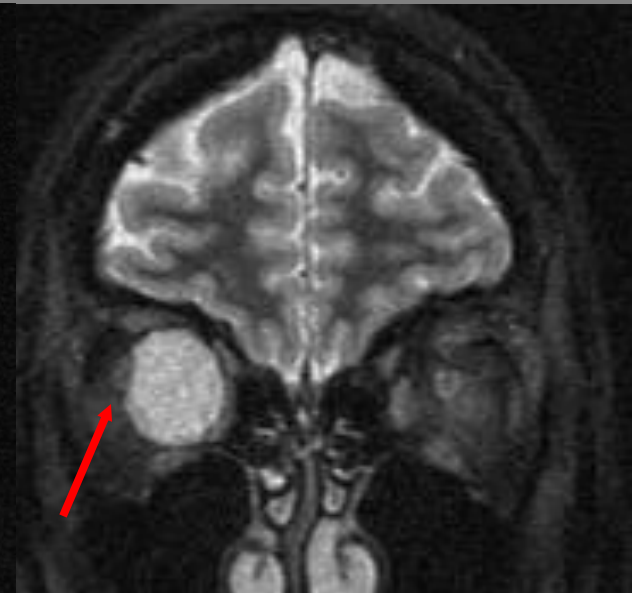
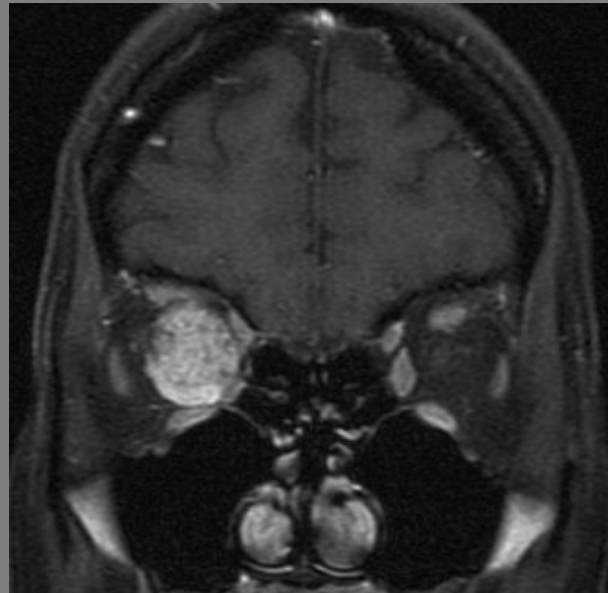
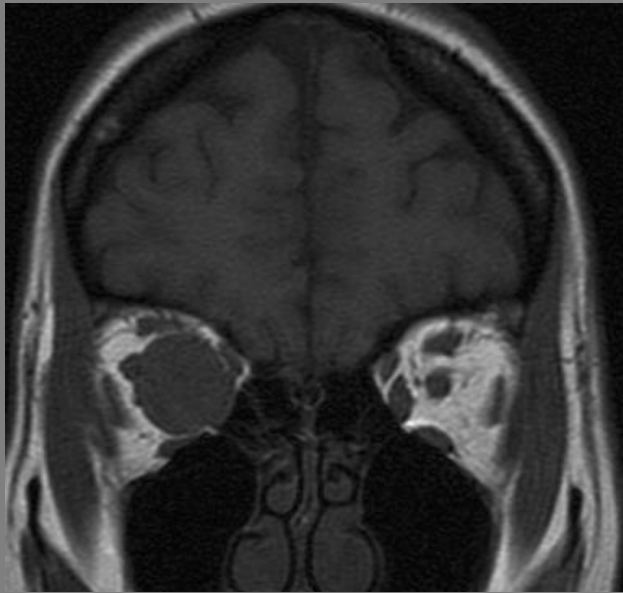
- Vasoformative lesions
- Lymphoma
- Metastatic disease
- NSOI
- Sarcoid
- Rhabdomyosarcoma
- Dermoid
- Neural tumors
- SCC or BCC extension

Infantile Hemangioma



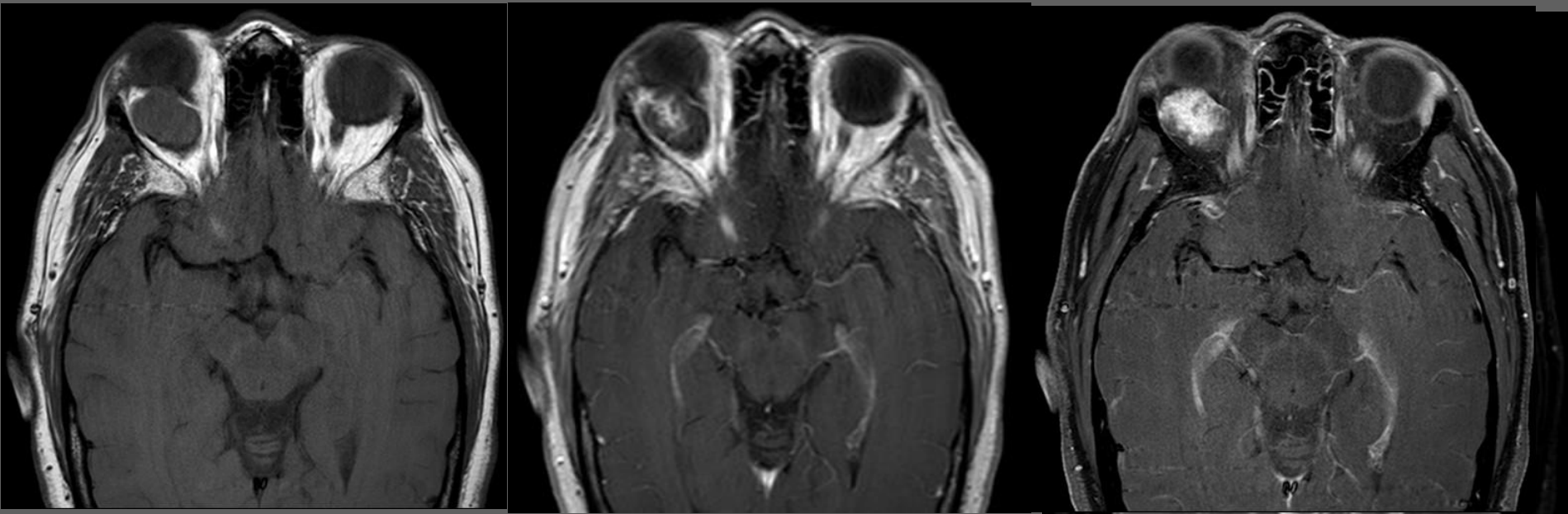
- Vascular **tumor** of **infancy**
- Hypervascular with internal **flow voids** and large feeding/draining vessels, prominent enhancement
- Moderate T2 hyperintensity because cellular neoplasm

Venous (Cavernous) Malformation



- Previously “cavernous hemangioma”
- Vascular **malformation** represents most common orbital mass in **adults**
- Malformed venous channels with sluggish flow
- Soft lesion with prominent enhancement, ↑↑ T2 SI

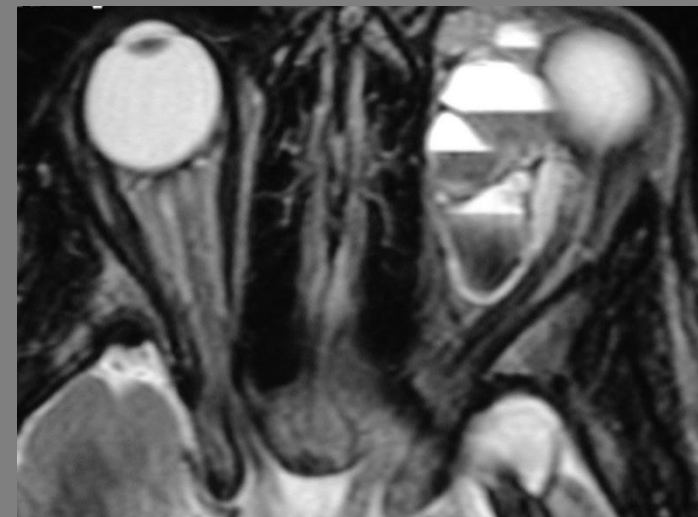
Venous Malformation



Early patchy enhancement fills in on
delayed scans

Lymphatic Malformation

- Previously lymphangioma, cystic hygroma
- Vascular **malformation** with dilated lymphatic channels and cysts
- Peripheral or no enhancement
- Soft, deformable
- **Hemorrhage** causing acute proptosis is common



