MR Imaging of the Orbits: Anatomy and Patholgy

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Dent Neurologic Institute
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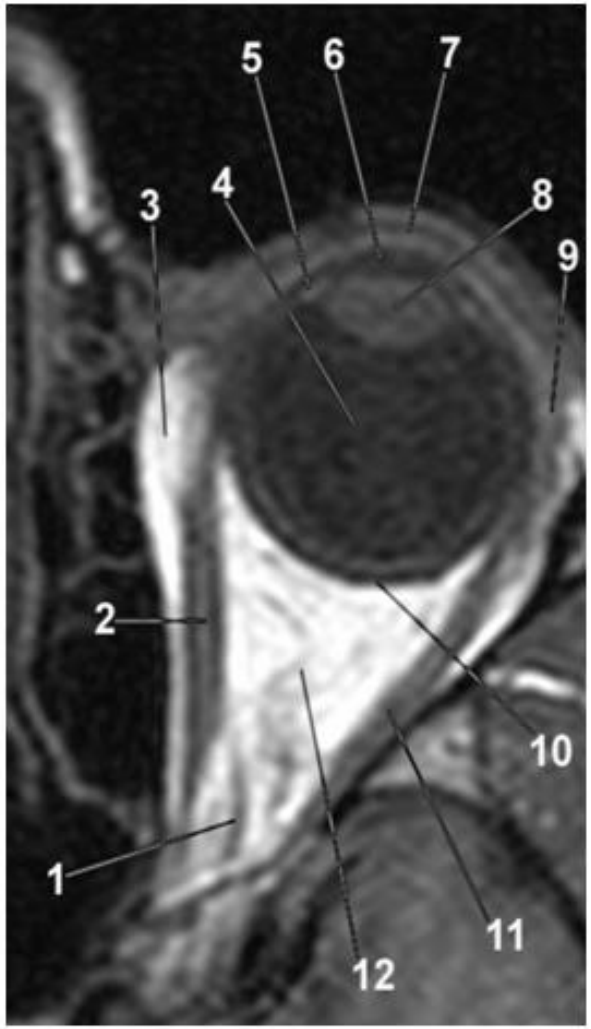
Disclosures

The presenter has no financial disclosures.

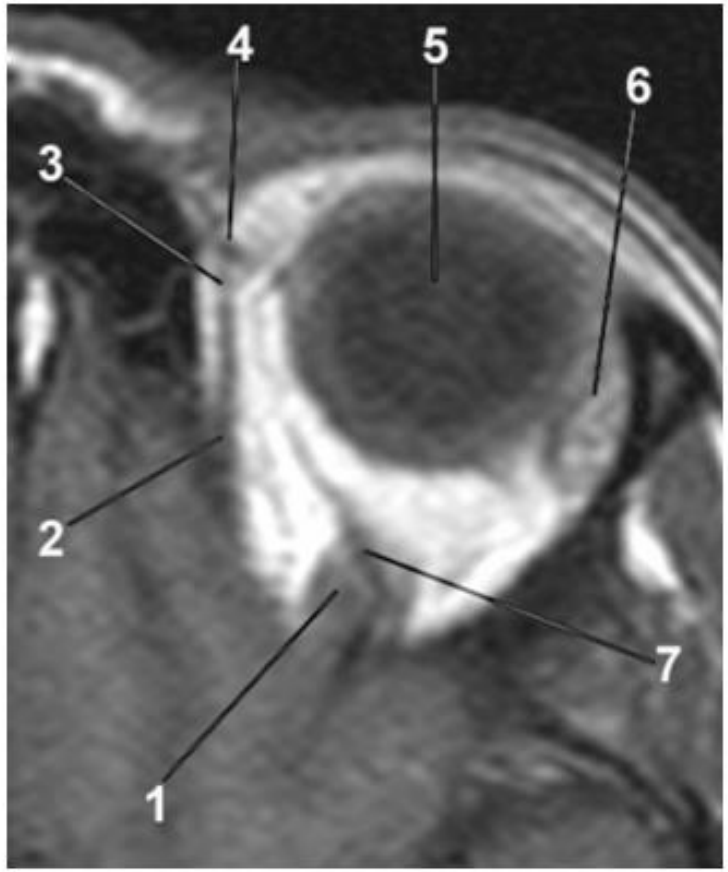
The displayed cases are largely from my practice and the imaging teaching file of the Dent Neurologic Institute (special thanks to Dr. Laszlo Mechtler).

The few images from other resources are referenced accordingly.

Normal anatomy I.

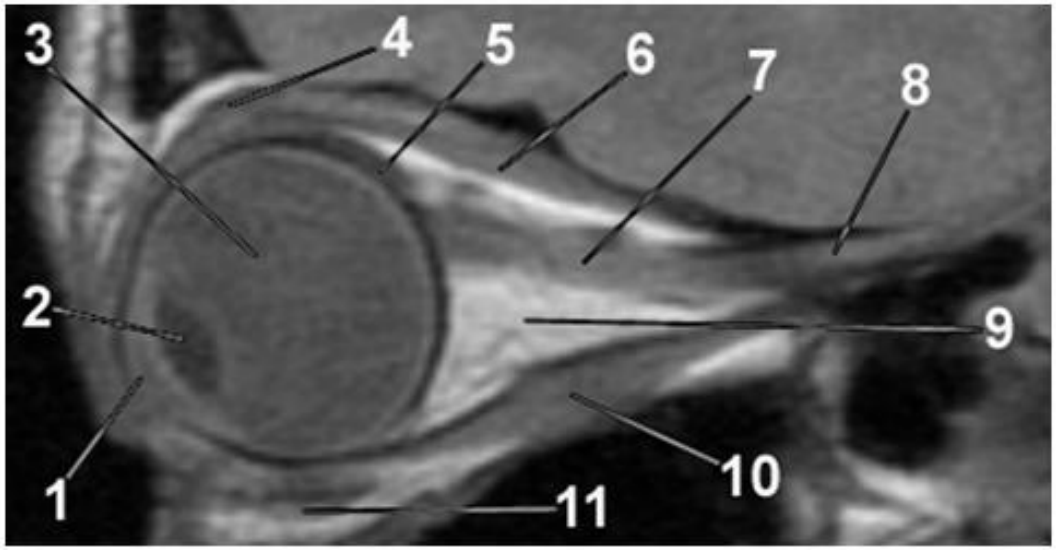


1-ophthalmic artery
2-medial rectus muscle
3-extraconal fat
4-vitreous body
5-suspensory ligament/ciliary body complex
6-anterior chamber
7-cornea
8-lens
9-lacrimal gland
10-sclera
11-lateral rectus muscle
12-intraconal fat



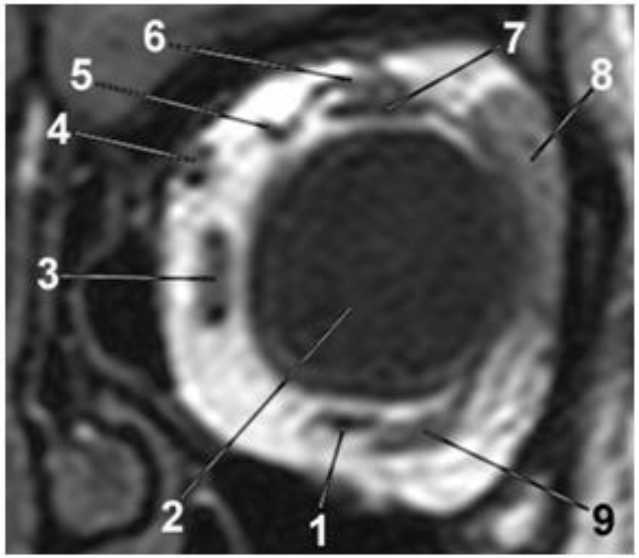
1-superior rectus muscle
2-superior oblique muscle
3-tendon of the superior oblique muscle
4-trochlea
5-vitreous body
6-lacrimal gland
7-superior ophthalmic vein

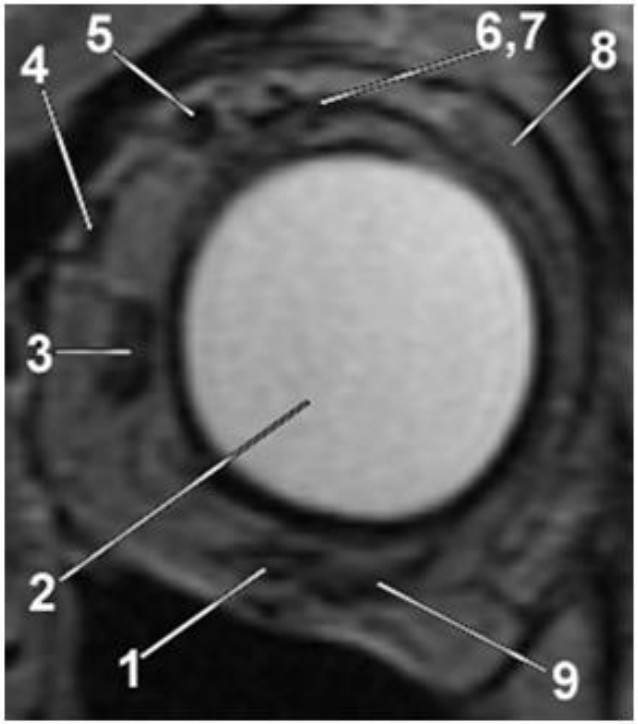
Normal anatomy II.



1-cornea
2-lens
3-vitreous body
4-levator palpebrae superioris muscle
5-sclera
6-superior rectus muscle
7-optic nerve (intraorbital segment)
8-optic nerve (intracanalicular segment)
9-intraconal fat
10-inferior rectus muscle
11-inferior oblique muscle

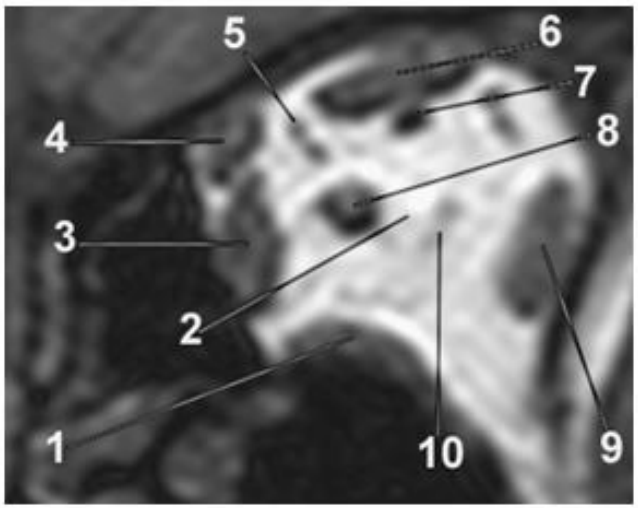
Normal Anatomy III.

