Proptosis

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Overview

- Patient 1
- Differential Diagnosis of Proptosis
- Relevant Orbital Anatomy
- Imaging Modalities for the Orbit
- Patient 2
- Patient 3
- Patient 4

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Patient 1

HPI: 62 yo woman with gradual progressive L eye vision loss and proptosis since 1980.

Eye exam: Proptosis of L eye with no pupillary reaction. Full vision, visual fields and extraocular movements of R eye.

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Proptosis

Proptosis: abnormal protrusion of one or both eyeballs

Measurement: Hertel exophthalmometer

Complications:

- Corneal: punctuate keratopathy leading to possible corneal perforation
- Compressive optic neuropathy due to space-occupying lesion

www.richmondproducts.com/ 52400Hertel%20Exophthalmometer.htm

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Differential Diagnosis of Proptosis:

- Infectious
- Inflammatory
- Tumors
- Trauma
- Other

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Infectious

- Bacterial: orbital cellulitis, abscess
- Fungal: aspergillosis, mucormycosis
- Parasitic: trichinosis, echinococcosis

Inflammatory

- Idiopathic orbital inflammatory syndrome (pseudotumor)
- Langerhans cell histiocytosis
- Sarcoidosis
- Graves' ophthalmopathy

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Tumors
- Capillary hemangioma
- Fibro-osseous tumors
- Fibrous histiocytoma
- Optic nerve gliomas
- Leukemia
- Lymphoma
- Meningioma
- Metastases

Trauma
- Orbital fractures
- Foreign bodies

Other
- Orbital varices
- AV malformations
- Mucocele
- Cysts (dermoid and epidermoid)

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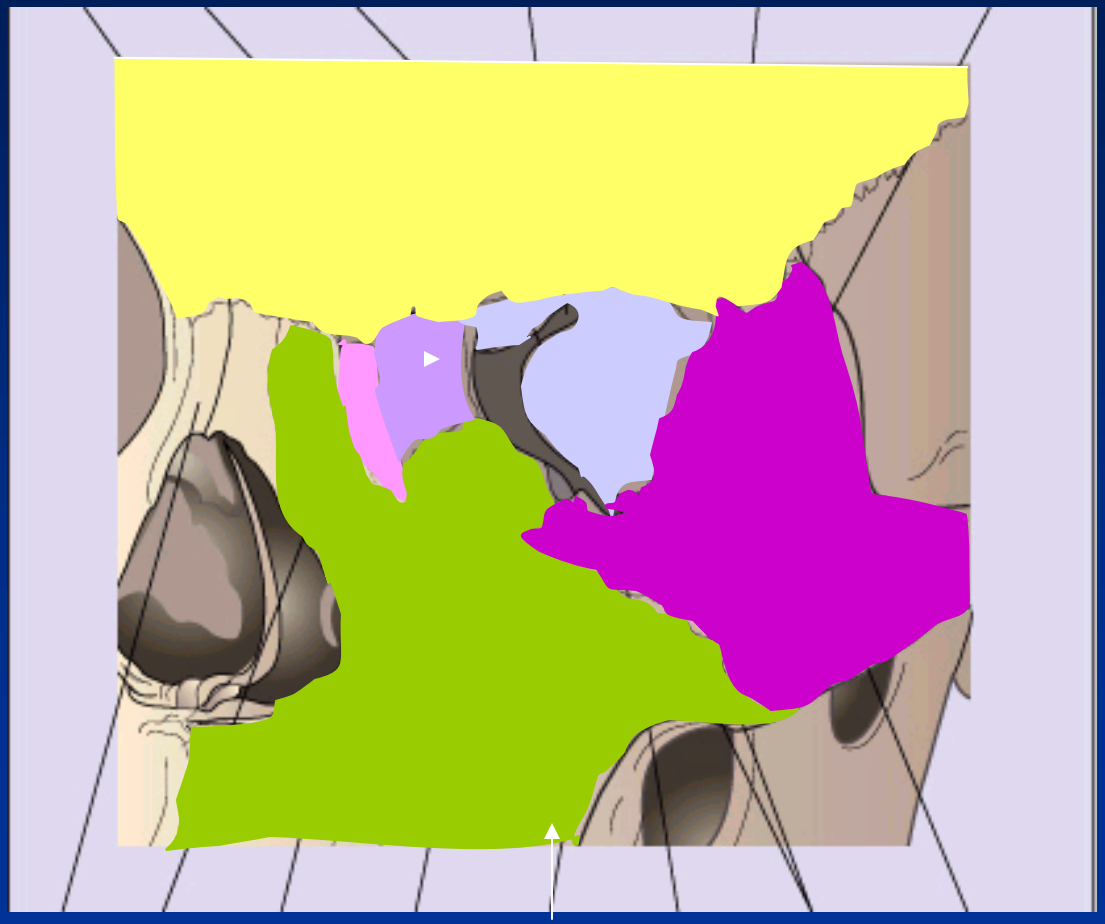
Bony Orbit

Frontal bone

Zygomatic bone

Ethmoid bone

Lacrimal bone



Maxillary bone

Sphenoid bone

Yanoff, M., ed. *Ophthalmology*. St Louis: Mosby , 2004.