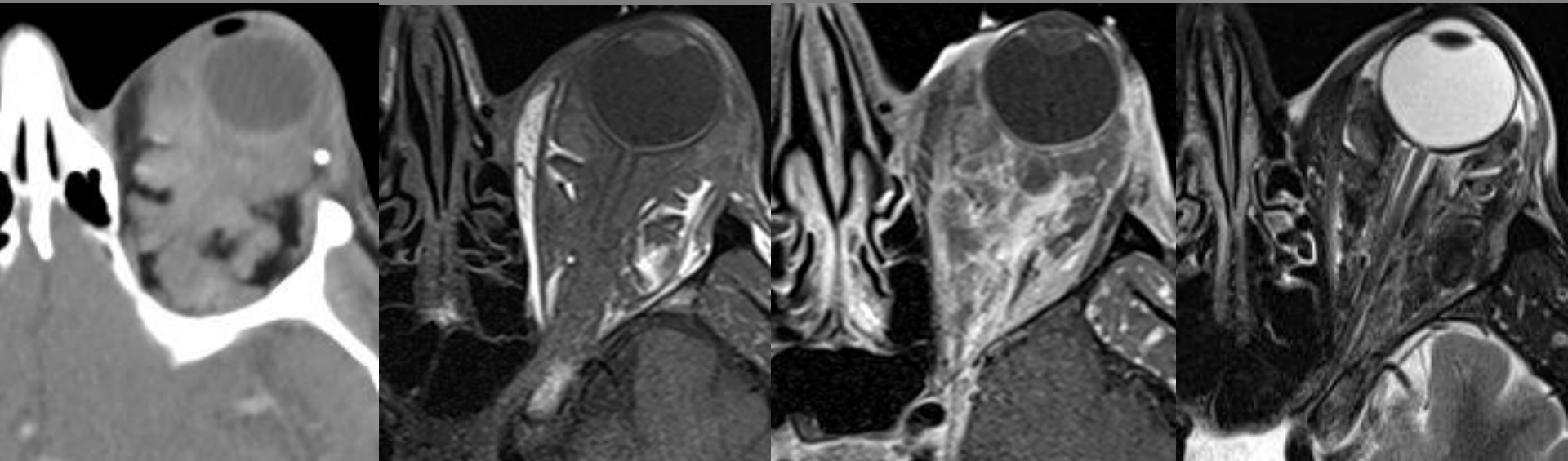
Lymphatic Malformation



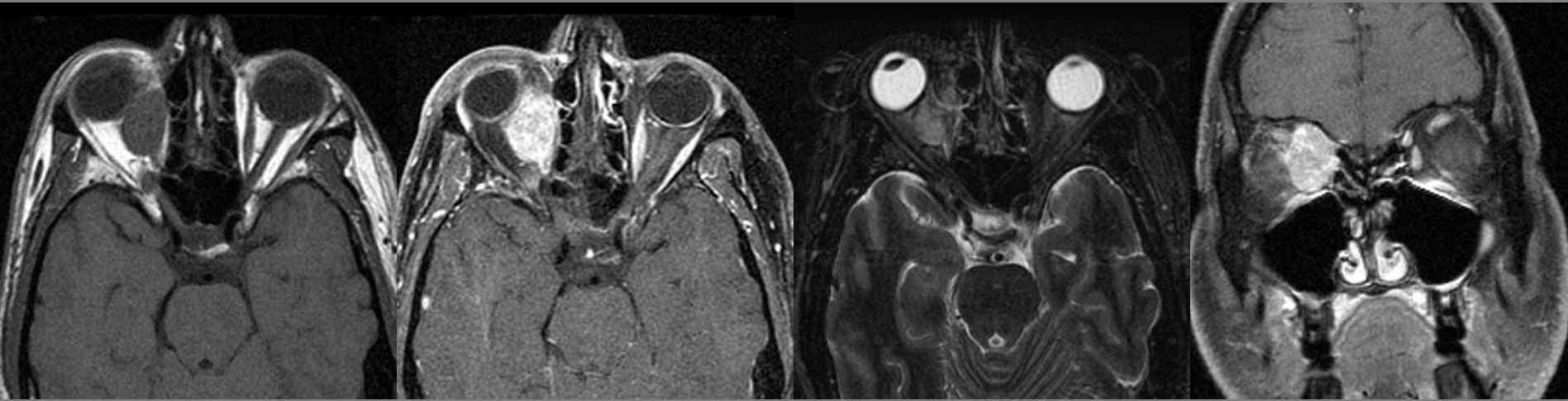
- Classic presentation: acute onset of painless proptosis
- Look for **hemorrhagic fluid levels**

Venolymphatic Malformation

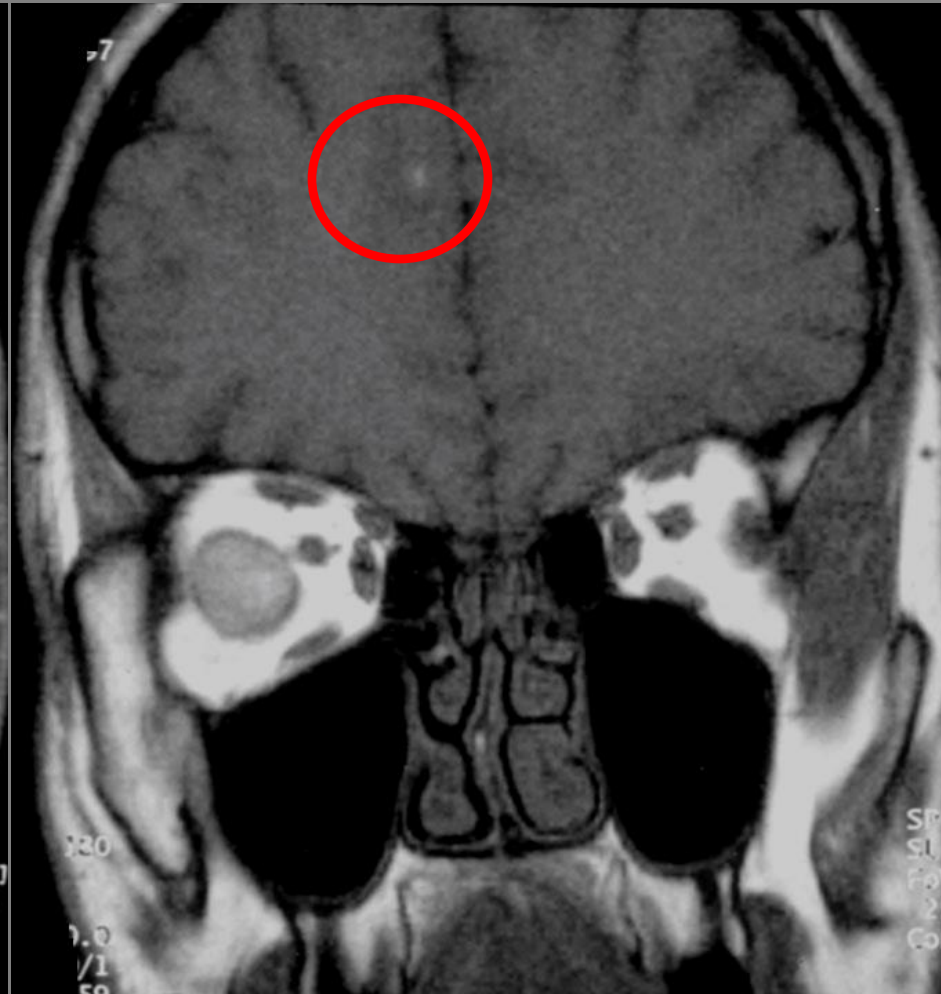
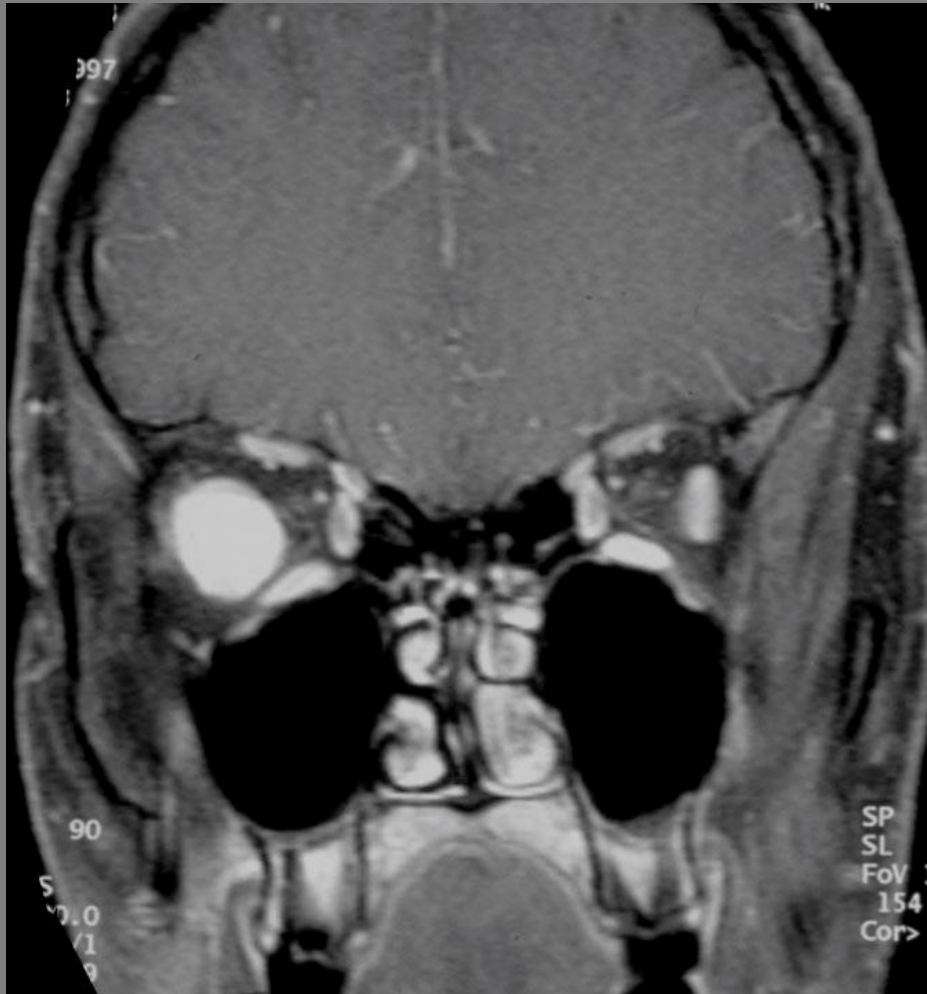
- Venous and lymphatic malformation
- Possible solid enhancement
- Soft, deformable, **phleboliths**
- **Hemorrhage** causing acute proptosis is common



Rhabdomyosarcoma



- Most common ST malignancy in children
- 10% occur in orbit
- Non-specific imaging features
- Rapidly growing soft tissue mass with bone destruction in a **child/young adult**

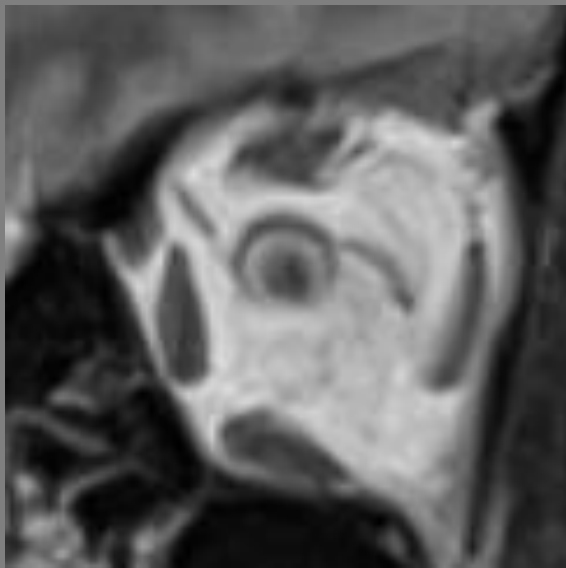


Metastatic melanoma

Pattern 4: Enlargement of the Optic nerve/Sheath Complex

Intrinsic to nerve

- Optic glioma
- Optic neuritis
(incl. sarcoid)