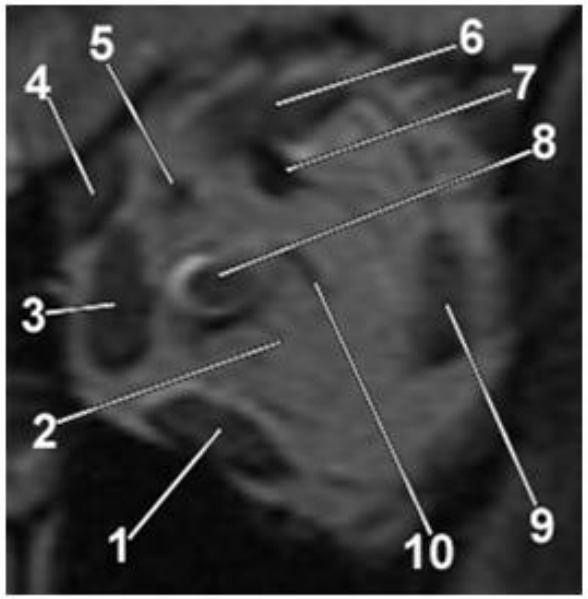




1-inferior rectus muscle
2-globe
3-medial rectus muscle
4-superior oblique muscle
5-superior ophthalmic vein
6-levator palpebrae superioris muscle
7-rectus superior muscle
8-lacrimal gland
9-inferior oblique muscle

Normal anatomy IV.

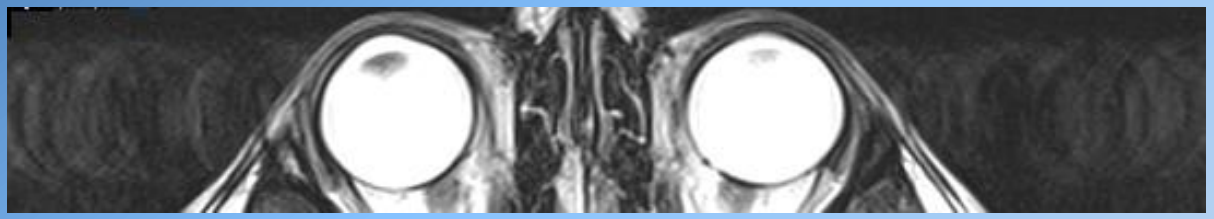




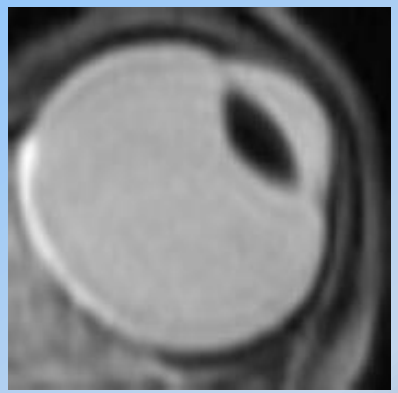
1-inferior rectus muscle
2-intraconal fat
3-medial rectus muscle
4-superior oblique muscle
5-ophthalmic artery
6-levator palpebrae superioris and rectus superior muscles
7-superior ophthalmic vein
8-optic nerve
9-lateral rectus muscle
10-lateral ophthalmic vein

Artifacts

Eye movement artifact

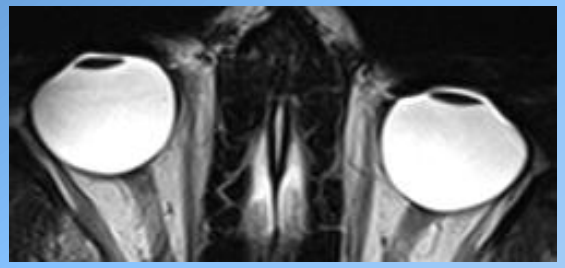


Chemical shift artifact

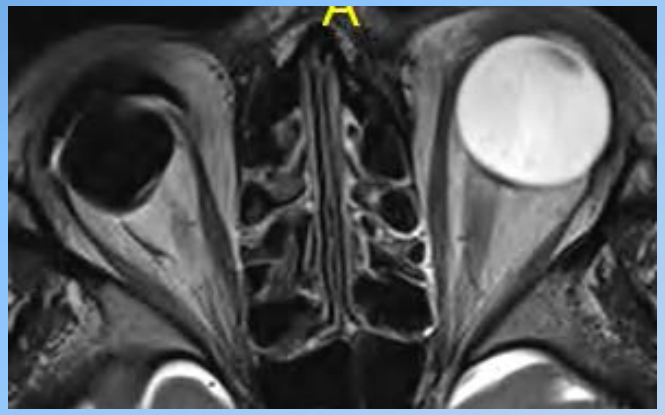


Artifacts

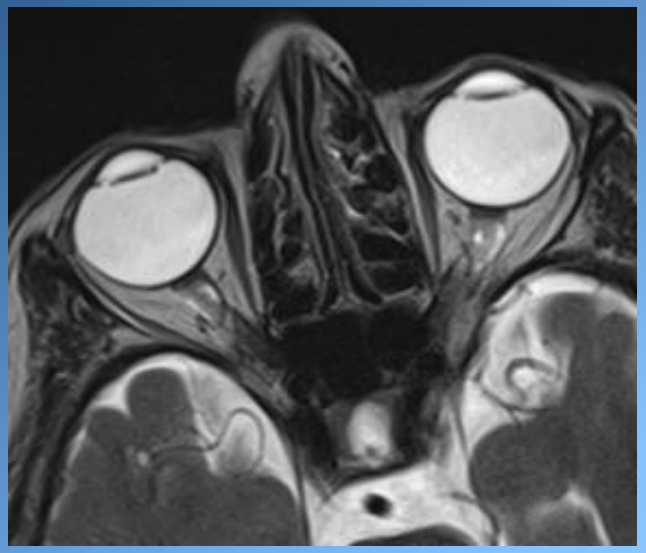
Mascara

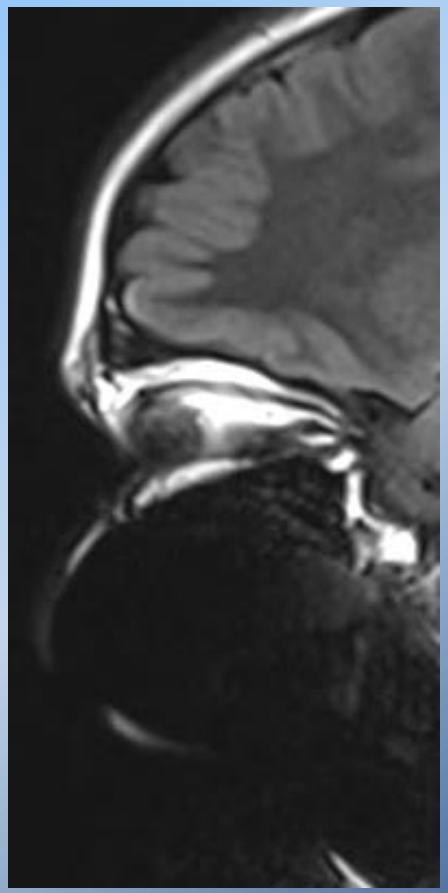


Prosthesis

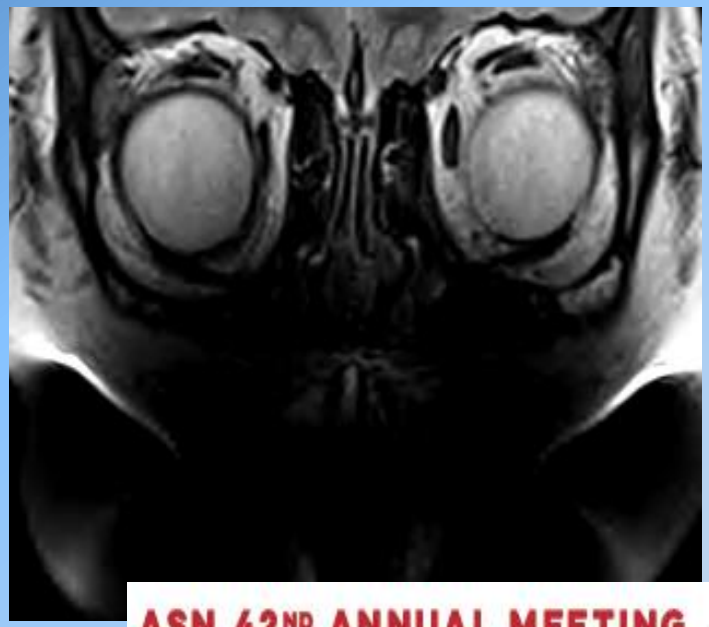


Cataract (Intraocular Lens Implant, IOL)