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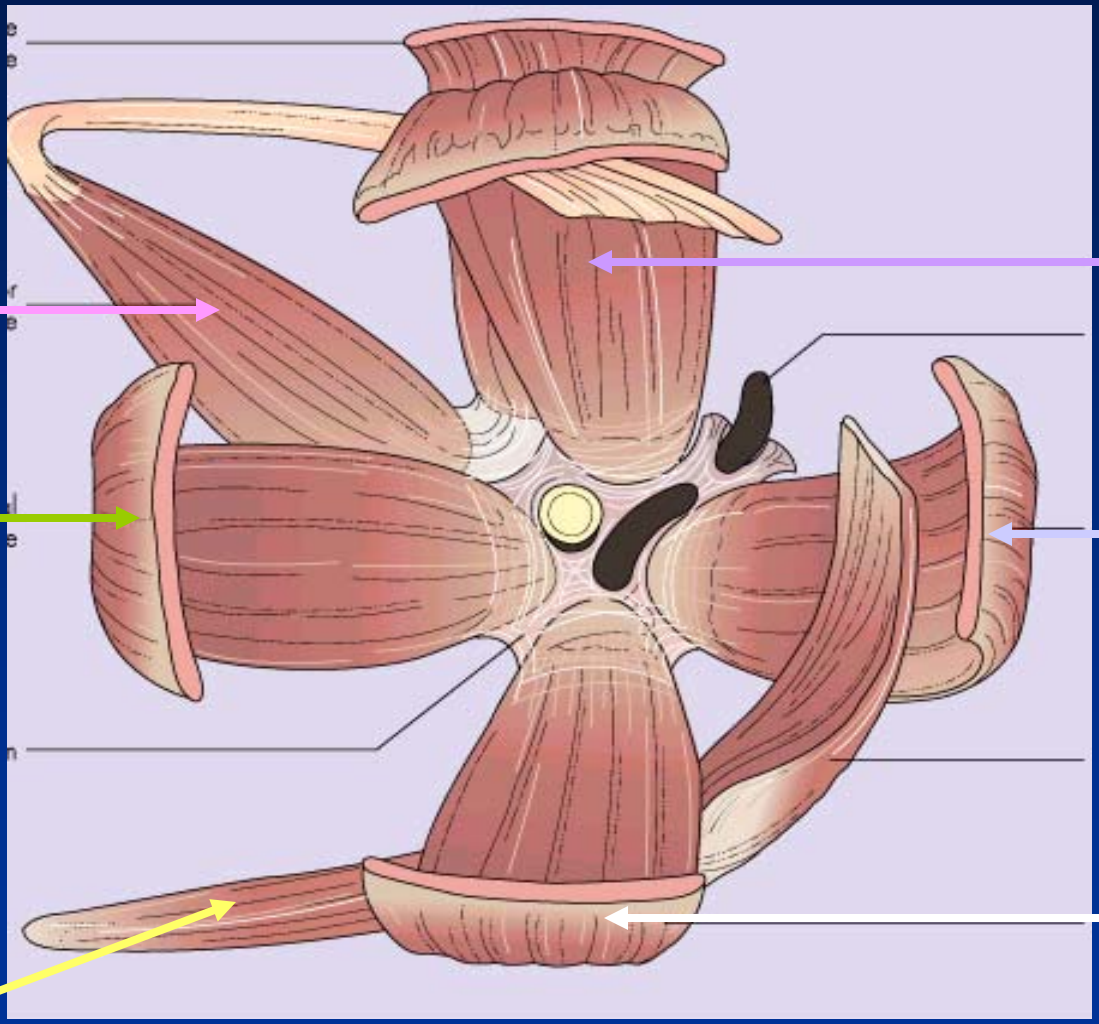
Extraocular Muscles



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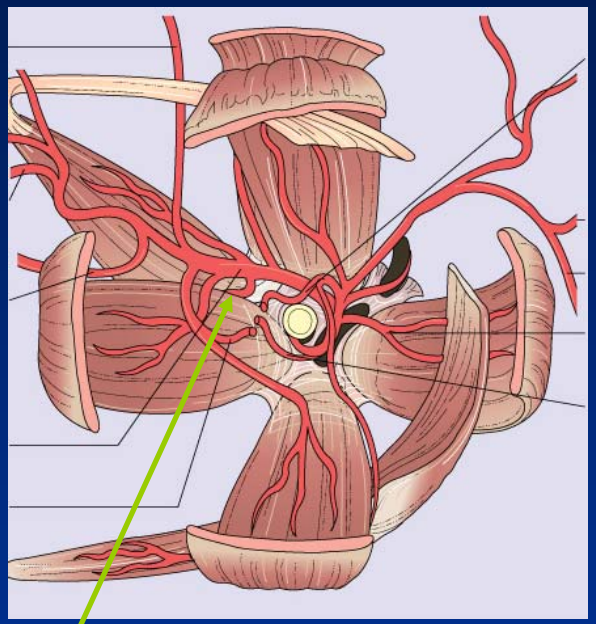
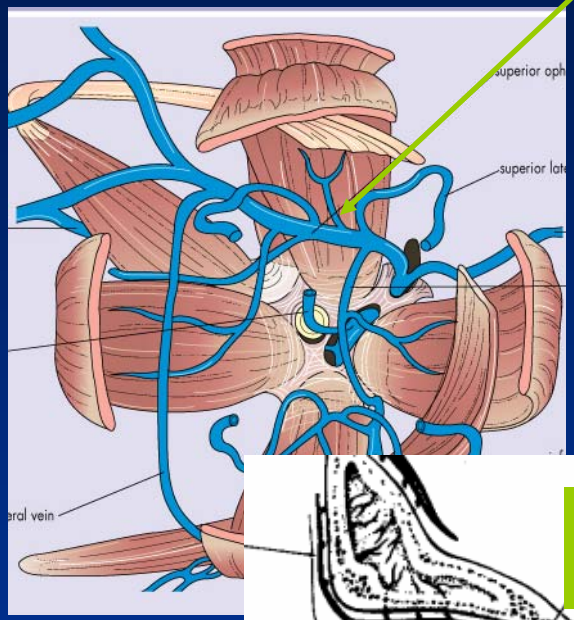
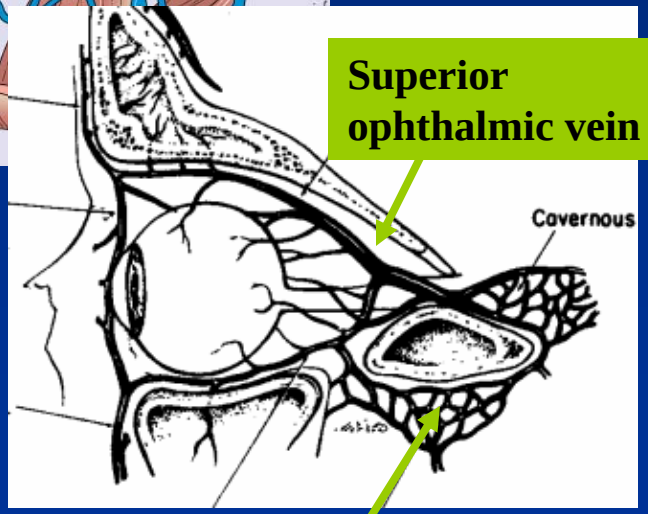
Orbital Vessels



Primary arterial supply to eye is via ophthalmic artery (branch of ICA)



Primary venous drainage via superior ophthalmic vein



Superior ophthalmic vein

Cavernous sinus

Yanoff, M., ed. *Ophthalmology*. St Louis: Mosby , 2004.