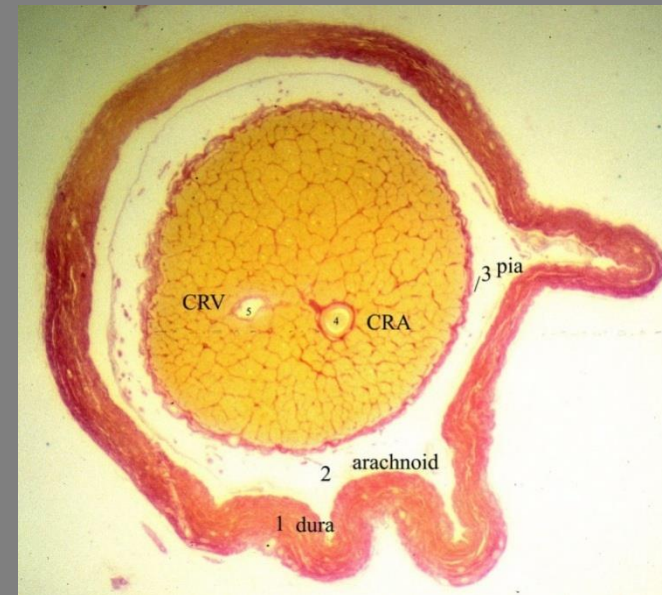


Extrinsic to nerve

- Perioptic meningioma
- Perioptic neuritis
 - NSOI
 - Sarcoid
 - Lymphoma
 - Mets

CN 2: Optic Nerve

- Outpouching of diencephalon
- **BRAIN, not nerve!**
- Lined by pia/arachnoid/dura;
NOT schwann cells
- Gliomas/meningiomas, **NOT**
schwannomas/neurofibromas
- Demyelinating/ischemic white
matter diseases

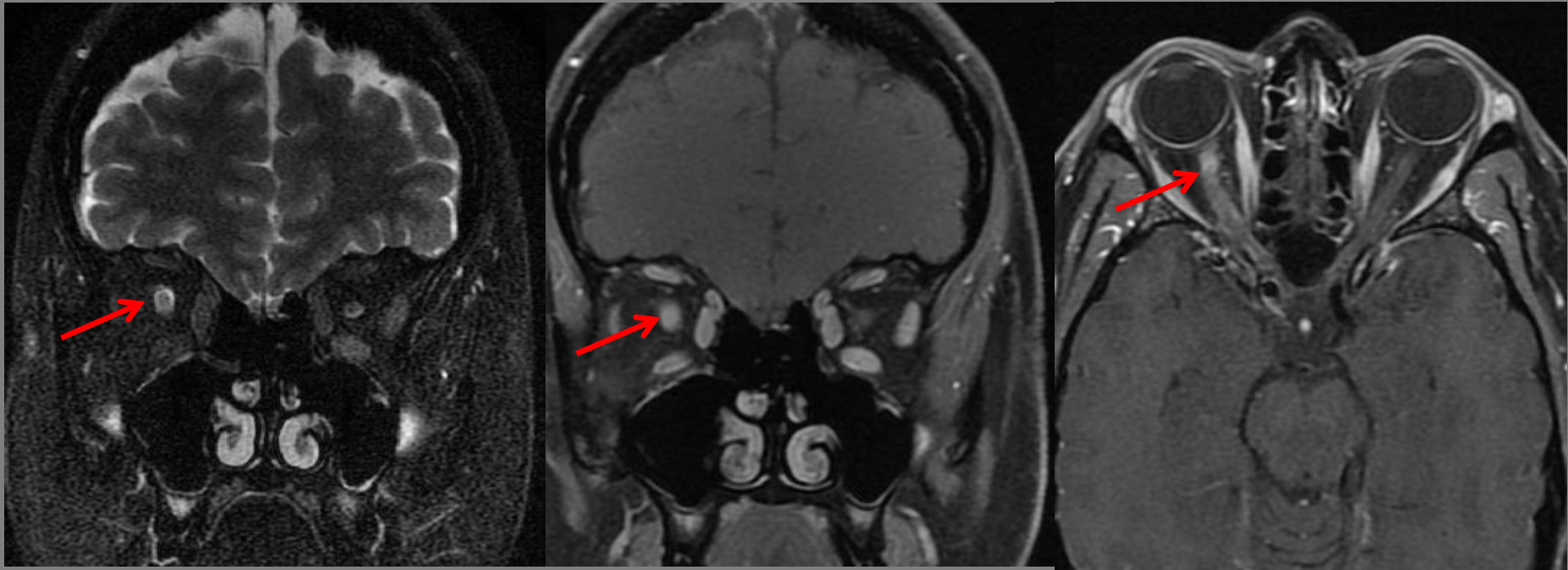


Optic Pathway Glioma (OPG)



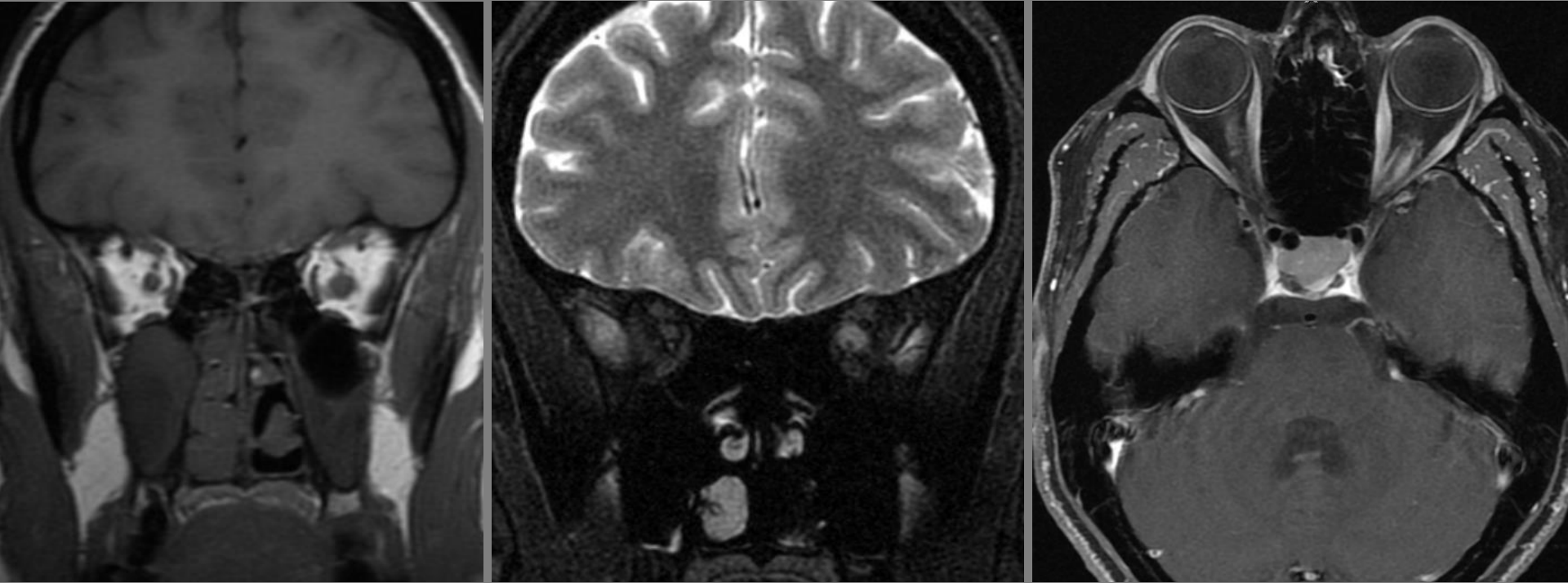
- 3 Forms: childhood syndromic (NF), childhood sporadic, adult
- Childhood OPG: pilocytic astrocytoma
- Adult OPG: high grade glioma
- Variable enhancement

Optic Neuritis



- Any inflammation of optic nerve
- Most cases associated with MS
- Enhancement, T2 hyperintensity, mild swelling
- Also: viral neuritis, neuromyelitis optica, sarcoid, radiation

Meningioma



- AKA optic nerve sheath meningioma
- Smooth **perioptic** enhancement
- “Tram-track” enhancement, calcification

Perioptic “Neuritis”



- Many entities, including **pseudotumor, lymphoma, sarcoid, mets**
- Irregular, nodular, fuzzy **perioptic** enhancement
- Often abnormal signal adjacent retrobulbar fat

Pattern 5: Lacrimal Enlargement

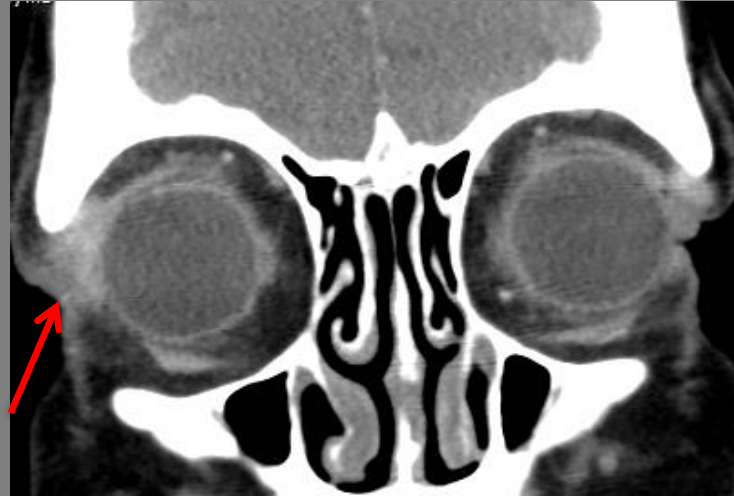
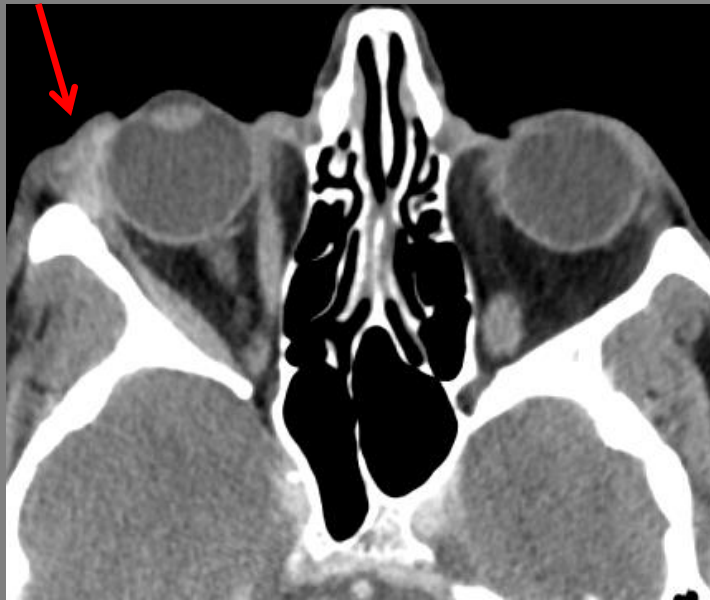
Unilateral