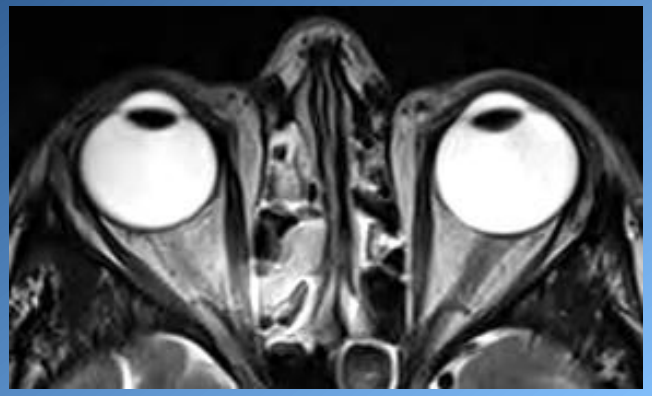


Metallic artifact from braces

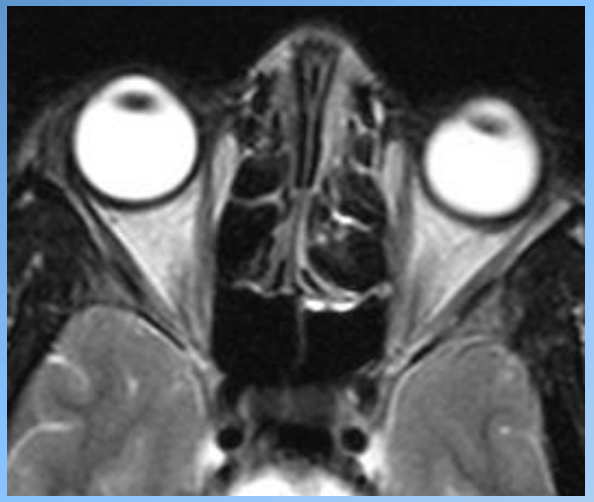


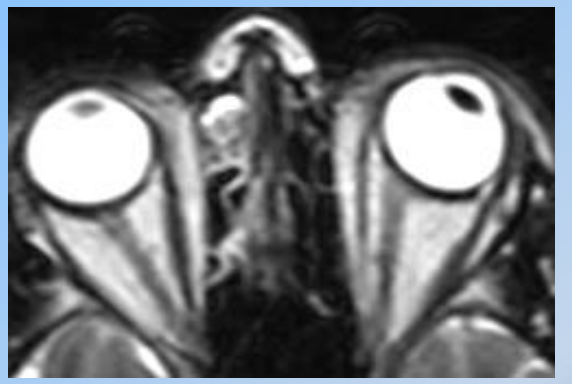
Eye positions

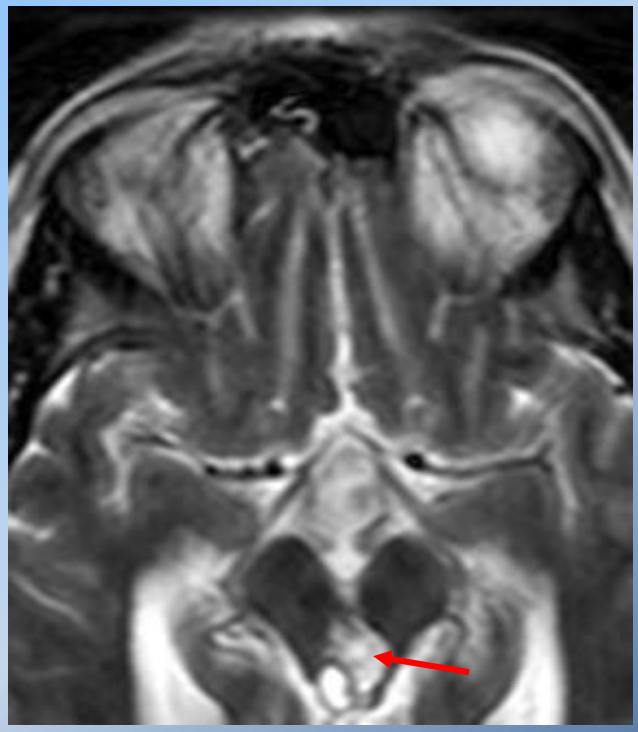
Normal awake, eyes open



Eyes closed, drowsy



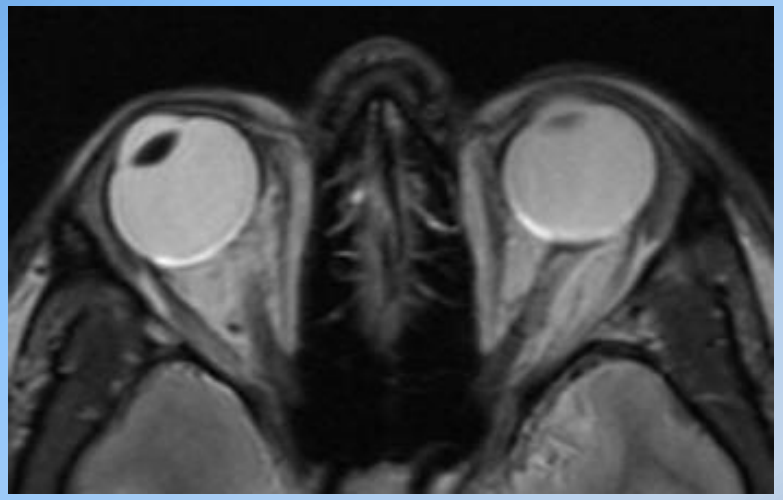




Left 3rd nerve palsy

Eye positions

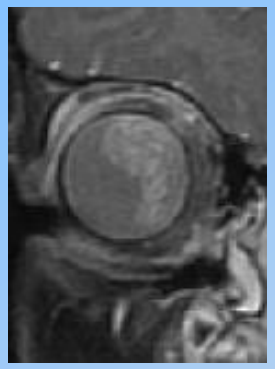
Left internuclear ophthalmoplegia

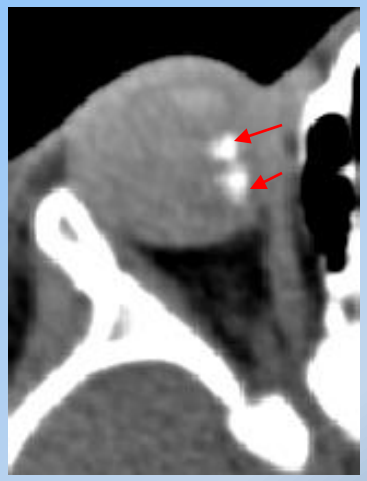


Tumors

I. Ocular tumors

Retinoblastoma



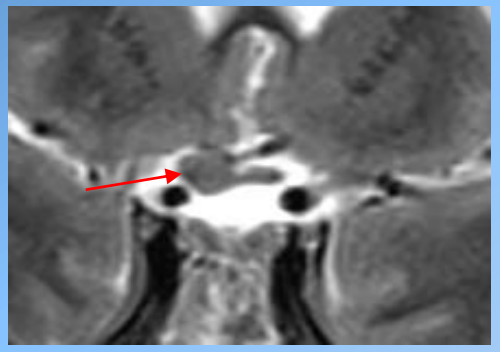


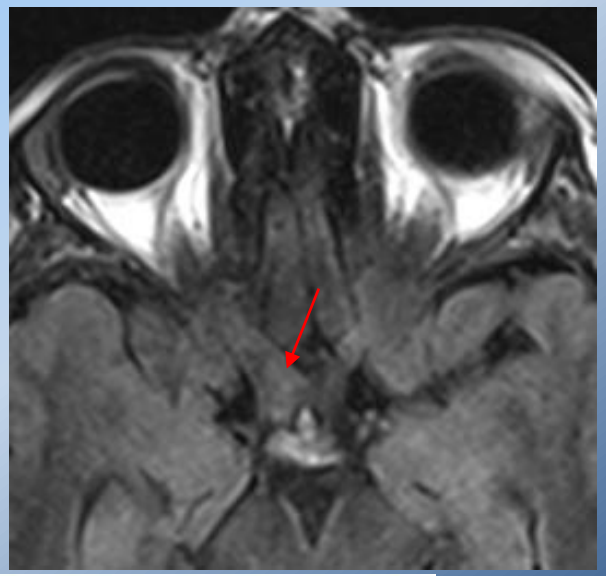
Endophytic mass, growing into the vitreous. T2 hypointense, enhancing with gadolinium. CT is a useful tool to indicate calcification zones within the mass.

Tumors

II. Optic nerve tumors

Optic (pathway)glioma (retroorbital)

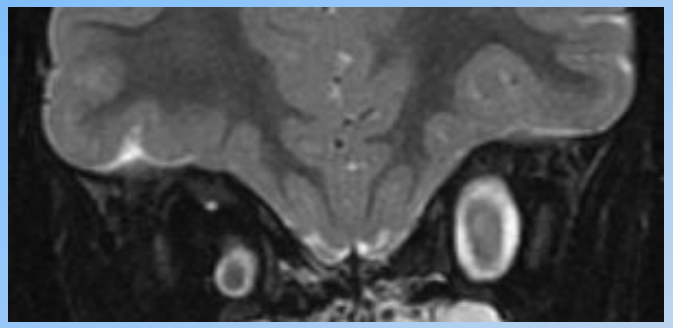


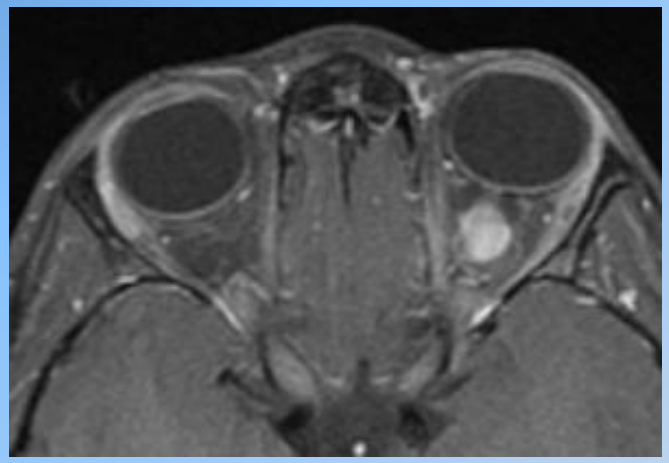


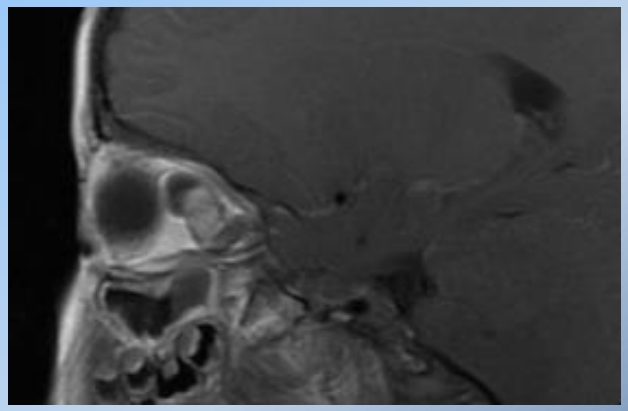
Stage 2 optic glioma is depicted (involves the right optic nerve, as well as the chiasm). Mostly isointense enlargement. May have hyperintense center and hypointense rim on T2. Enhancement varies (none in this case).

Tumors
II Optic nerve tumors
Optic glioma (intraorbital)

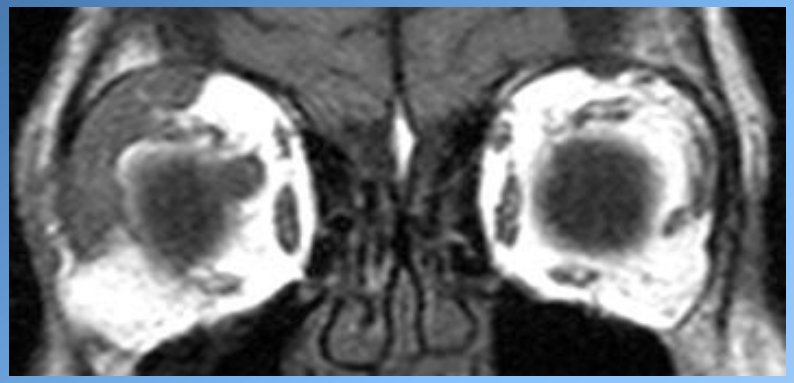
The central T2 hyperintensity is better seen here.
The contrast enhancement is quite robust.