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Orbital Imaging Modalities

- Plain film
- Ultrasound
- CT
- MRI

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Orbital Imaging Modalities

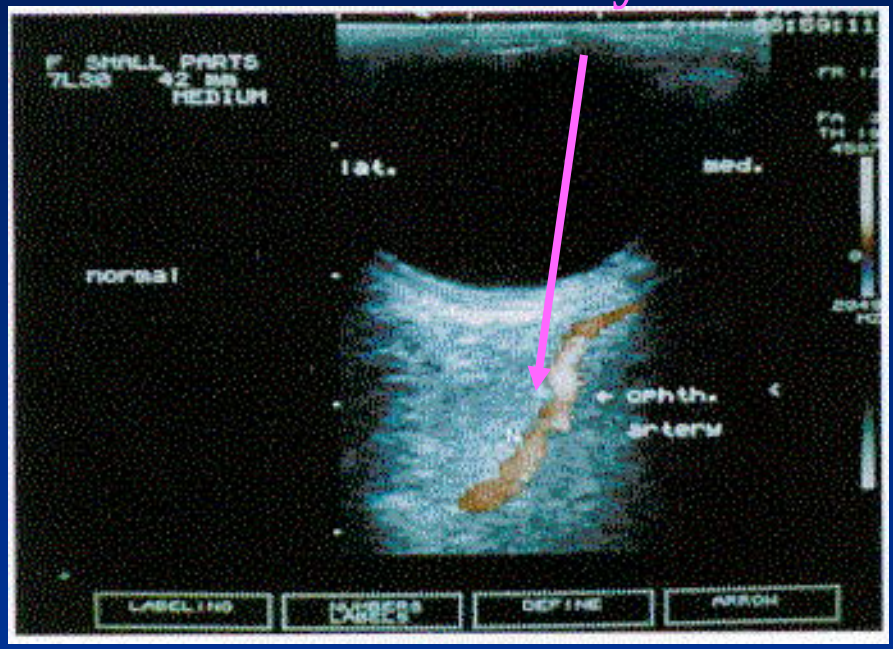
Plain Film

- Rarely used in the evaluation of proptosis

US

- Useful for visualizing anterior and middle orbit
- Vascular malformations
- Color Doppler imaging for detecting areas of low flow

Ophthalmic Artery



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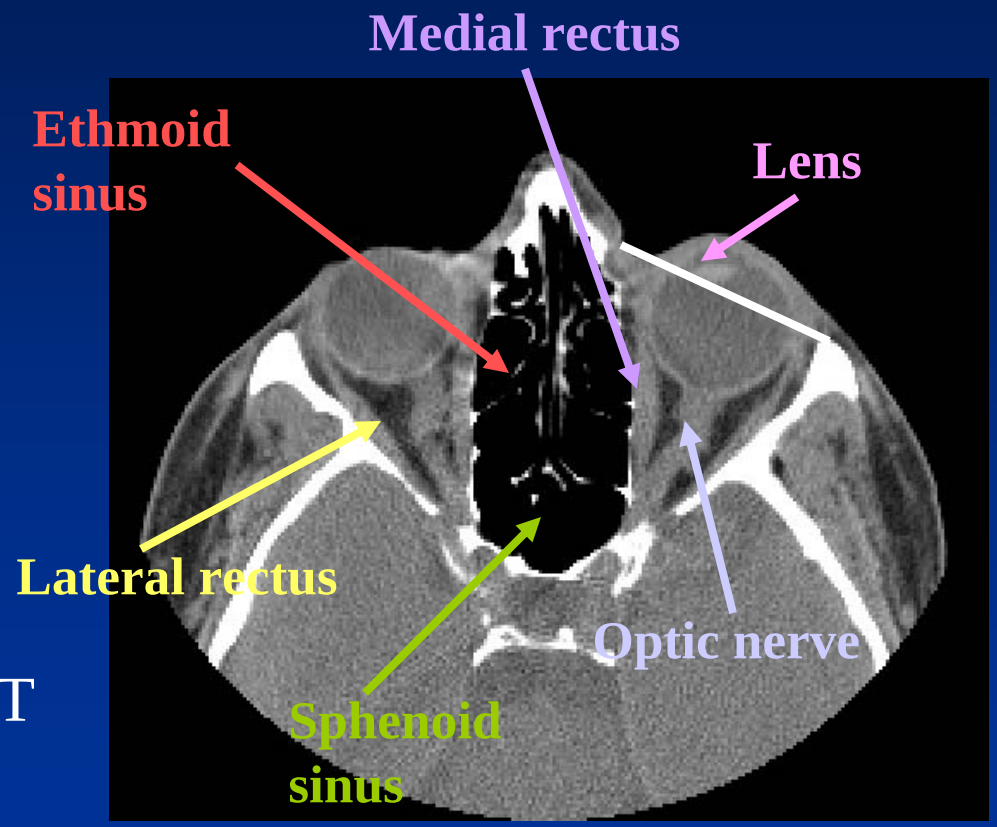
CT

- Spiral CT = primary imaging modality in evaluation of trauma, extraocular muscles, calcifications
- Bony structures well demonstrated
- Fast (acquisition ~ 40 seconds)
- Radiation dose ~ head CT or series of orbital plain films



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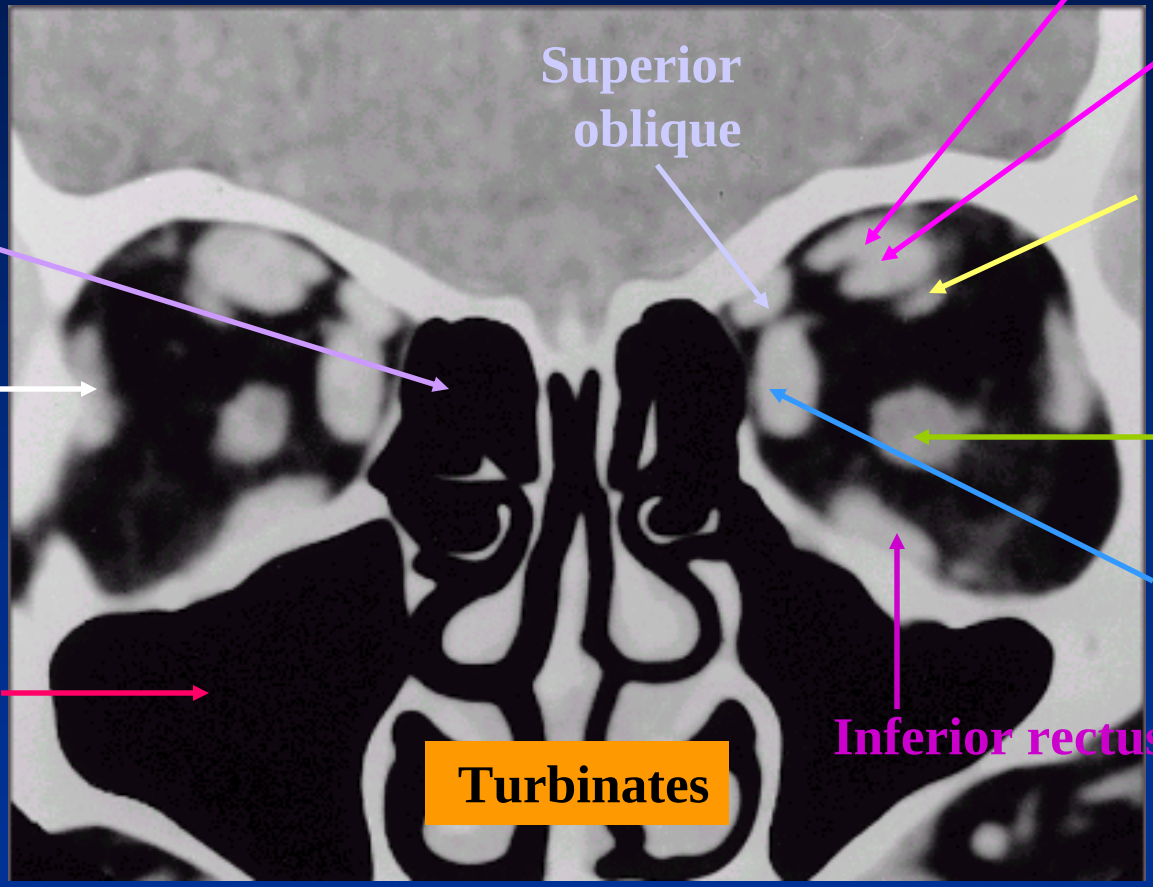
Coronal CT