- Acute dacryoadenitis
- Benign/malignant epithelial tumor
- NSOI
- Metastatic disease
- Lymphoma

Bilateral

- Chronic dacryoadenitis:
 - Sarcoid
 - GPA/Wegener
 - Sjögren syndrome
 - Thyroid orbitopathy
- Lymphoma

Dacryoadenitis



- Inflammation with enlargement/enhancement
- **Acute:** bacterial (staph, GC), viral, pseudotumor, (unilat > bilat)
- **Chronic:** non-infectious inflammatory (sarcoid, GPA, thyroid orbitopathy, Sjogren) (bilat > unilat)

Lacrimal Tumors

- “Compound gland”: salivary & lymphoid elements
- Tumors: epithelial (salivary) or lymphoproliferative
- **Benign**: e.g. benign mixed tumor (pleomorphic adenoma) **BONE REMODELING**
- **Malignant**: e.g. adenoid cystic ca, mucoepidermoid ca **BONE DESTRUCTION**

Benign mixed tumor

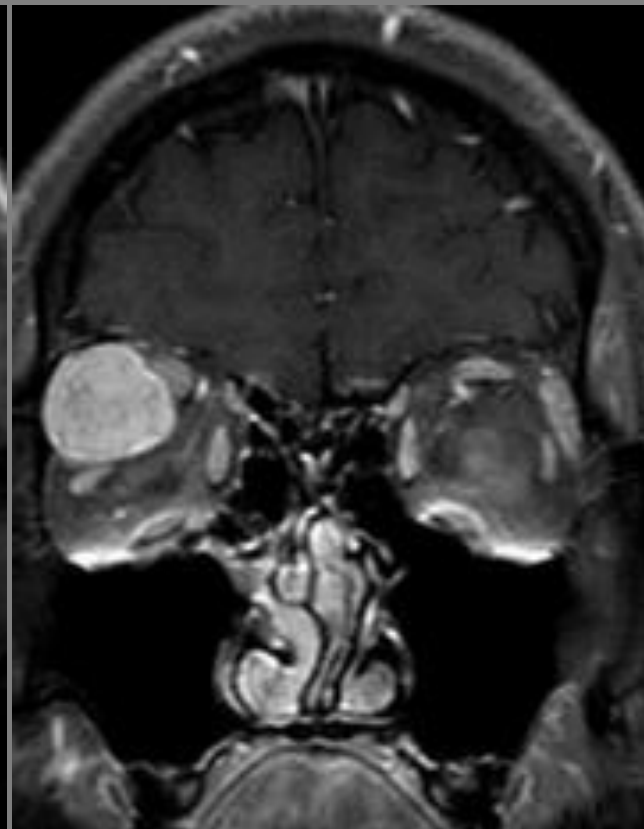
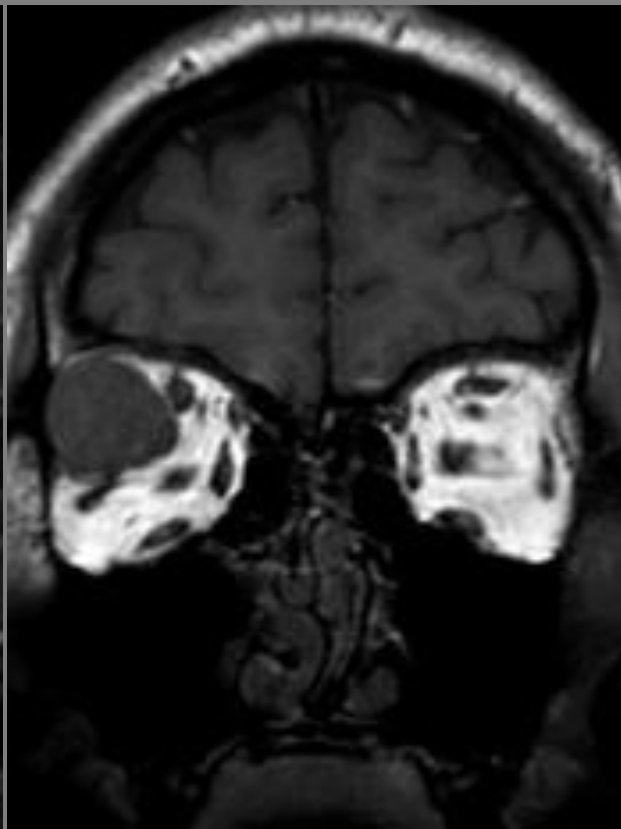
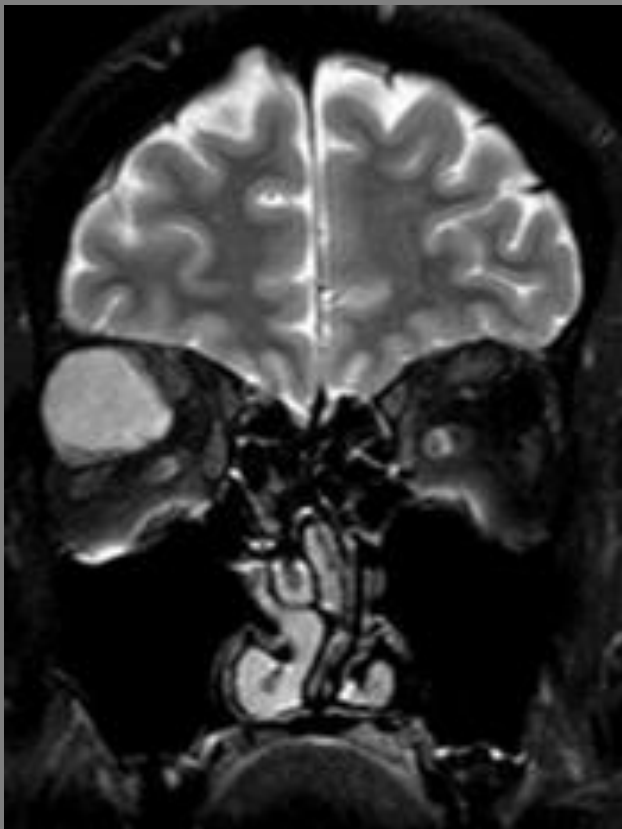


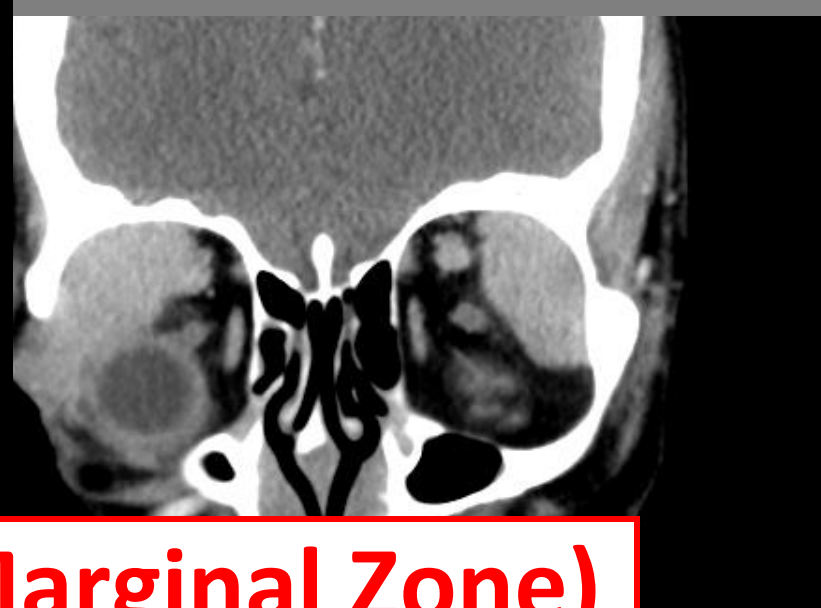
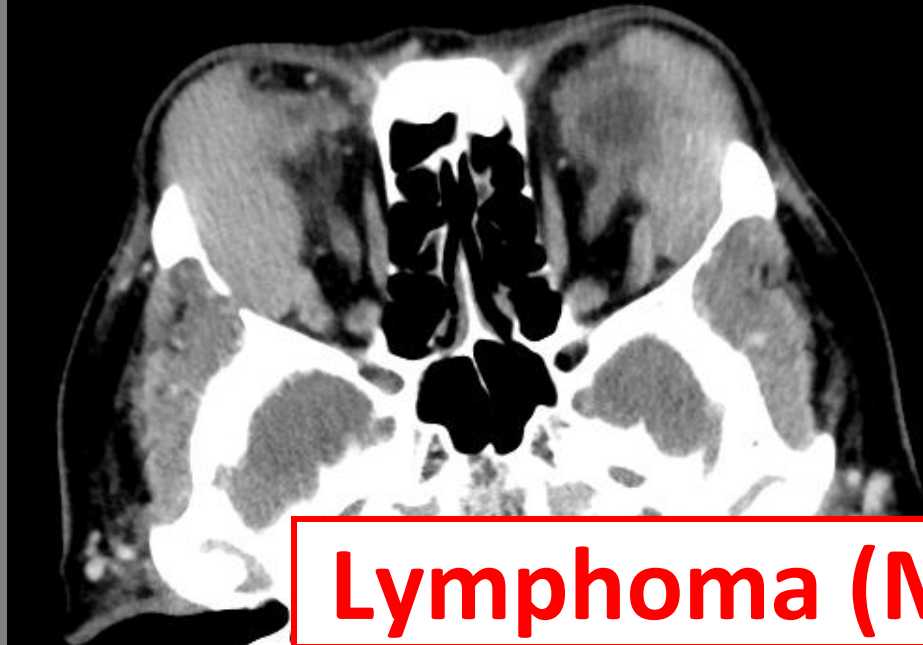
Lacrimal Adenoid Cystic Ca