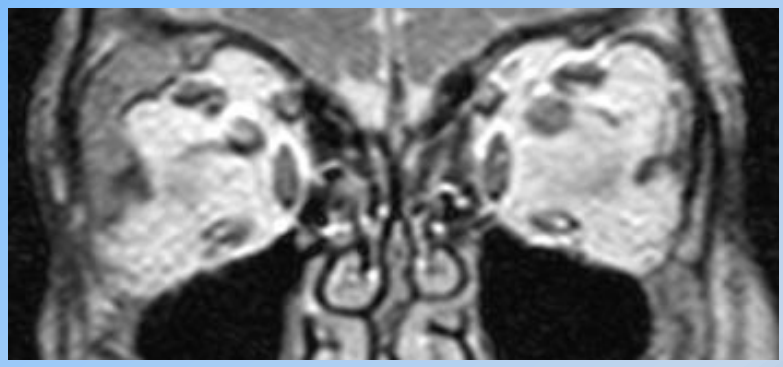






Tumors
III. Other intraorbital tumors
Lymphoma



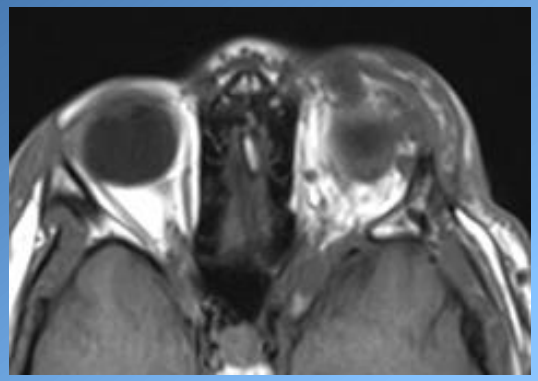
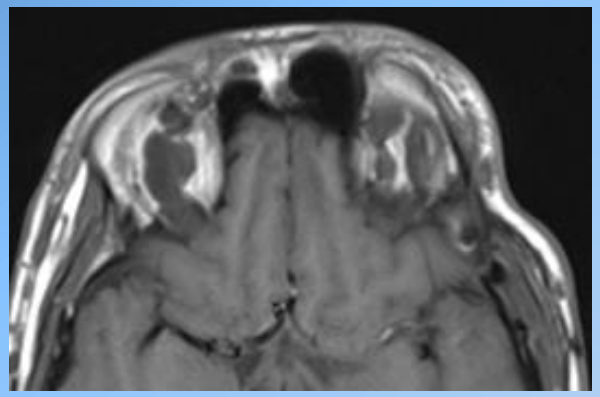
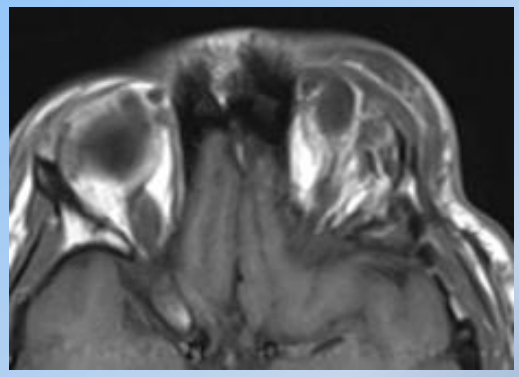
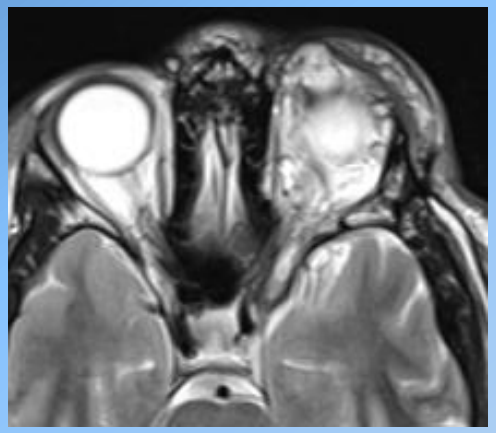
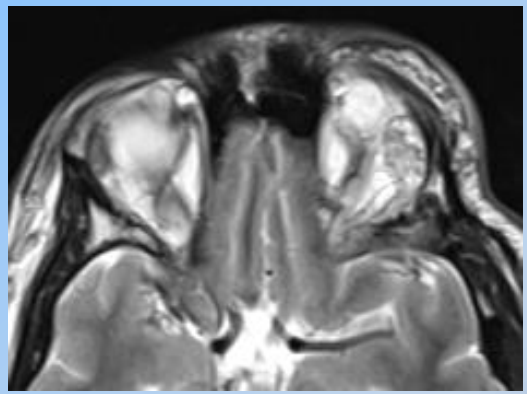


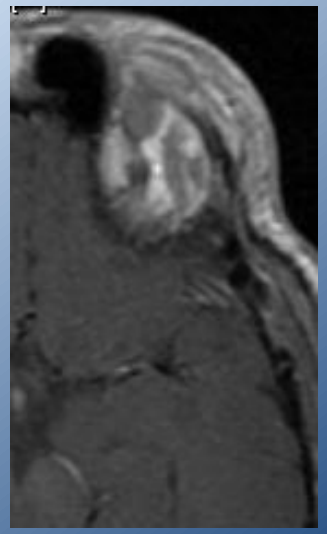
-2 % of all lymphomas
-densely cellular
-most commonly in the superolateral aspect of the orbit, associated with the lacrimal gland
-T1 iso- to hypointense to muscle
-T2 iso- to hyperintense to muscle
-intense contrast enhancement

Tumors

III. Other intraorbital tumors

Neurofibroma



T1 hypointense, T2 hyperintense, at times with central hypointensity. Mild homogenous enhancement.

Tumors

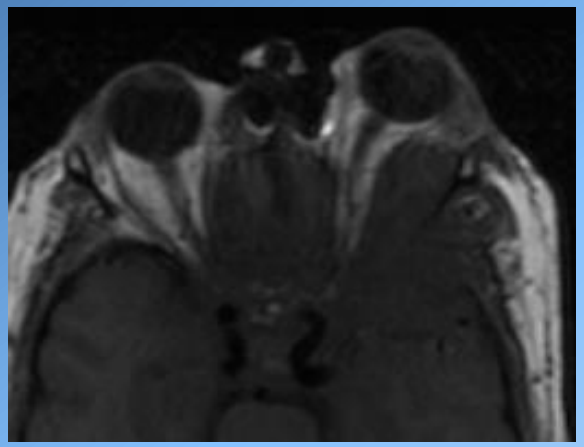
III. Other intraorbital tumors

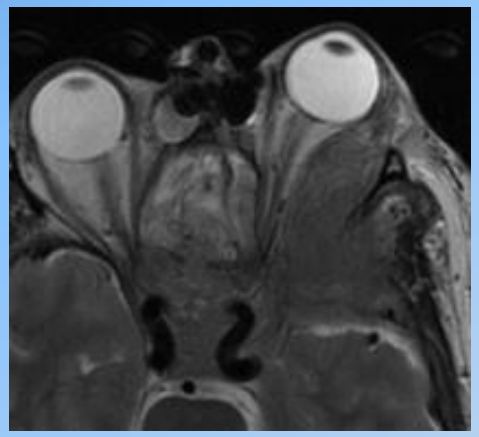
Neurofibroma (in orbital apex)

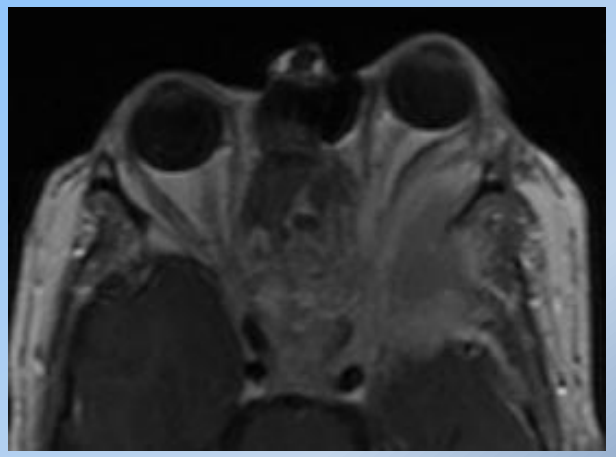
Tumors

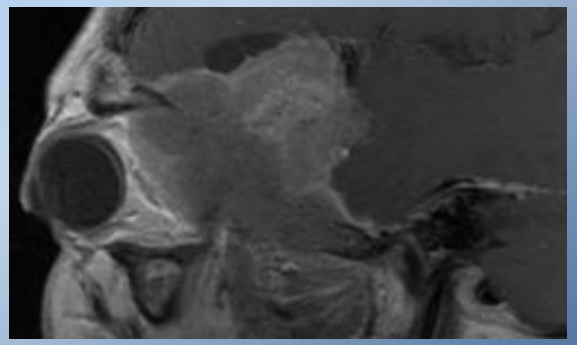
III. Other orbital tumors

Neuroblastoma









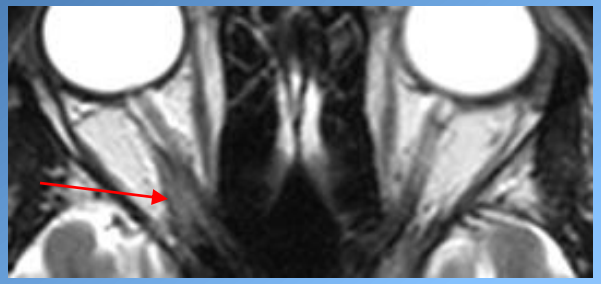
-most commonly metastatic
-typically involves the orbital roof and lateral wall, sphenoid wing
-T1: hypointense to muscle, T2 iso- or hyperintense
-robust contrast enhancement, can be heterogenous
-extraorbital extensions also

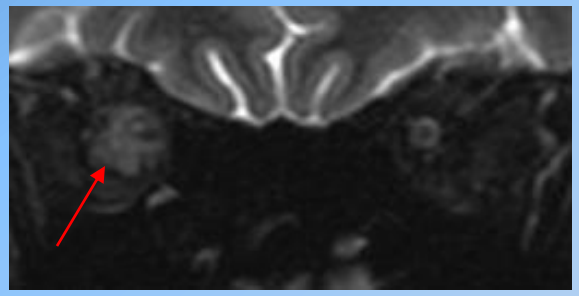
Tumors

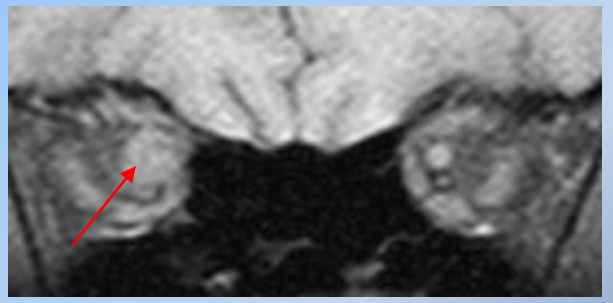
III. Other intraorbital tumors

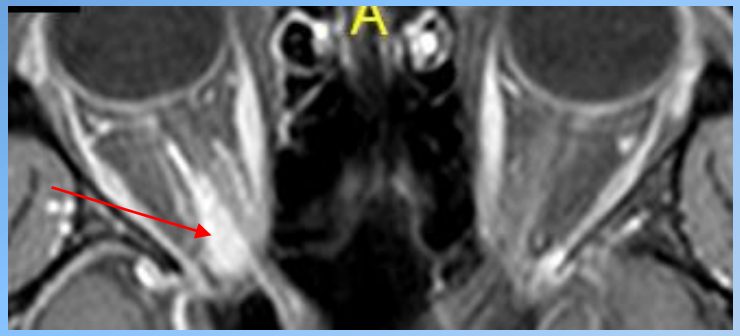
Optic sheet meningioma

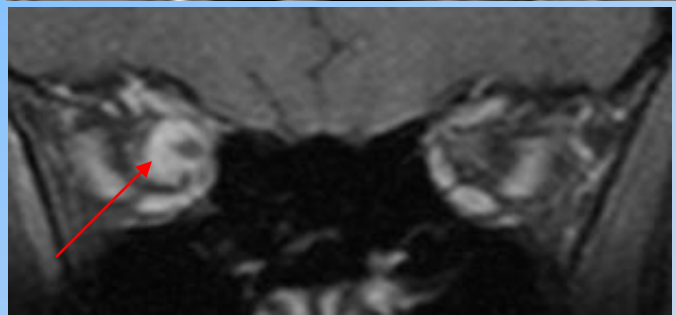
Homogenously enhancing mass, encasing the optic nerve