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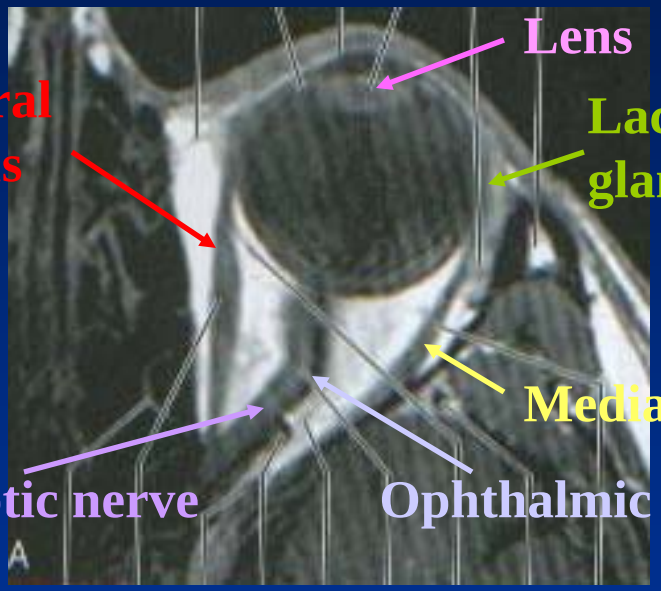
MRI

- Superior soft tissue resolution (optic nerve, orbital fat, tumors)
- Better visualization of structures at orbital apex
- Lack of radiation exposure
- Ability to obtain T1 and T2 weighted images, gadolinium, fat suppression
- Contraindicated if suspicion of metallic foreign body
- Slower acquisition time

T1-weighted scan



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Back to Patient 1…

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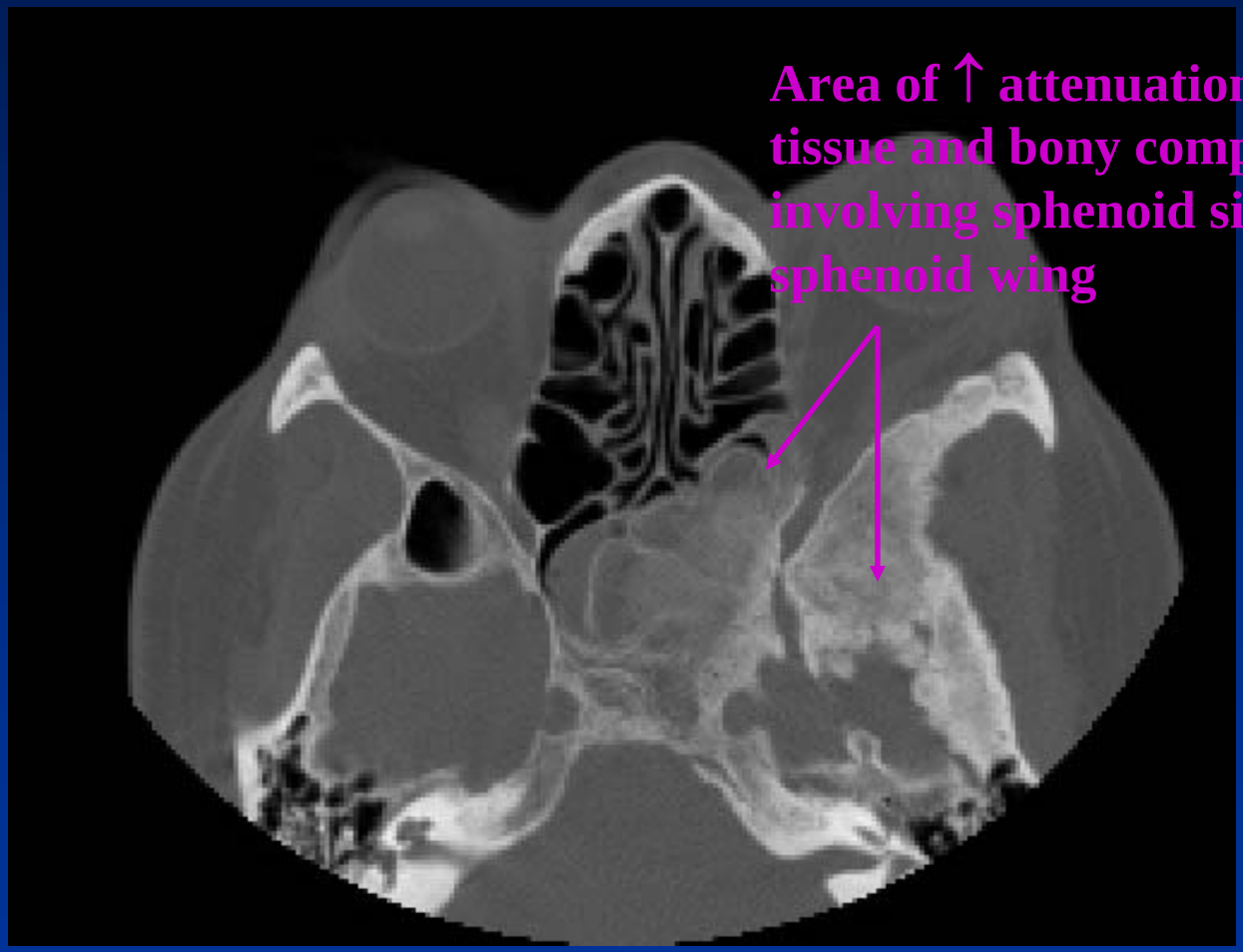
Patient 1 - CT without contrast