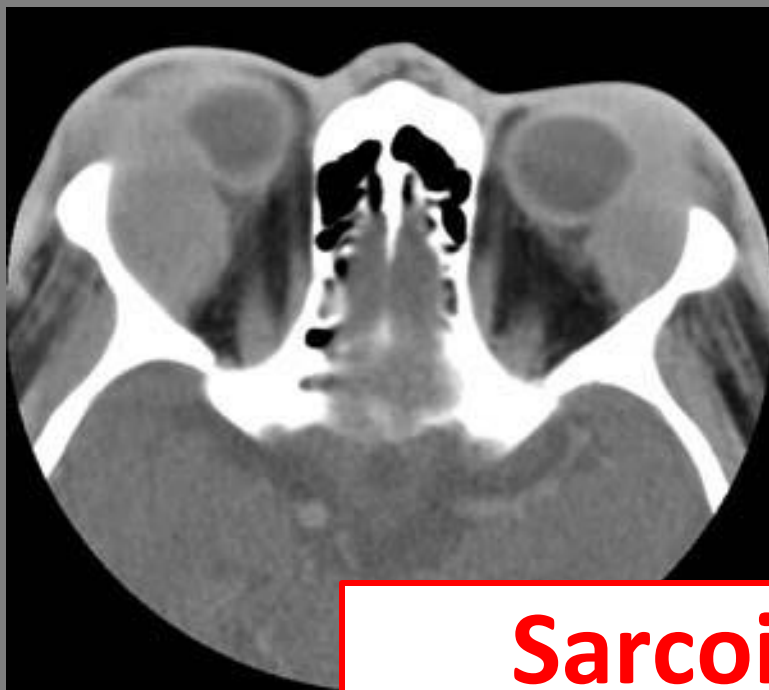
Bone destruction heralds malignant disease

Lacrimal Benign Mixed Tumor





Lymphoma (Marginal Zone)



Sarcoidosis

Pattern 6: Bony Orbital Lesion

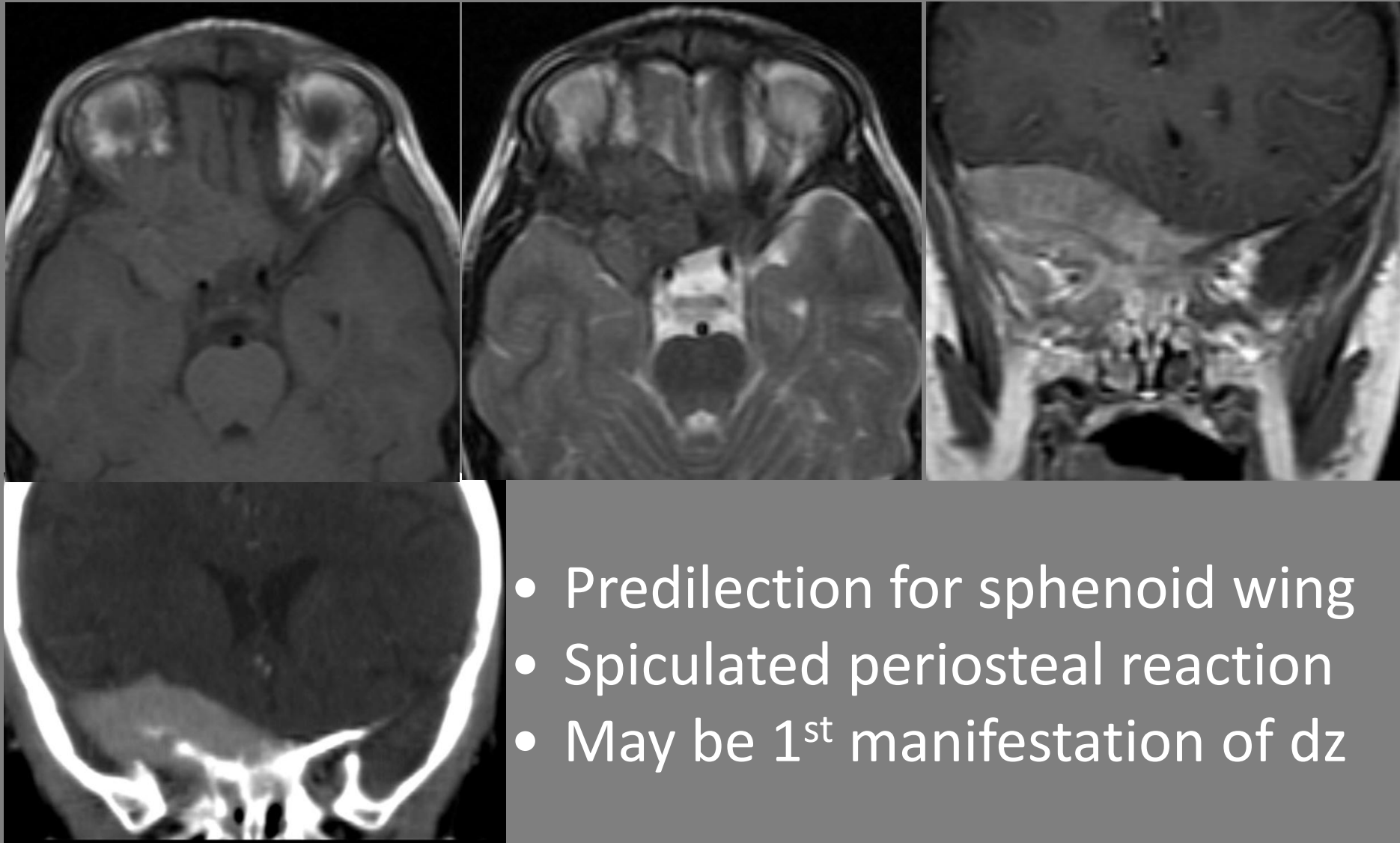
Child

- Metastatic disease (neuroblastoma)
- Leukemia/lymphoma
- Rhabdomyosarcoma
- LCH
- Fibro-osseous lesion
- Expansile PNS process

Adult

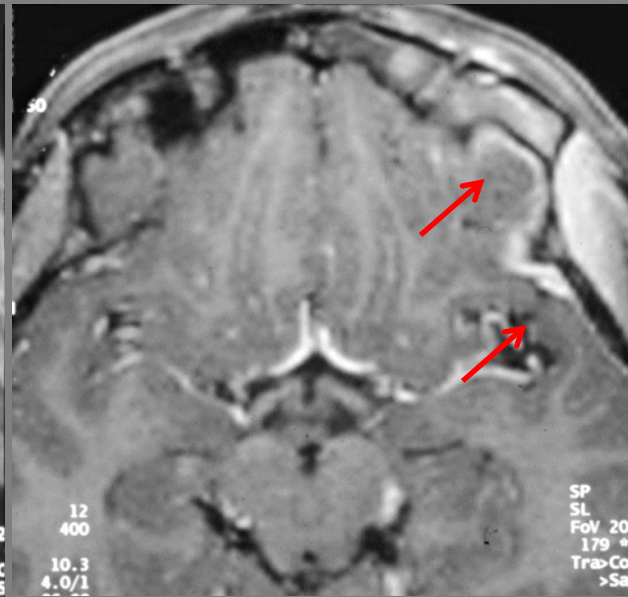
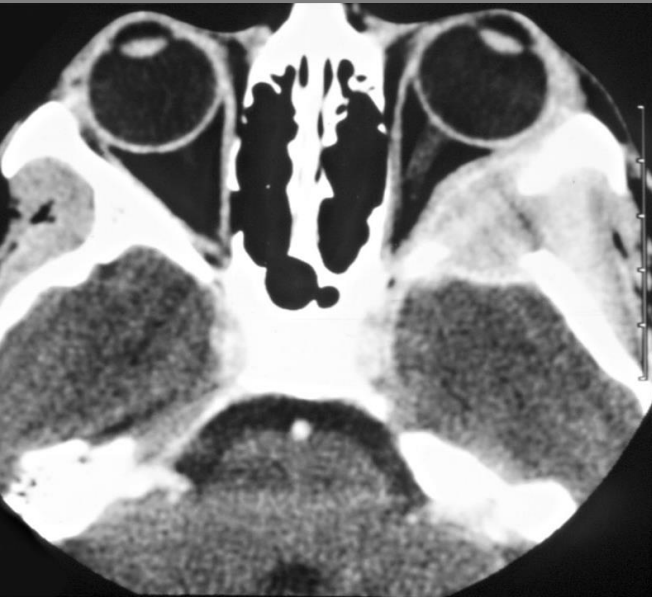
- Metastatic disease
- Lymphoma/myeloma
- Meningioma
- Fibro-osseous lesion
- Expansile PNS process

Metastatic Neuroblastoma



- Predilection for sphenoid wing
- Spiculated periosteal reaction
- May be 1st manifestation of dz