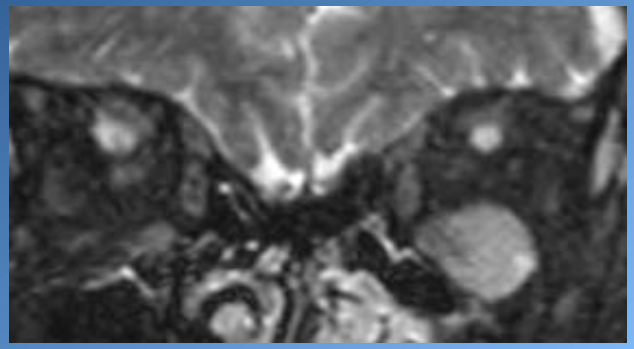




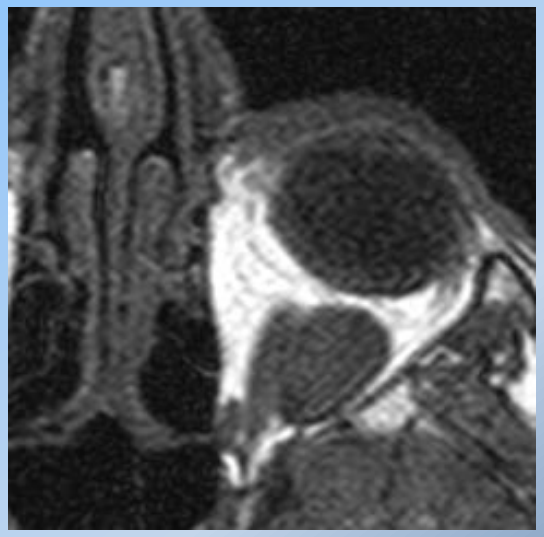


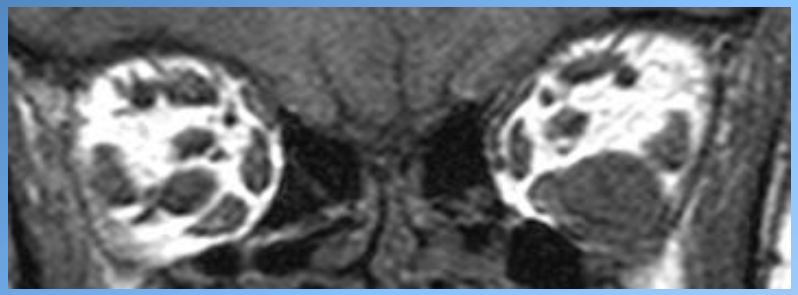
Tumors

III. Other intraorbital tumors

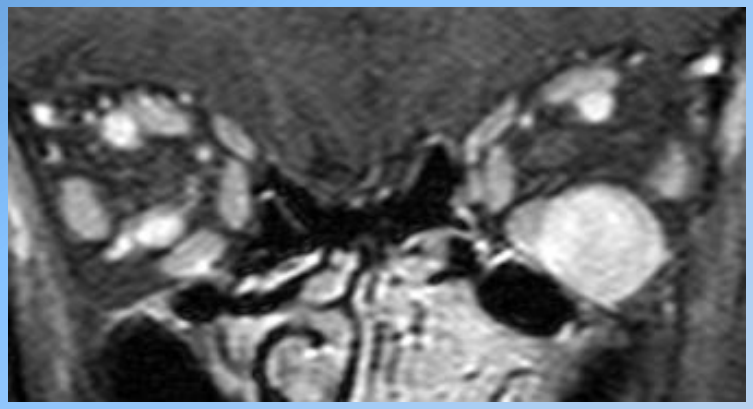


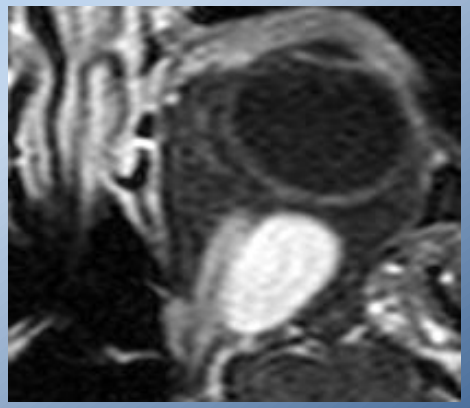
Cavernous hemangioma: most common vascular lesions in the orbit in adults.
Dilated large vascular spaces with a fibrous pseudocapsule.
Cavernous malformation is a more accurate term.





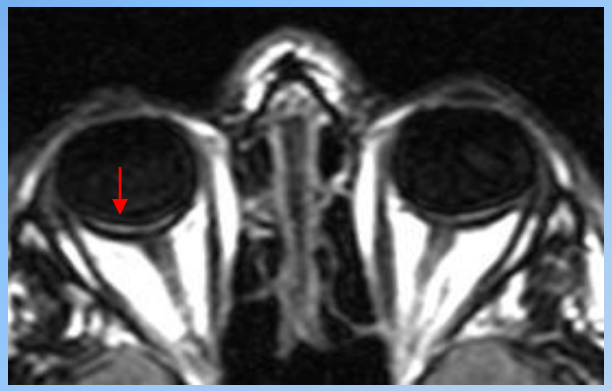
T1: iso to muscle
T2: hyper to muscle, may have hypointense rim (capsule)
Delayed contrast enhancement





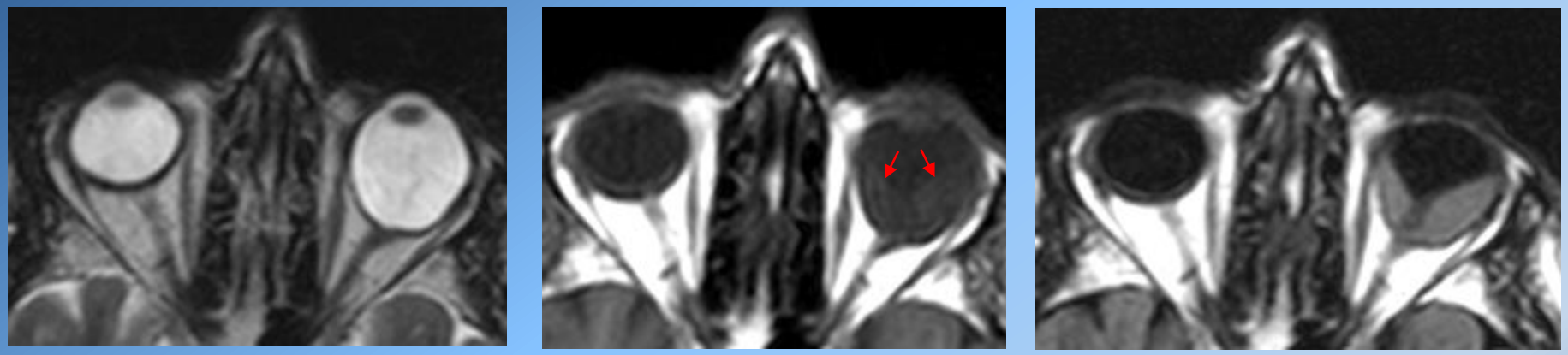
Disorders of the retina

Retinal thickening from diabetes

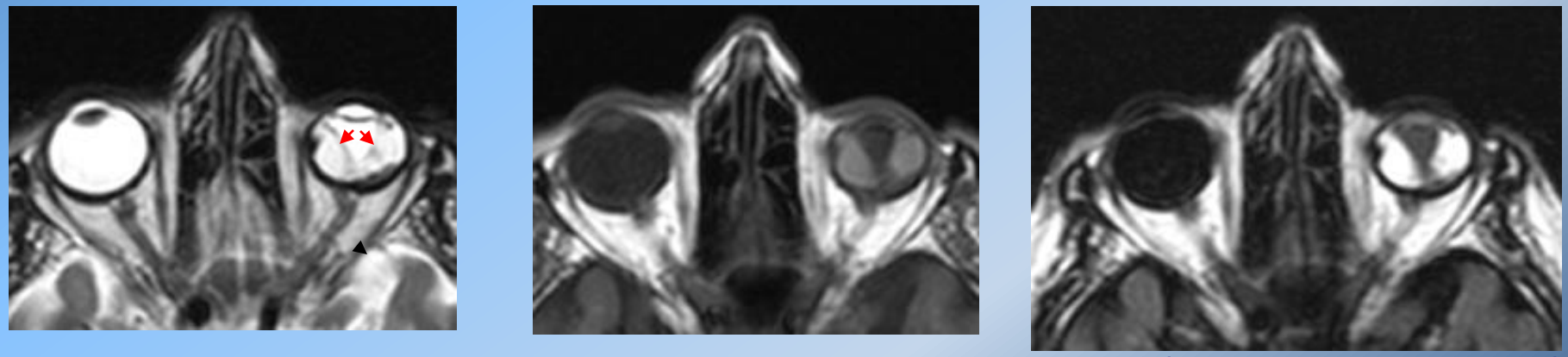


Disorders of the retina

Retinal detachment



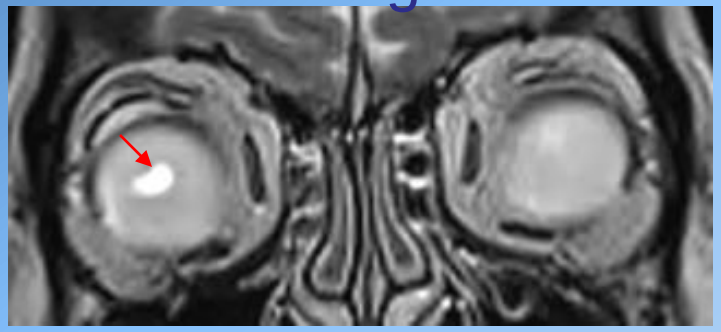
Retinal detachment (exudative)

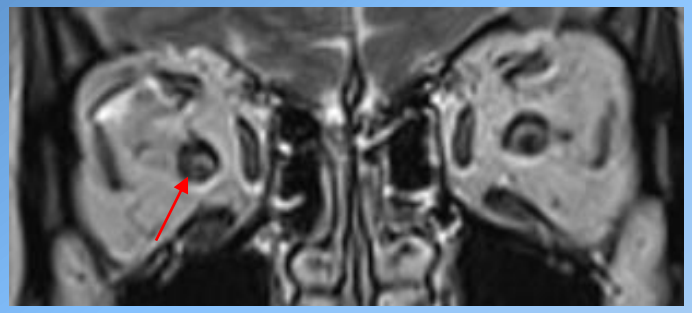


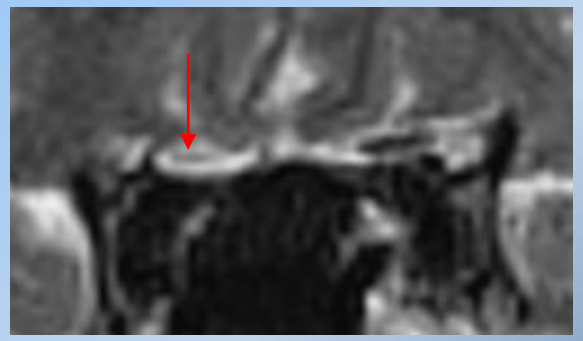
Ends at the optic nerve and does not extend past the ora serrata (10 and 2 o'clock rule). This is how it can be differentiated from choroidal detachment.