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MR pre-gadolinium, T1

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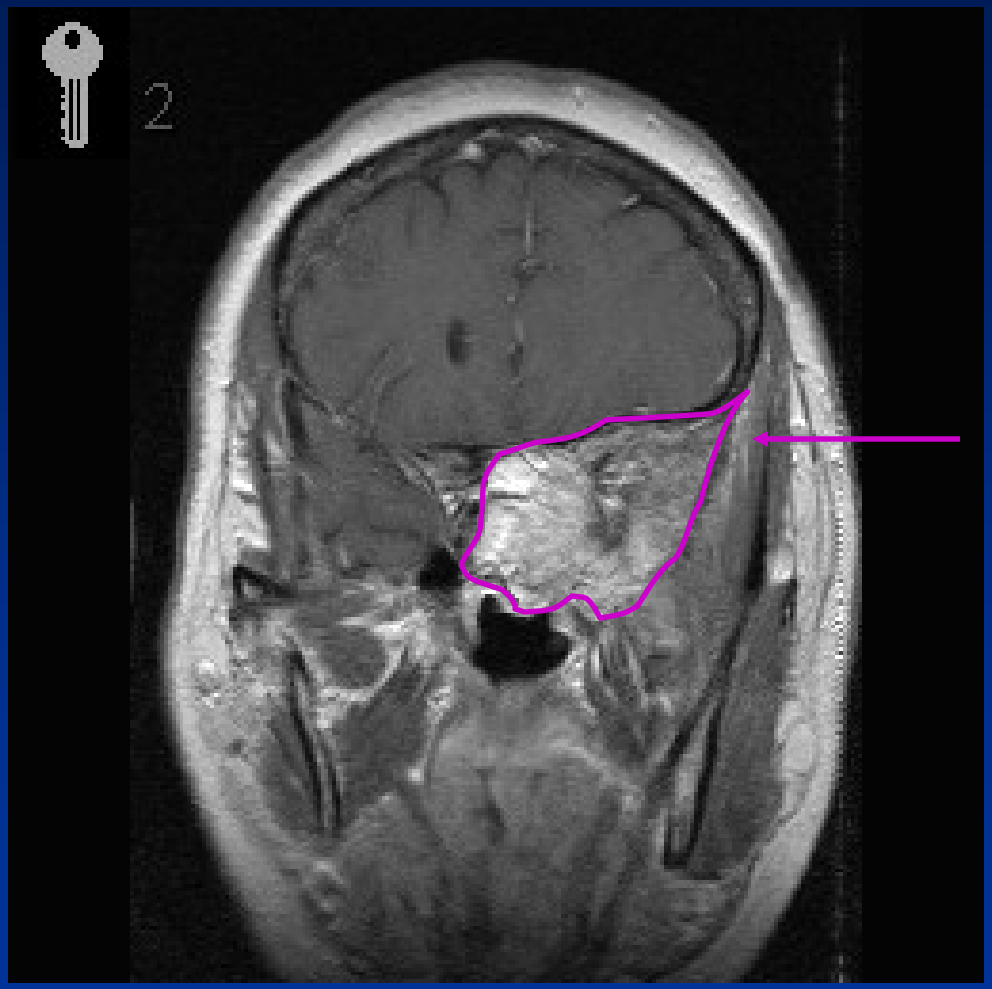
MR post-gadolinium, T1



Diffuse enhancement – but how to distinguish fat (also bright on T1) from abnormality?

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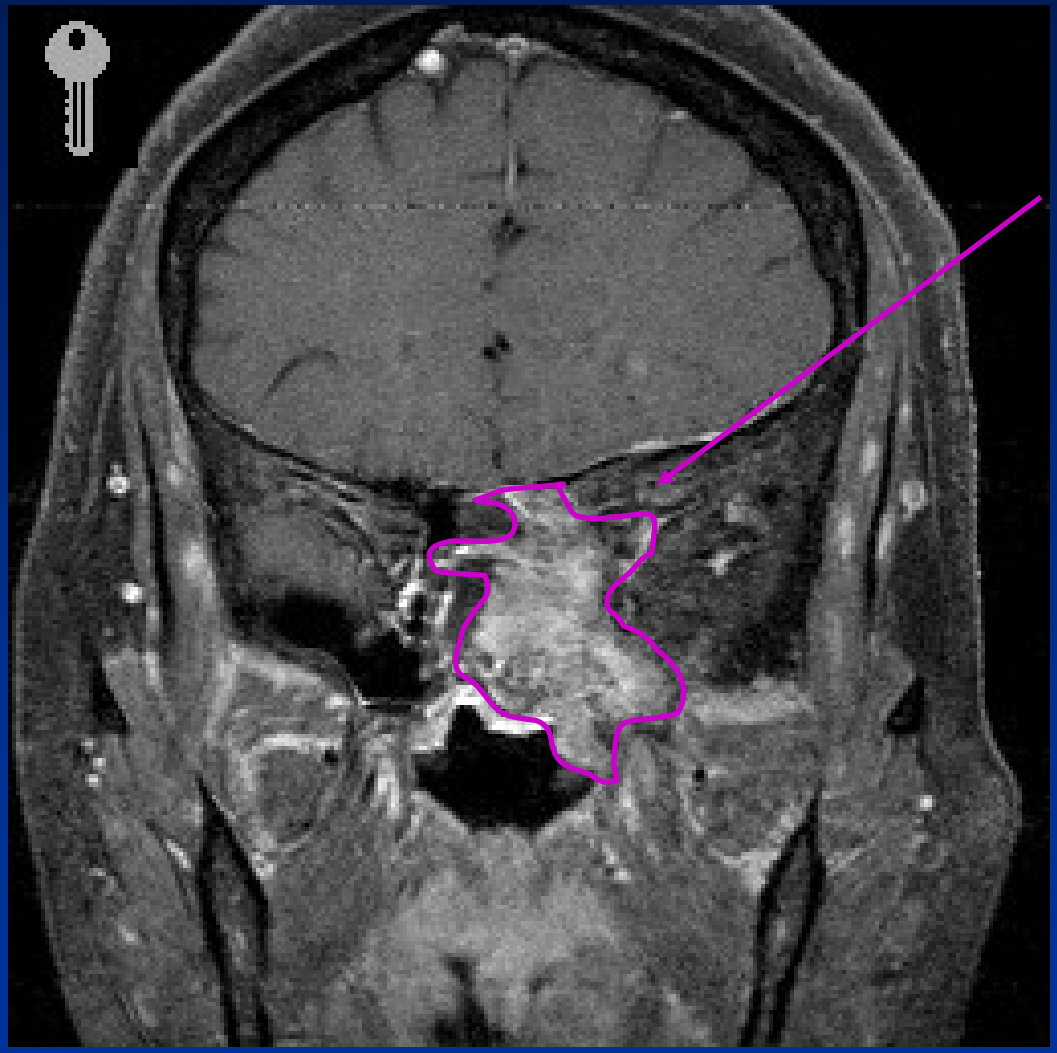
MR w/gadolinium, fat saturation



With fat saturation MRI, can distinguish area of true enhancement

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Fibrous Dysplasia v. Orbital Meningioma

Fibrous Dysplasia

- Idiopathic bone disease - normal bone replaced by weak fibrous and osseous tissue
- Most patients under 30
- Craniofacial involvement often in maxilla
- Associated with McCune-Albright syndrome

Orbital Meningioma

- Benign neoplasm from meningoepithelial cells
- Can arise from optic nerve or extension of intracranial meningioma into orbit
- Often seen in middle-aged to elderly women

Difficult to distinguish since both have similar appearance on MR, with moderate to marked enhancement with IV gadolinium.