Langerhans Cell Histiocytosis



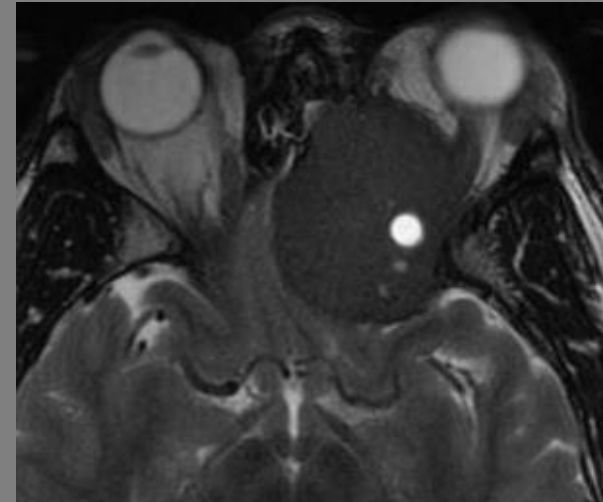
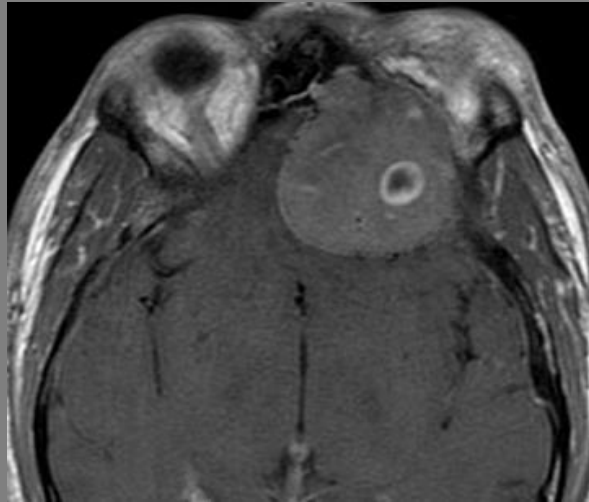
- Idiopathic reticuloendothelial disorder
- Isolated form: **eosinophilic granuloma**
- ST mass with lytic bone destruction in young patients (DDX: rhabdo, met)

57F with slowly progressive proptosis



Sphenoid wing meningioma

Fibrous Dysplasia

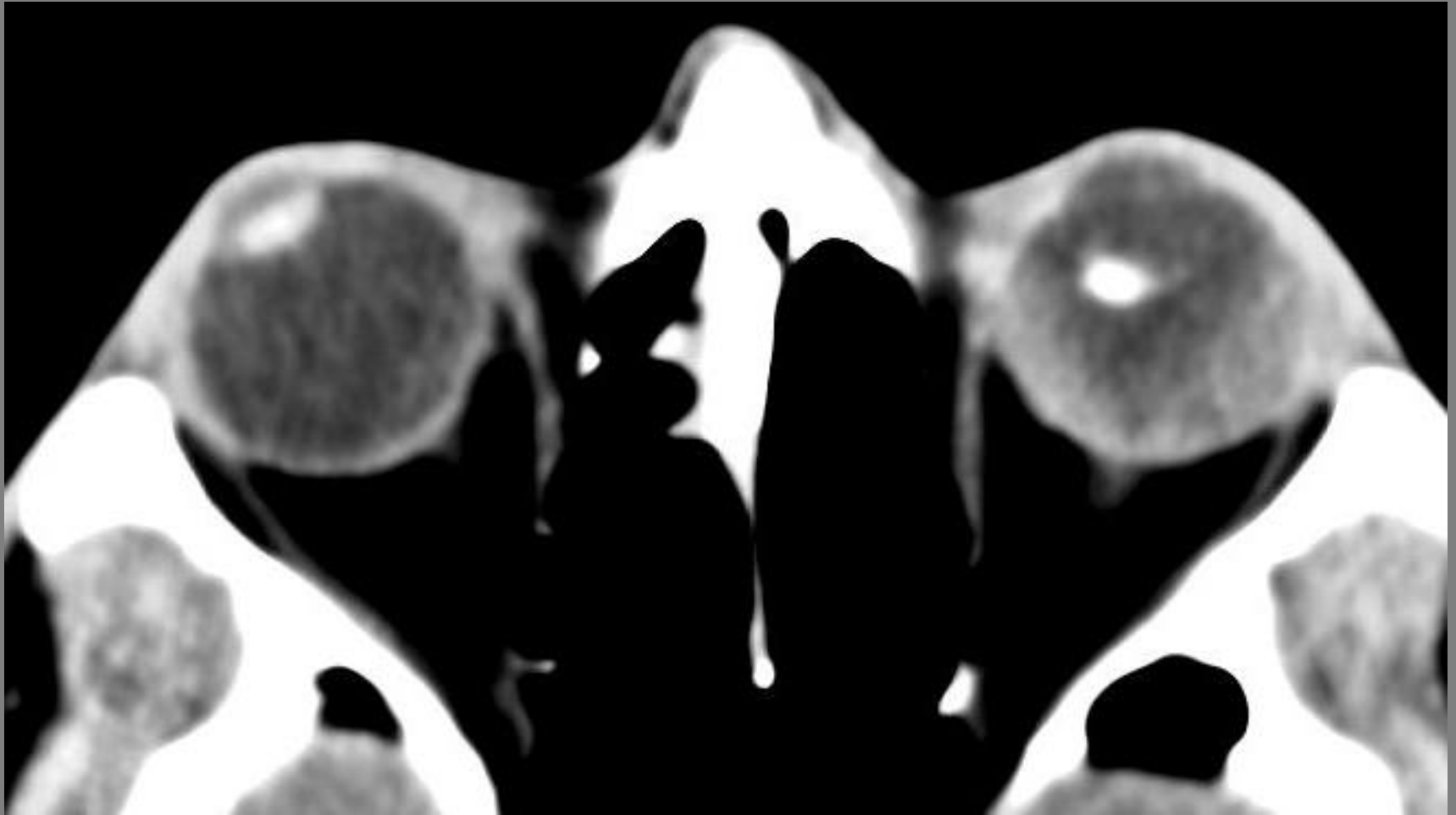


- Benign fibro-osseous disease of the young
- CT: ground glass, cystic, sclerotic
- MR: Enhancement and **T2 hypointensity**