Disorders of the retina

Macular degeneration

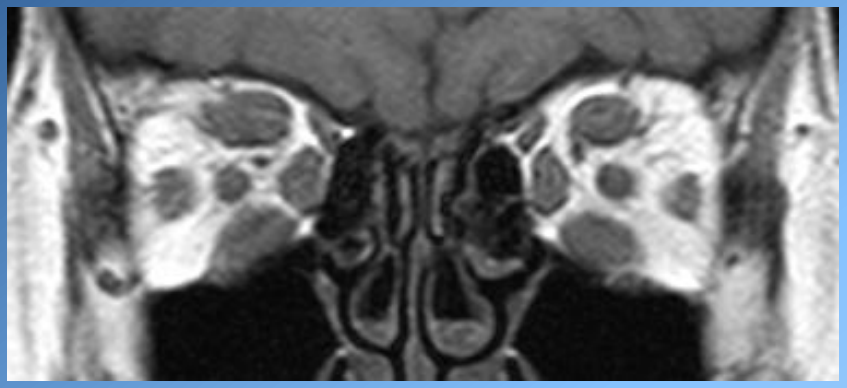


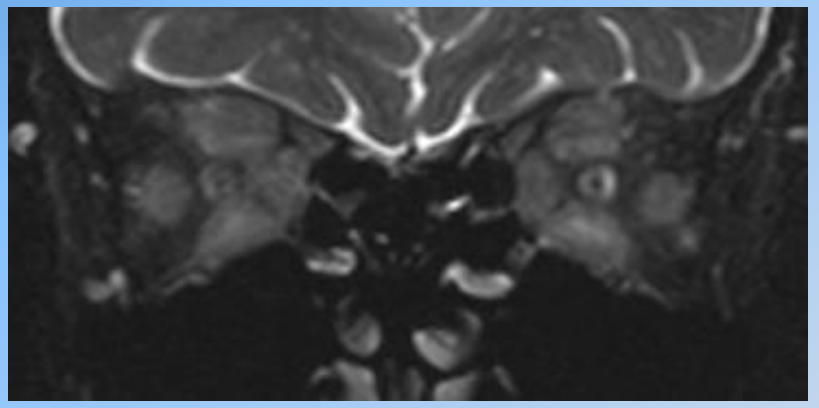


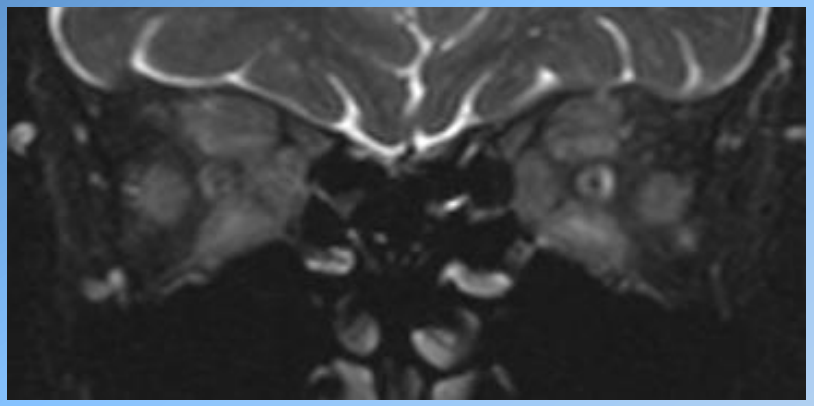


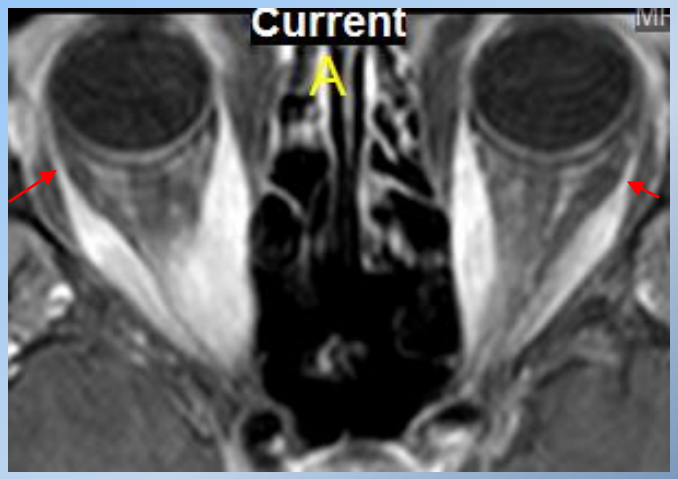
Disorders of the extraocular muscles

Thyroid ophthalmopathy







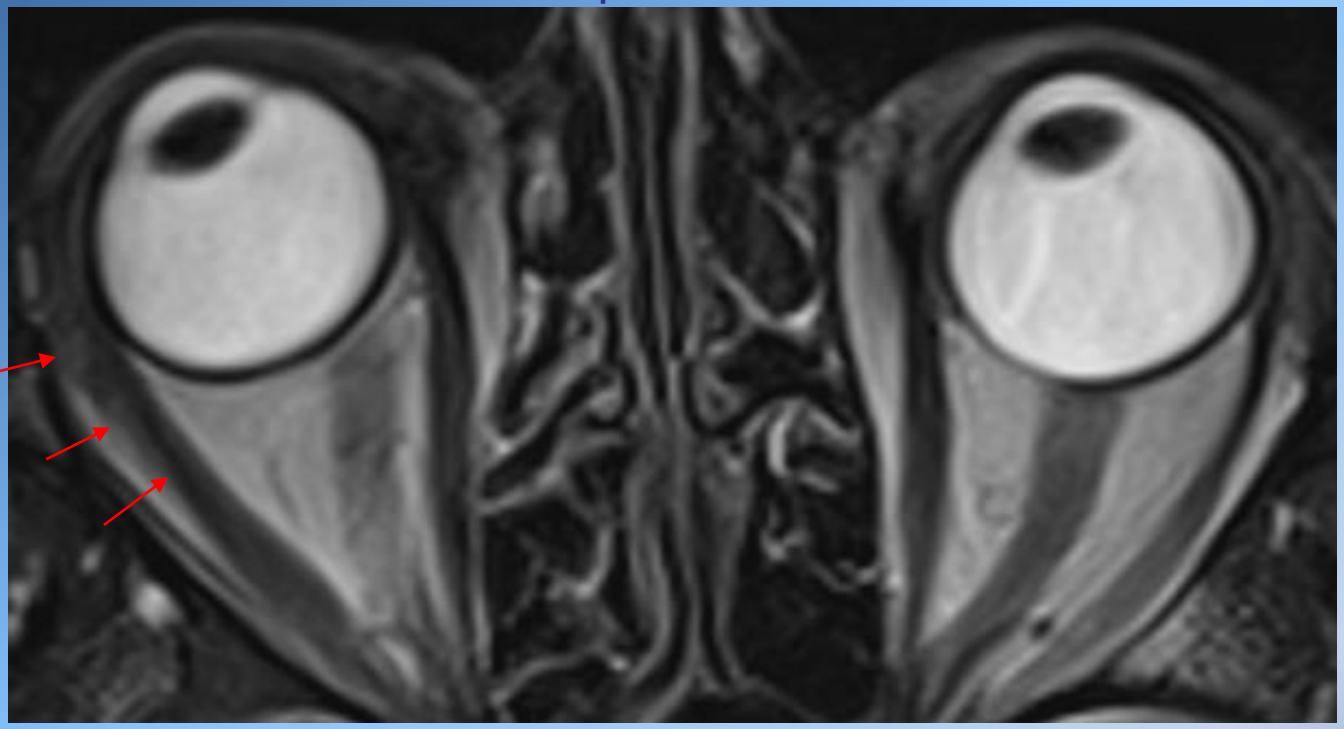


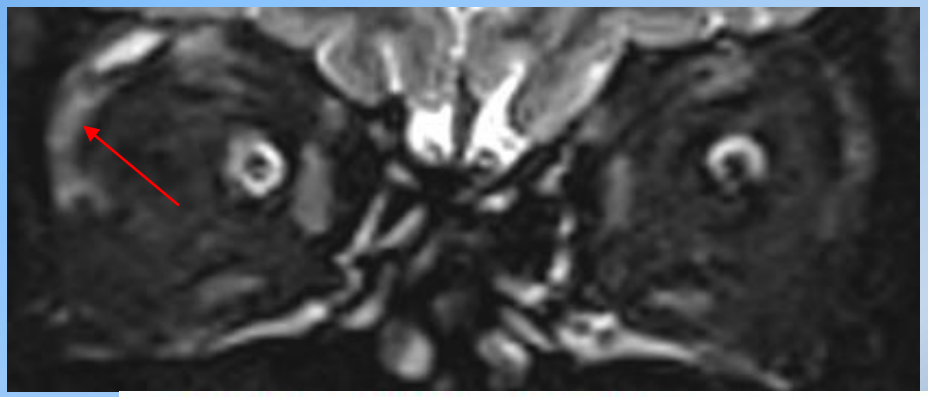
Extraocular muscle tendons are spared!

Axial T1 +C

Disorders of the extraocular muscles (and other soft tissues)

Orbital pseudotumor

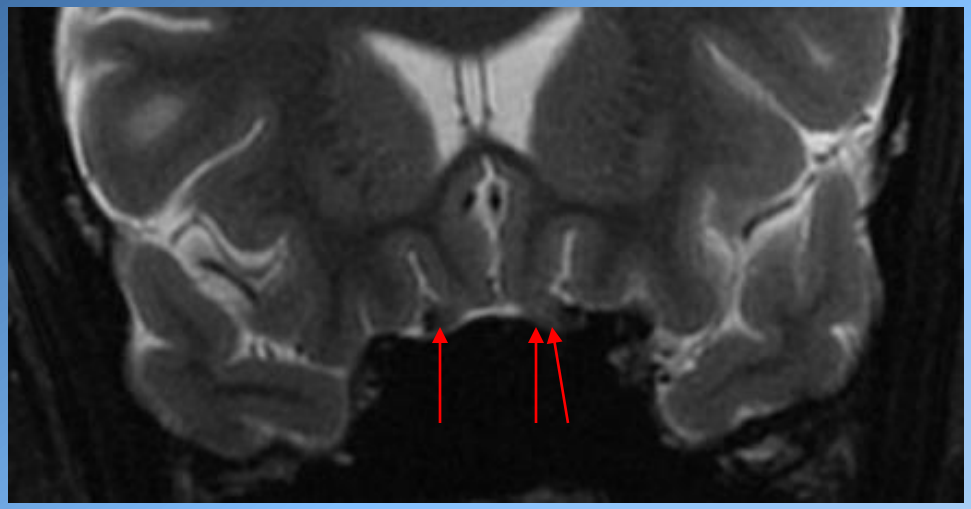




Idiopathic inflammatory process in the orbit. Any of the orbital contents can be involved, but most commonly the extraocular muscles, especially the lateral rectus. Contrary to thyroid ophthalmopathy, the muscle tendon is also involved!