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Patient 1

- Radiological findings: Lesion with both soft tissue and bony components involving L orbital apex, sphenoid sinus, and extending into intracranial compartment. Possibly atypical fibrous dysplasia or orbital meningioma
- Based on patient's history and combination of soft tissue and bony components of mass – more likely to be orbital meningioma
- Surgery: L orbital frontotemporal craniectomy
- Pathology: Grade I meningioma with extensive dura and bone involvement

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Patient 2

HPI: 79 yo woman with history of DM, HTN, and glaucoma presenting with few days of L eye proptosis and pain, rapidly increasing in ED. URI two weeks prior.

Eye exam: Pupils equal and reactive to light. Vision intact. Slight L medial rectus weakness, EOM otherwise intact.

ED course: Rapidly rising IOP over few hours in ED, from 16 mmHg $\rightarrow$ 45 mmHg. Lateral canthotomy performed, bringing IOP down to 22.

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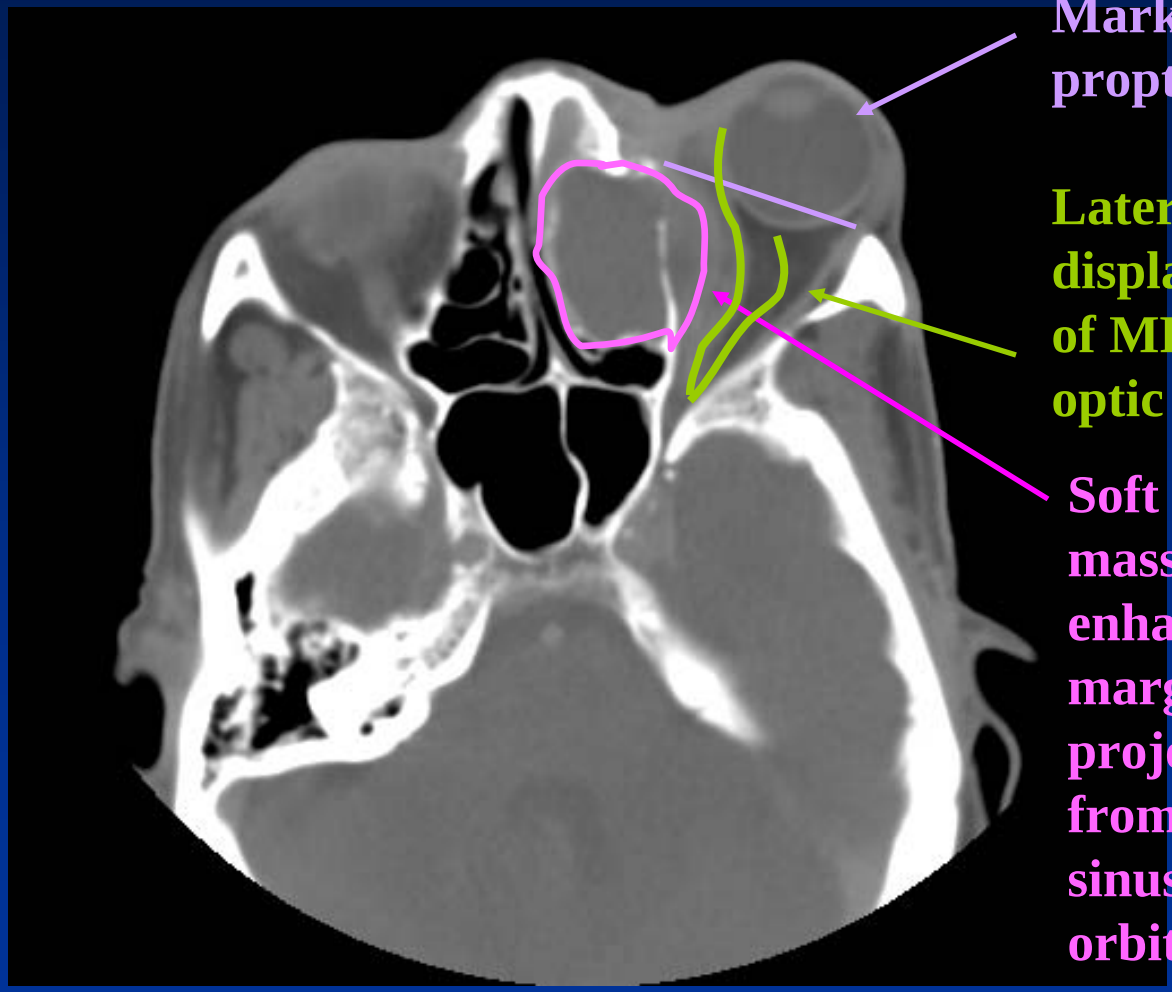
CT with 100cc Optiray