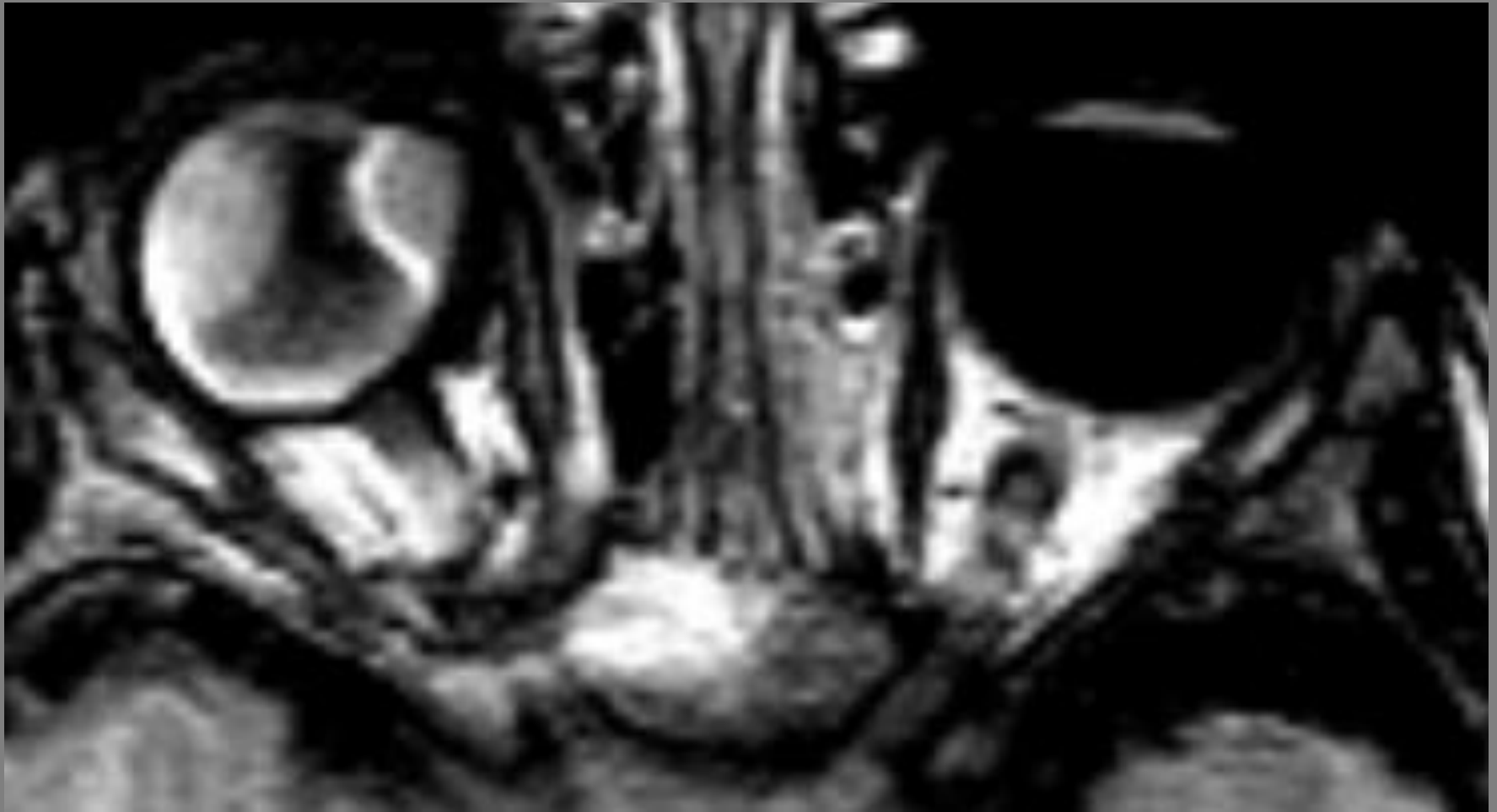
57M bus driver with diplopia



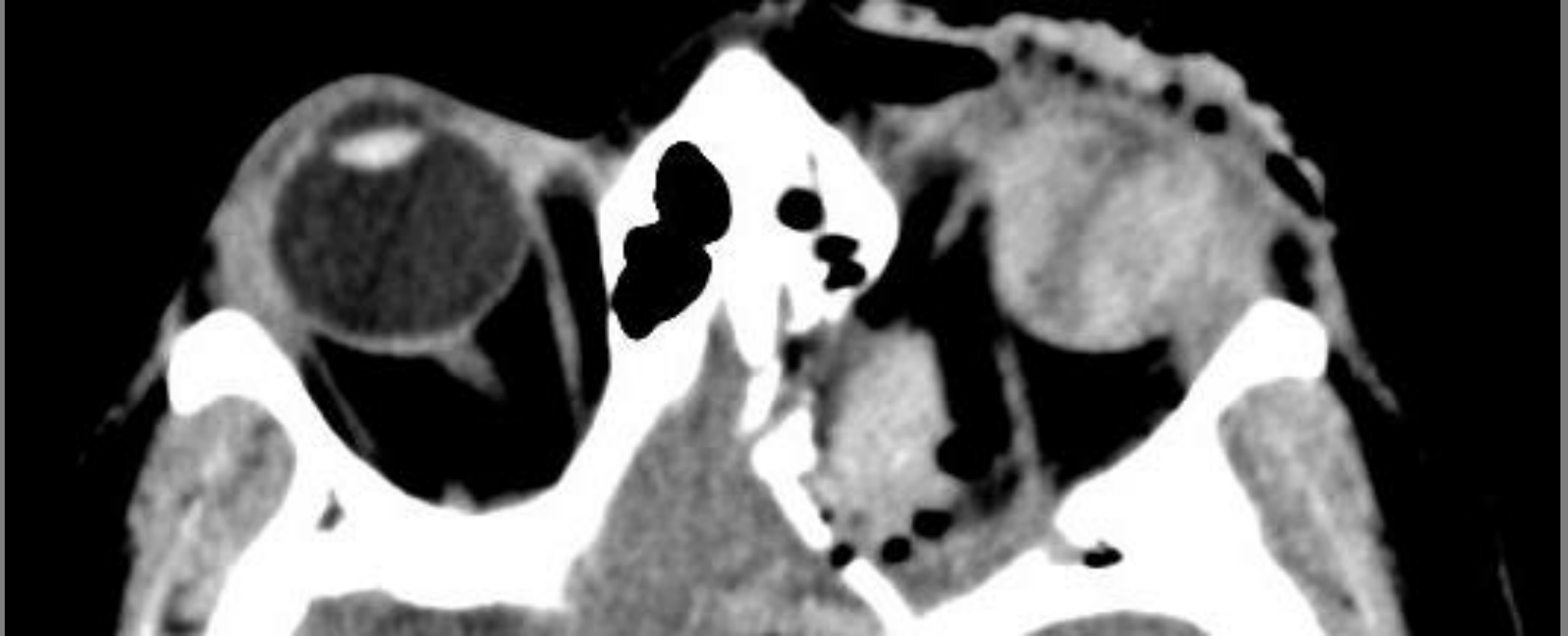
Frontal Mucoceles



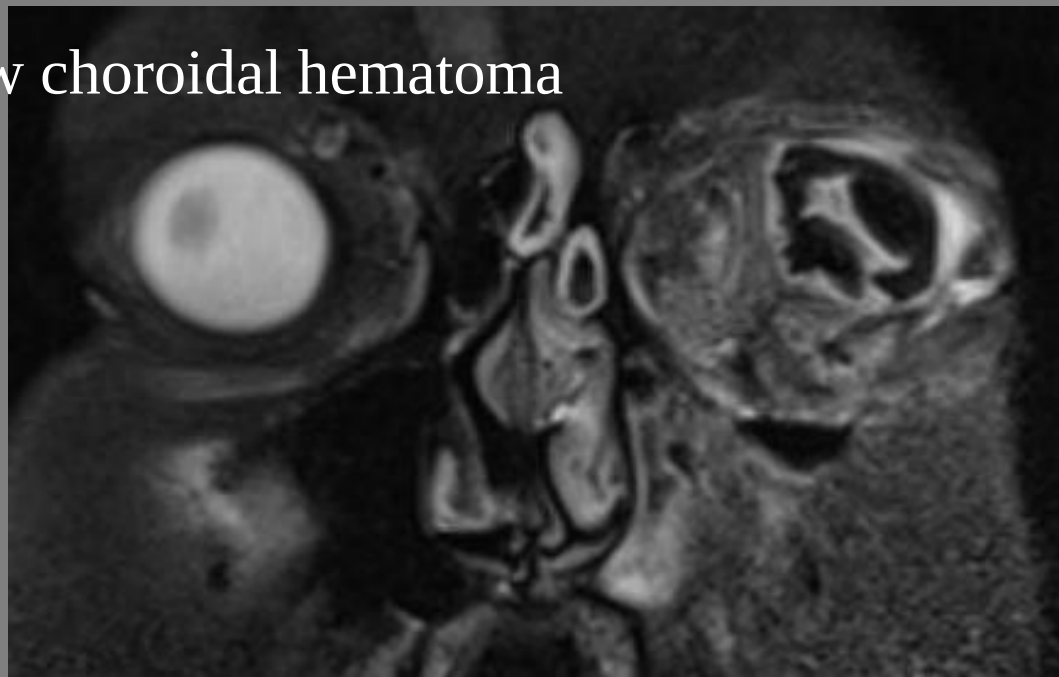
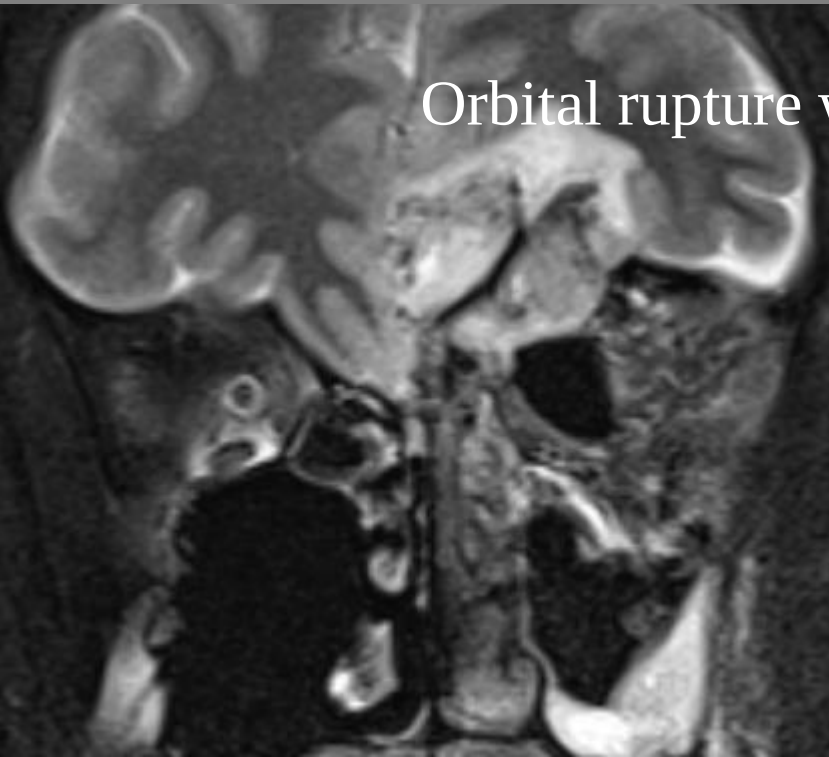
Retinal detachment with lens dislocation