Disorders of the optic nerve

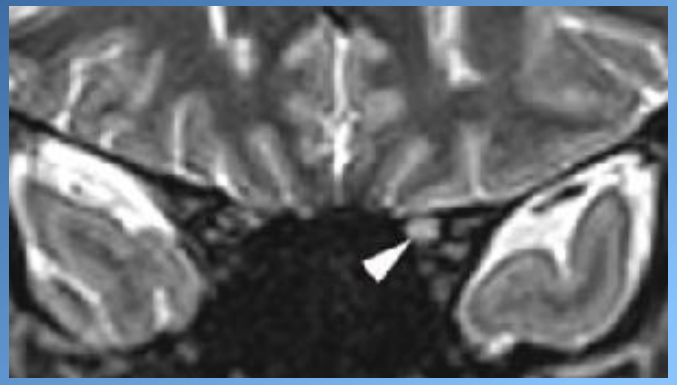
Optic neuritis-hyperacute

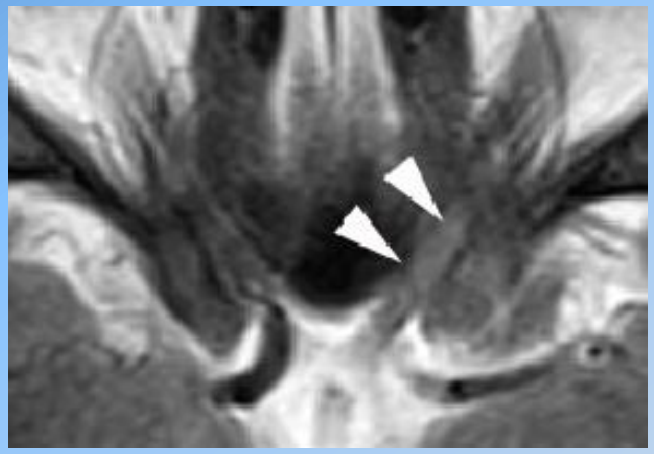


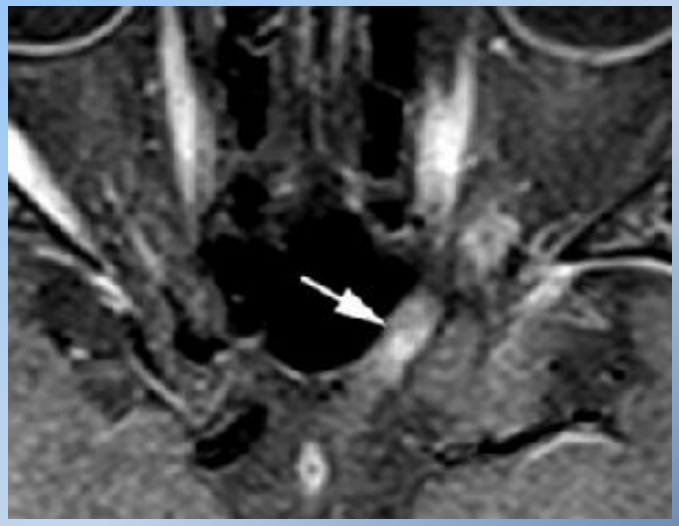
MRI performed on the day of symptom onset. The nerve segment is somewhat swollen and enhances with gadolinium.

Disorders of the optic nerve

Optic neuritis-acute



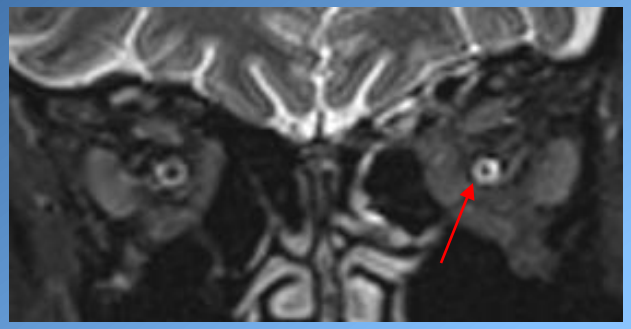


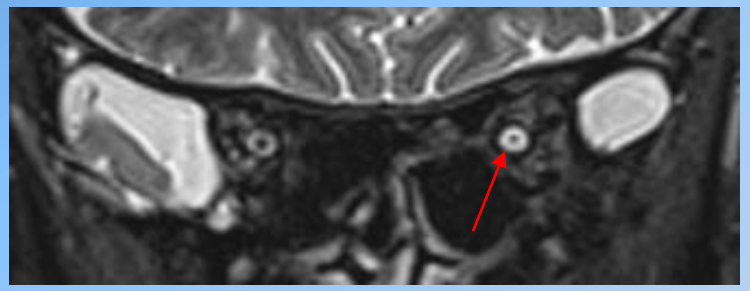


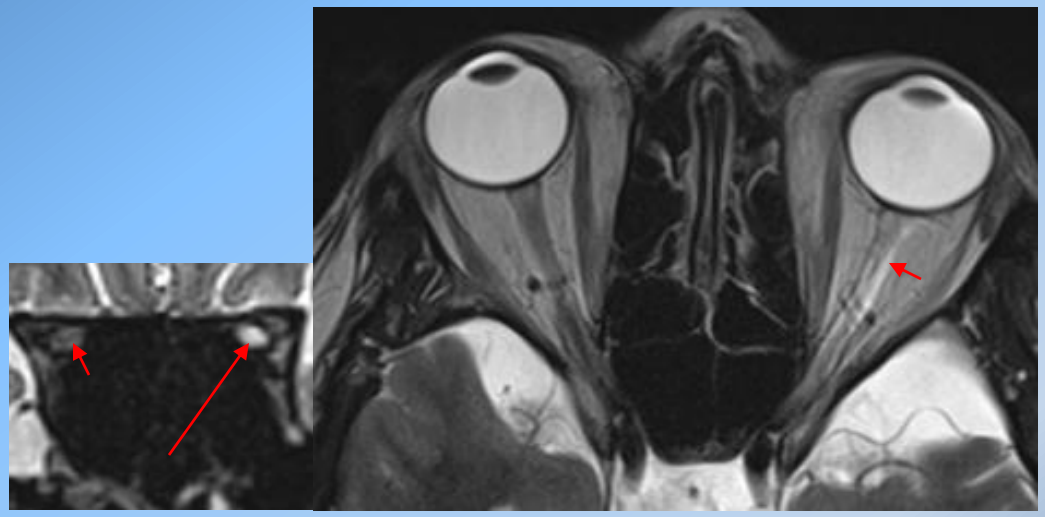
T2 hyperintense nerve segment, with contrast enhancement.

Disorders of the optic nerve

Optic neuritis-chronic stage



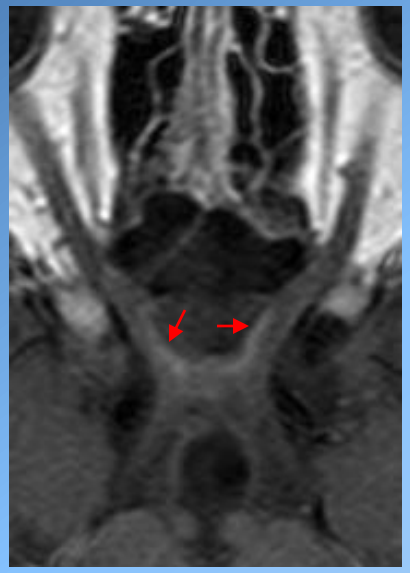




T2 hyperintense nerve segment with decreased caliber

Disorders of the optic nerve

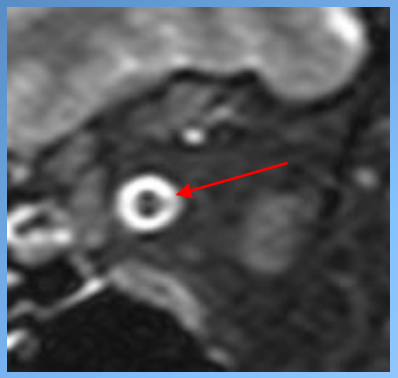
Radiation induced optic neuropathy

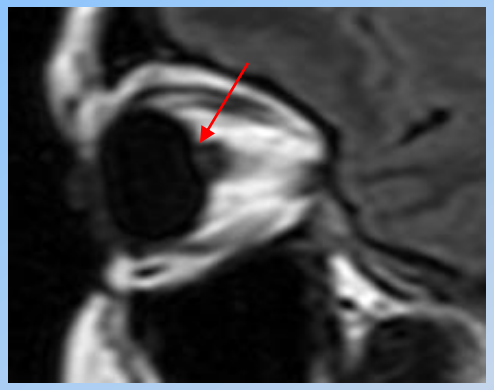


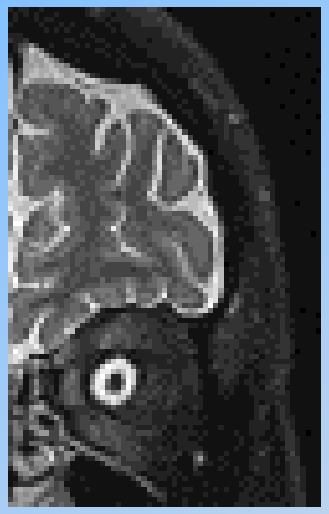
Delayed onset visual loss in patient who received radiation therapy. Somewhat decreased caliber of the optic pathway with contrast enhancement.

Disorders of the optic nerve

Pseudotumor cerebri





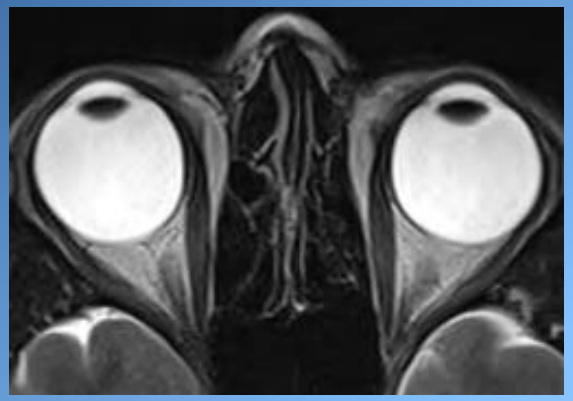


-expansion of the perioptic CSF space (not very specific)
-indentation of the posterior aspect of the globe (more helpful)
-look for additional findings (flattened pituitary, slit-like ventricles,low lying tonsils)
-clinical correlation is needed!