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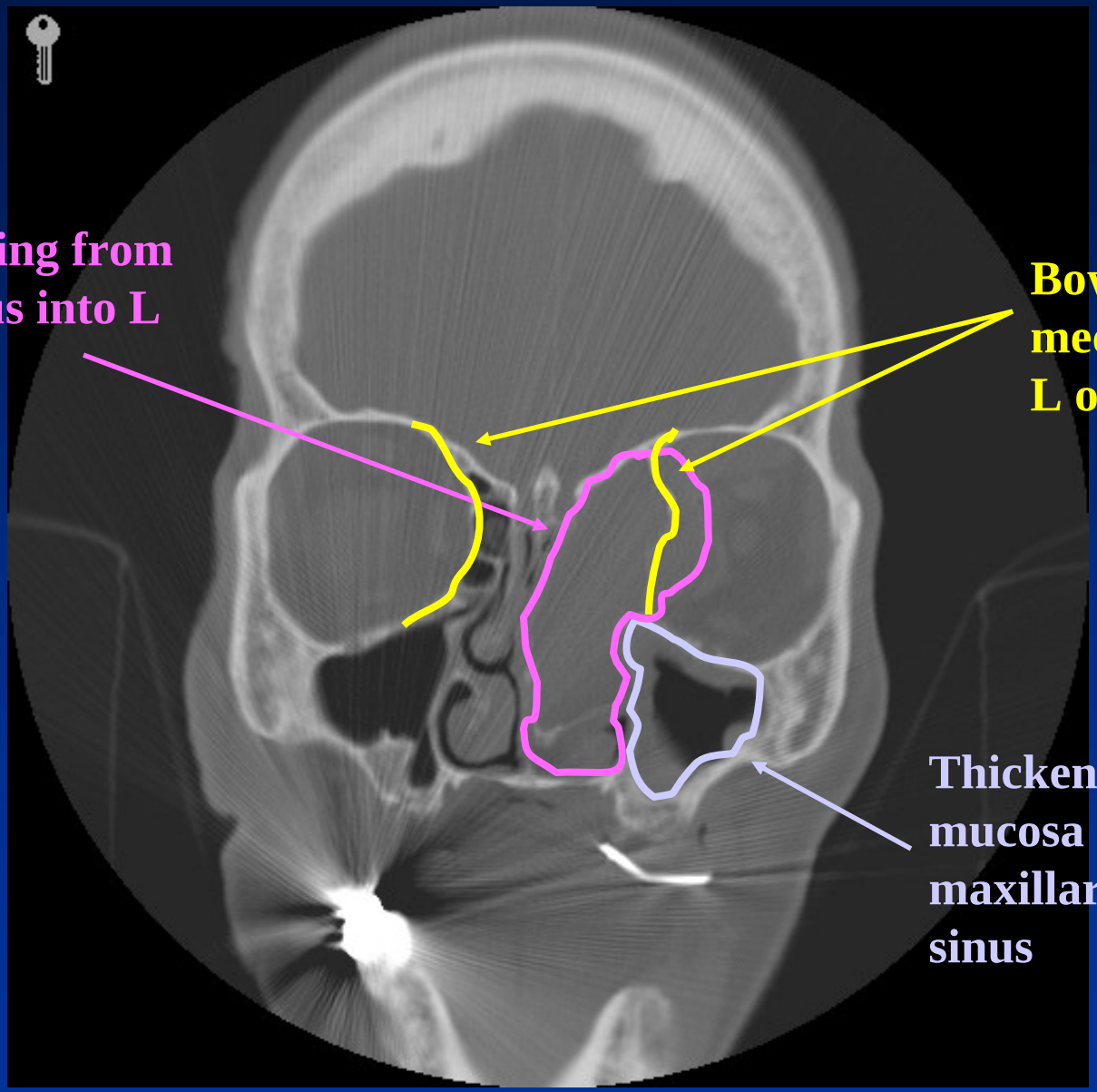

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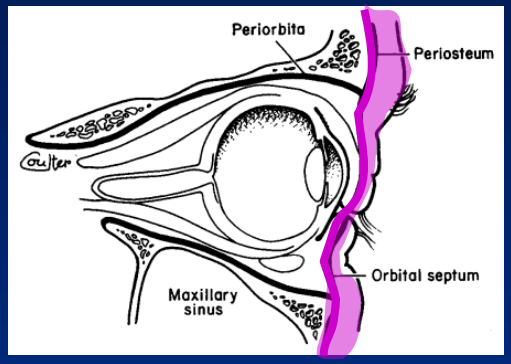
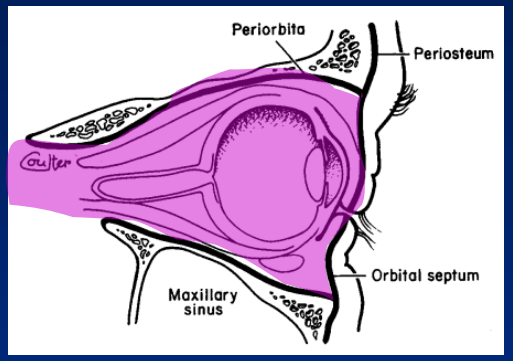
Orbital Infections



Cellulitis



Preseptal (infections anterior to orbital septum)

Postseptal (infection within orbit, w/edema, proptosis, chemosis)

Antibiotics

Orbital Abscess

Subperiosteal Abscess

Cavernous sinus thrombosis

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Imaging of Orbital Infections

- If preseptal (erythema and swelling of eyelids without proptosis) → imaging generally unnecessary
- If suspicion of postseptal cellulitis → CT to look for abnormalities of postseptal tissues
- CT with contrast useful to look for enhancement of edematous orbital fatty reticulum and adjacent tissues in postseptal cellulitis
- Subperiosteal or orbital abscesses should also enhance with contrast

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Orbital Abscess v. Mucocele

Orbital Abscess

- Complication of postseptal orbital cellulitis, typically caused by sinusitis
- Clinical findings: marked proptosis, ophthalmoplegia, and visual loss
- Most require surgical drainage

Mucocele

- Long-standing obstruction with ↑ pressure in sinus causing outward expansion of sinus
- Outward bowing and/or resorption of bony wall of sinus

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Patient 2

Hospital course:

- L middle turbinectomy, total L ethmoidectomy, drainage of ethmoid abscess with endoscopic orbitotomy and drainage of orbital hematoma.
- Post-surgical diagnosis: L orbital hematoma and expanding L ethmoid abscess with mucocele.
- Gross pus found in L ethmoid sinus mass. L orbital hematoma without pus.
- Visual acuity remained 20/30 – 20/40 in L eye.

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Patient 3

HPI: 66 yo man who fell down 20 steps after seizure.

Eye Exam: GCS 6 → no spontaneous eye opening. R eye swelling and proptosis

Studies ordered: CT without contrast.