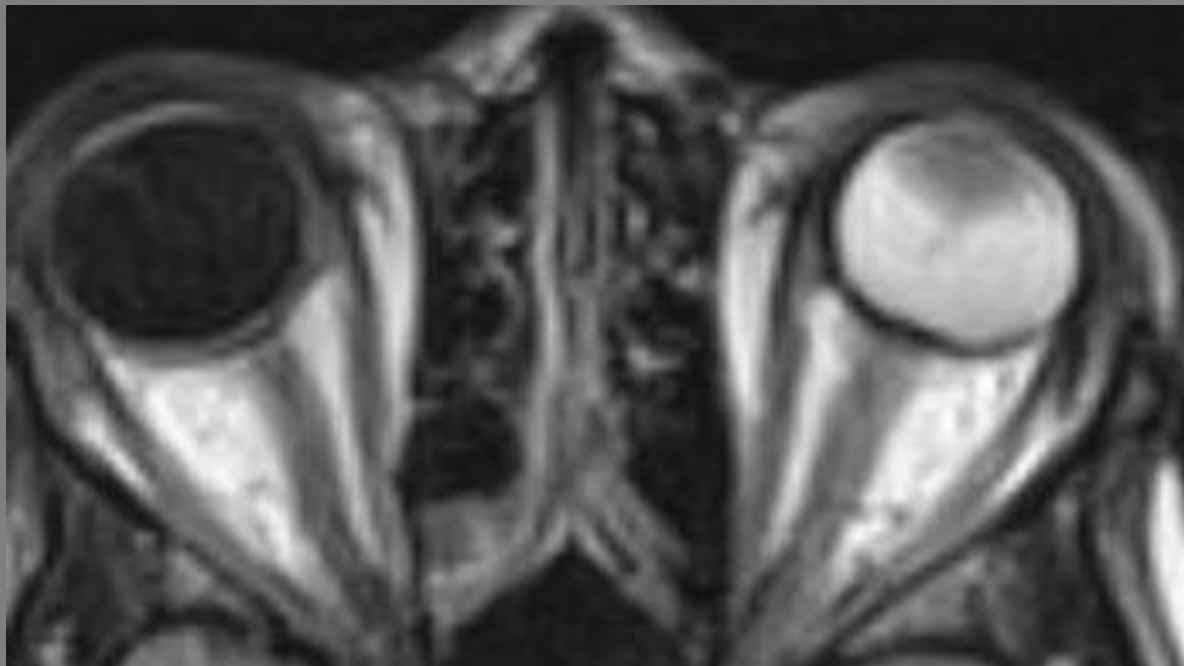


Choroidal detachment

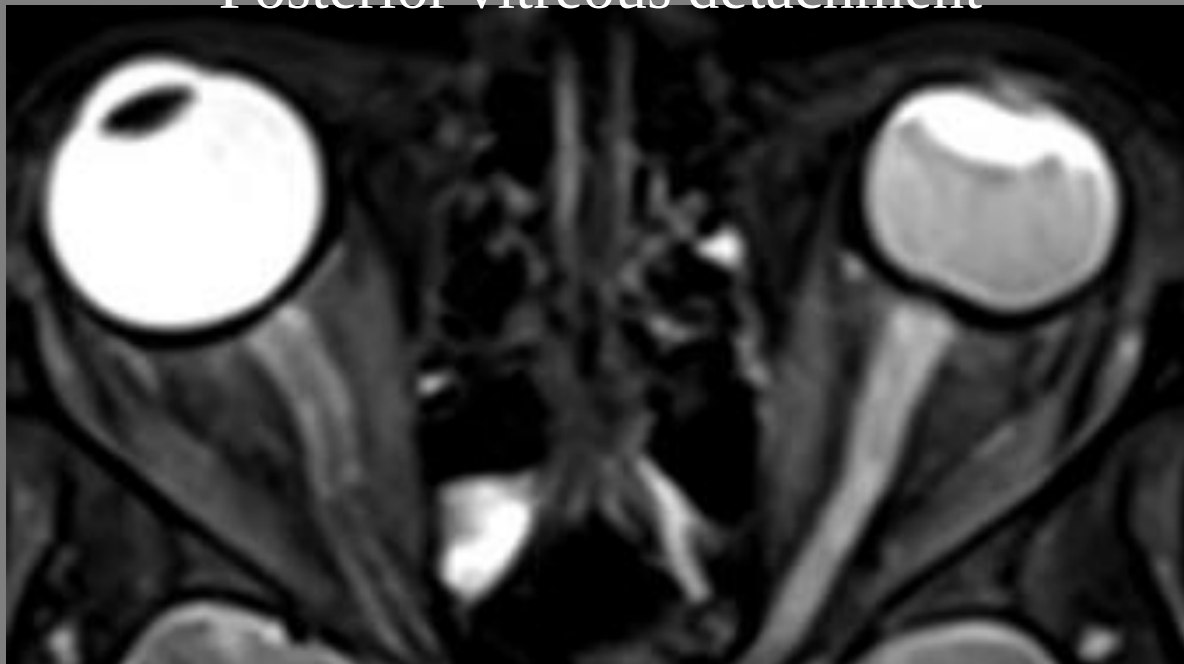


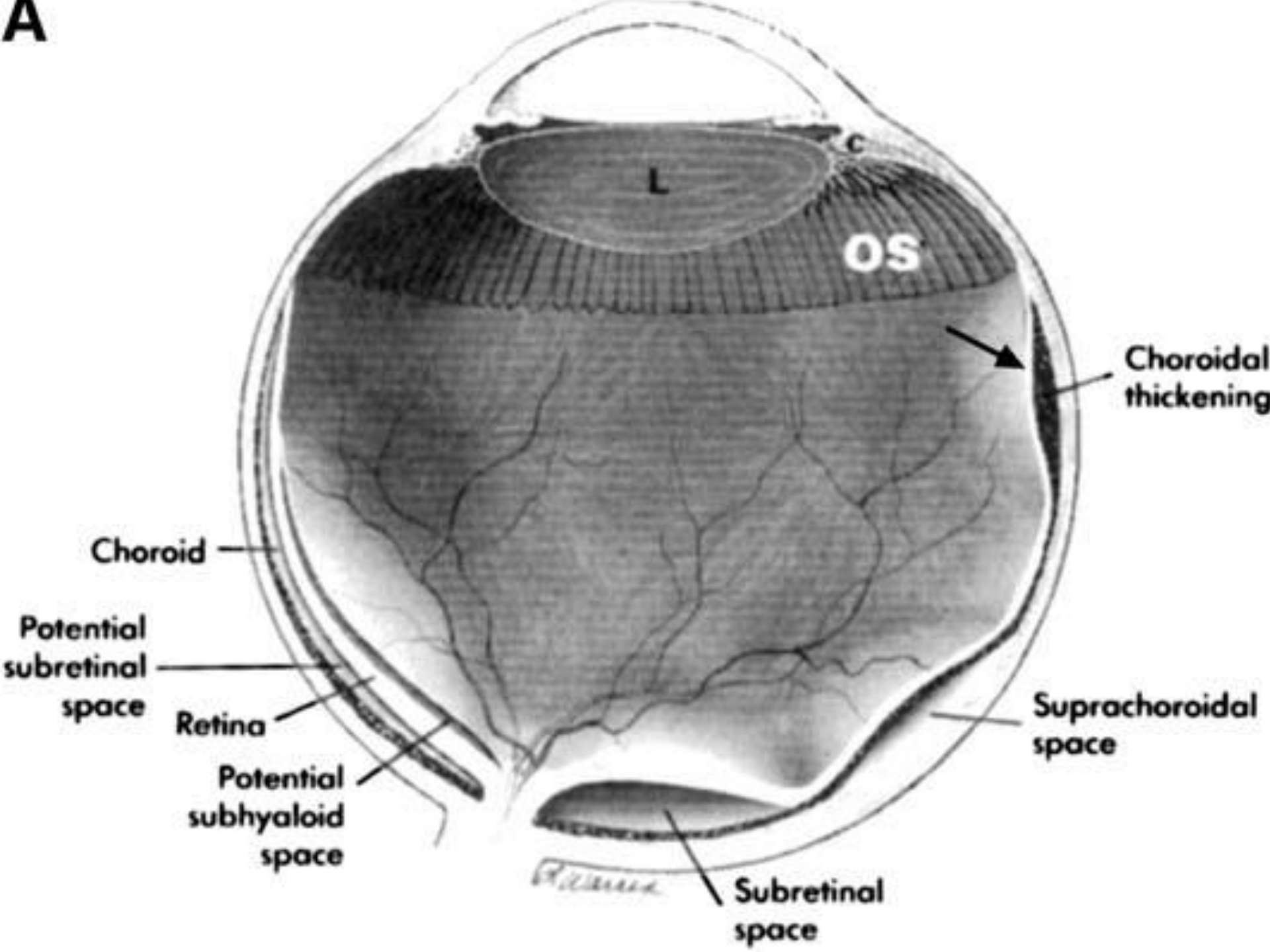
Orbital rupture w choroidal hematoma

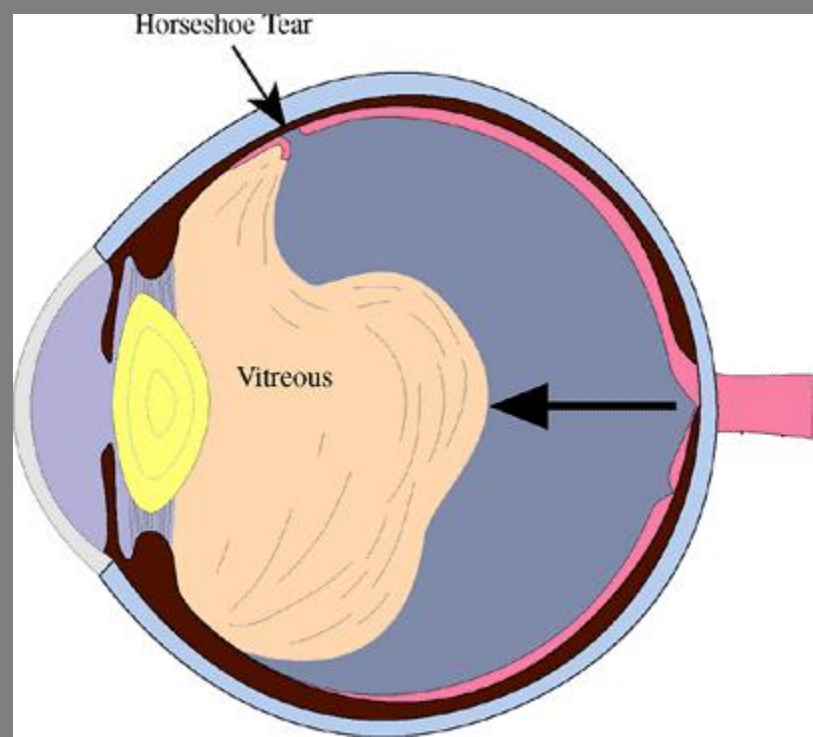
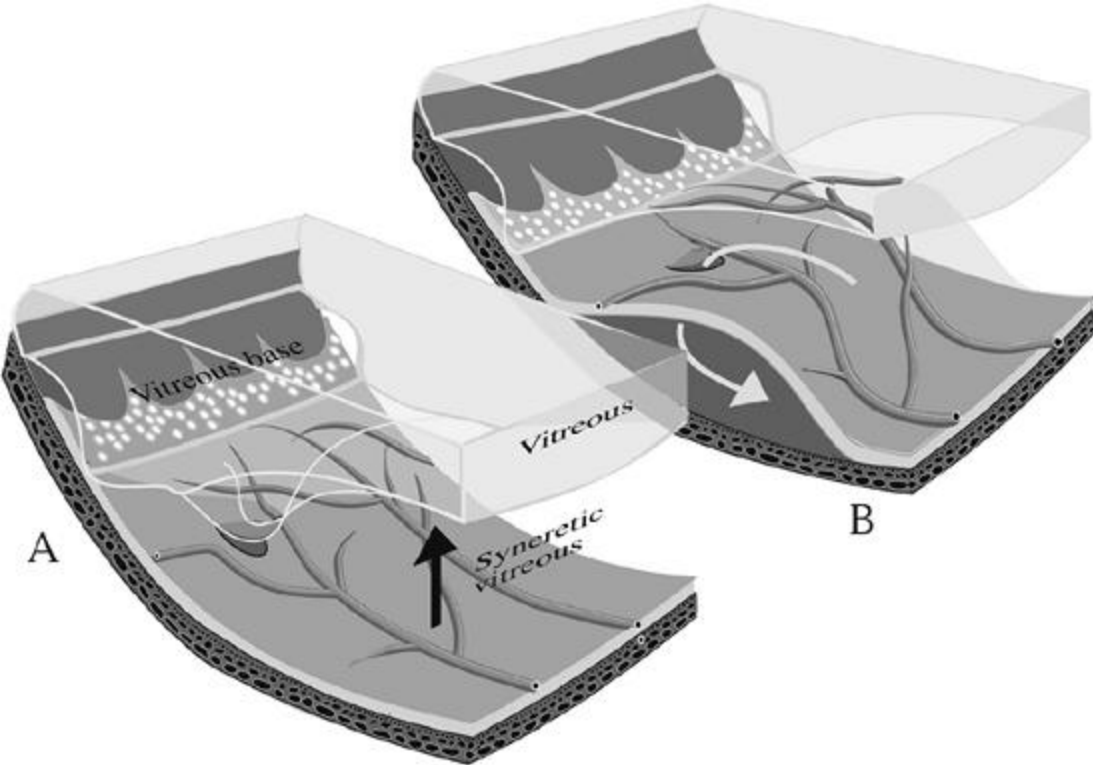




Posterior vitreous detachment



A



Summary

- Few patterns, many diagnoses!
- Some diagnoses have myriad appearances in the orbit
- Patterns indicate type of detachment
- Omnipresent:
 1. Pseudotumor
 2. Lymphoma
 3. Sarcoid
 4. Metastatic Disease