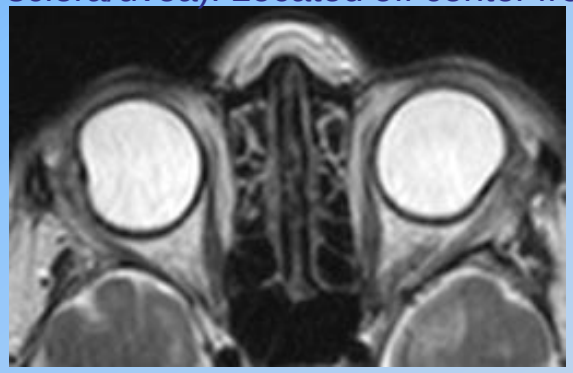
Abnormalities of the globe

Enlarged globe (macrophthalmia)

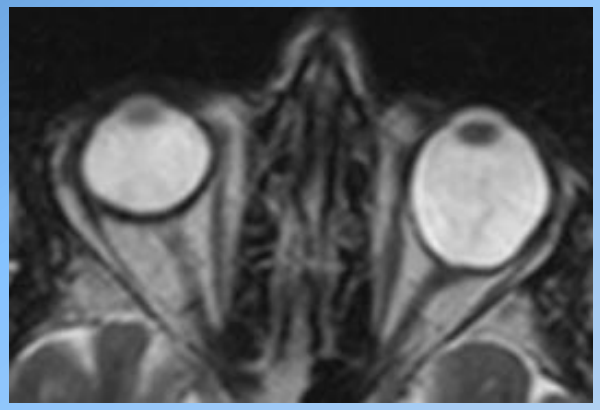
Borderline/slight enlargement of the globes (myopia possible)

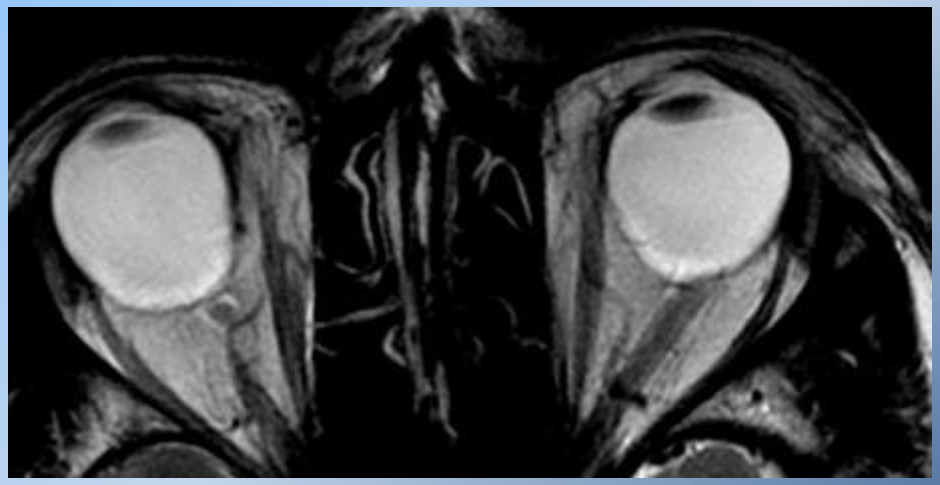


Staphyloma, with enlarged axial diameter of the globes, causing axial myopia. Due to weakness/stretching of the sclera/uvea). Located off center from the optic disc.



Macrophthalmia, retinal detachment



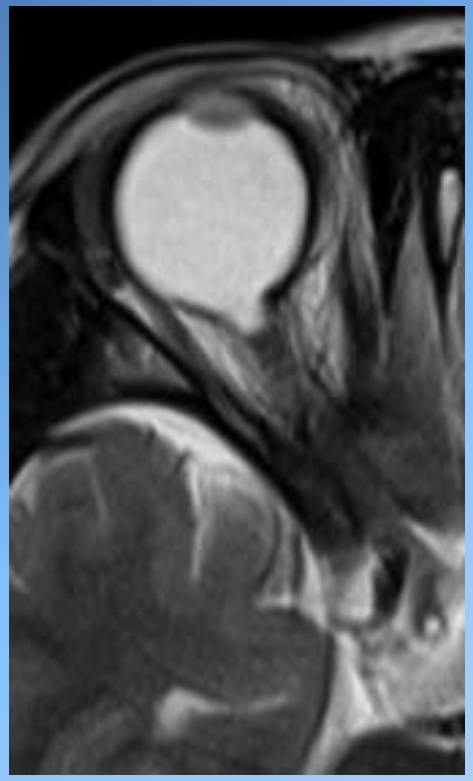


(Di Muzio et al, Radiopaedia)

Abnormalities of the globe

Enlarged globe (macrophthalmia)

Coloboma: outpouching, in the center, due to failure of posterior choroidal fissure closure.



(Weerakkody Y et al, Radiopedia)

Buphthalmos: enlargement of the globe. Often seen in glaucoma, but in the presented case it was a finding in a patient with NF-1 and optic nerve glioma.

Abnormalities of the globe

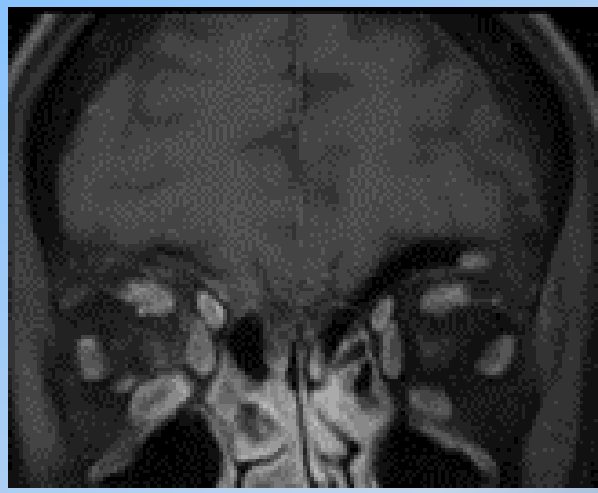
Phthisis bulbi: shrunken, disfigured, non-functioning eye, the result of any destructive process.

(From the collection of Dr. Balaji Anvekar
SP Institute of Neurosciences, India)

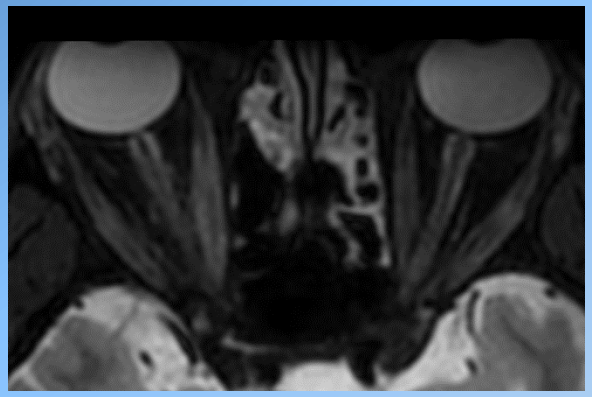
Orbit MR Imaging protocol (3T)

Coronal T2 FS

Axial T1+C



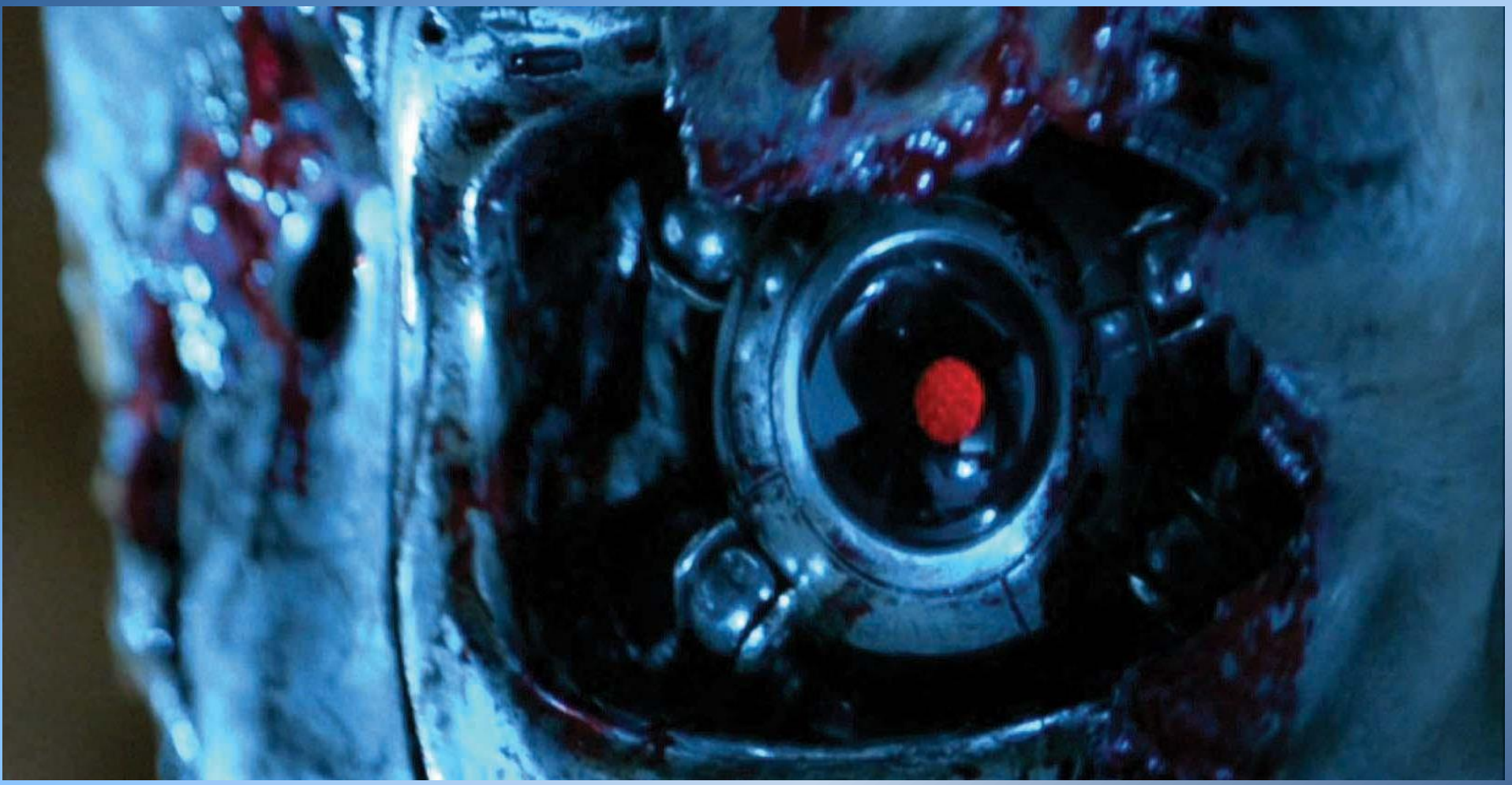
Coronal T1+C FS



Axial T2 FS

Axial T1+C FS

Thank you!



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