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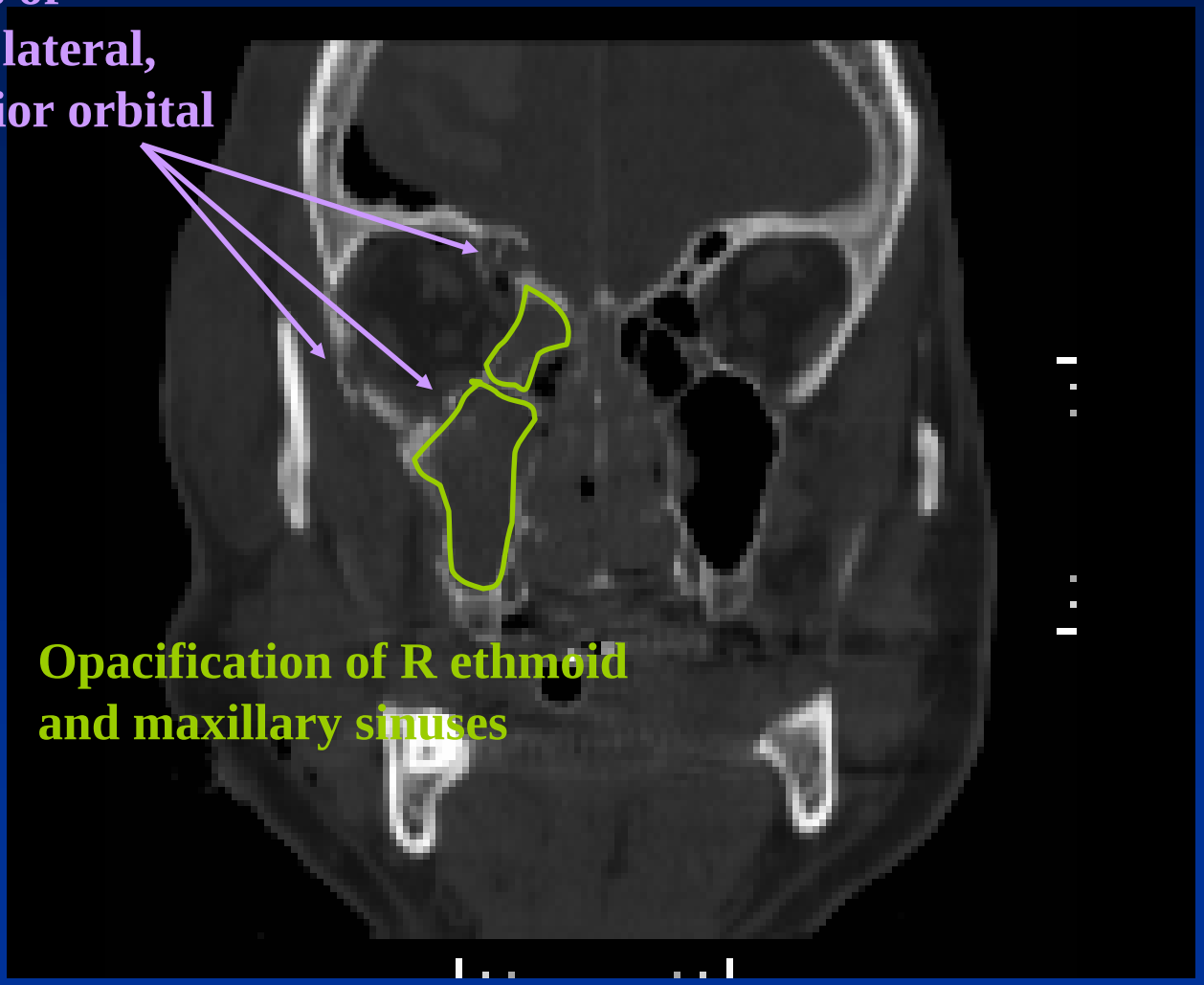
CT without contrast

Fractures of superior, lateral, and inferior orbital walls



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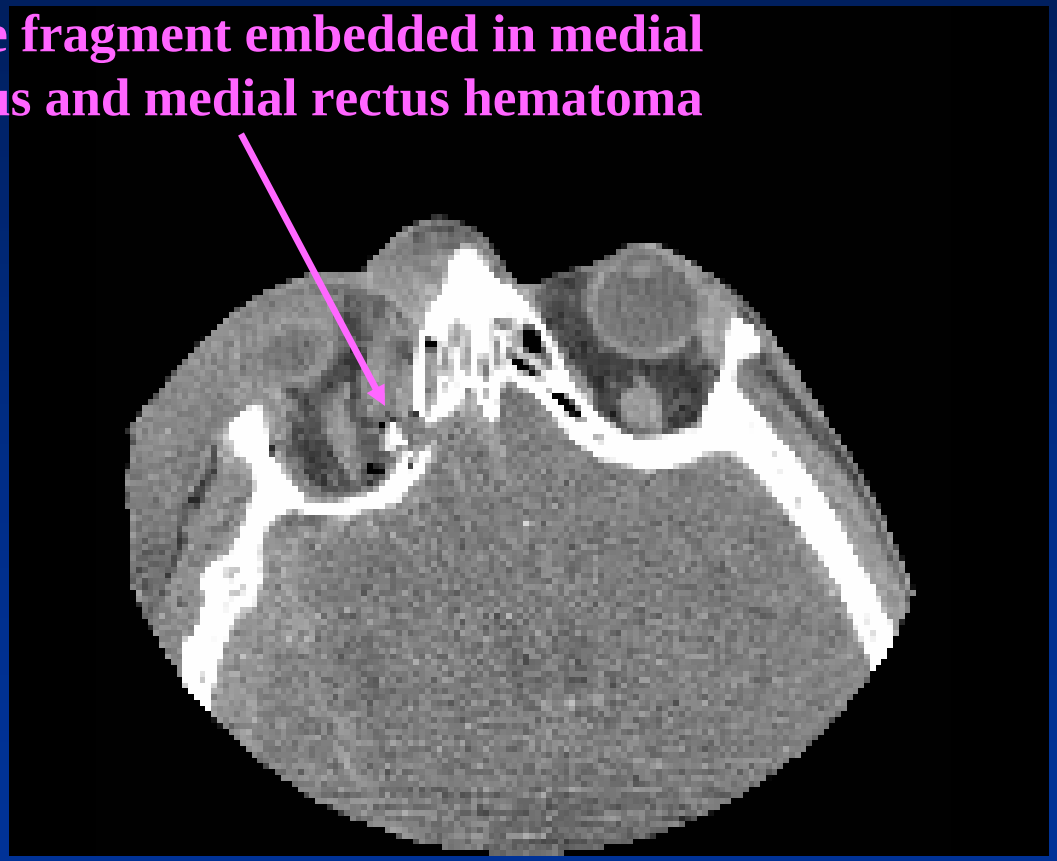
CT without contrast



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Orbital Trauma

Blow-out fracture

- Outward fracture of involved orbital bones
- Most commonly involves lamina papyracea of medial wall and orbital floor
- If orbital floor involved, check for inferior rectus entrapment → need surgical release

Blow-in fracture

- Displacement of orbital fragments toward the orbital space
- Less common
- More commonly involves orbital roof (requires severe blunt trauma)

Very important to tell patients not to blow their nose → can introduce infection into orbit from sinuses

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Orbital Trauma

- High-resolution spiral CT is the primary imaging modality for orbital trauma
- Rapid scan time reduces motion artifacts and is necessary for unstable or uncooperative patients
- Rules out metallic foreign body in case later MR imaging desired (to look for optic nerve sheath hematoma)
- Capability of CT angiography if vascular injury suspected

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Patient 3

Hospital course:

- Due to suspicion for epidural hematoma, worsening subdural hematoma, and frontal lobe contusion → taken to OR for R frontotemporal craniectomy.
- Ophthalmology performed a R lateral canthotomy for increased IOP. However, he was noted to have a persistent right afferent pupillary defect.

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Patient 4

HPI: Patient with known Graves' disease

Eye exam: Marked bilateral proptosis with normal vision.

Studies ordered: CT without contrast.

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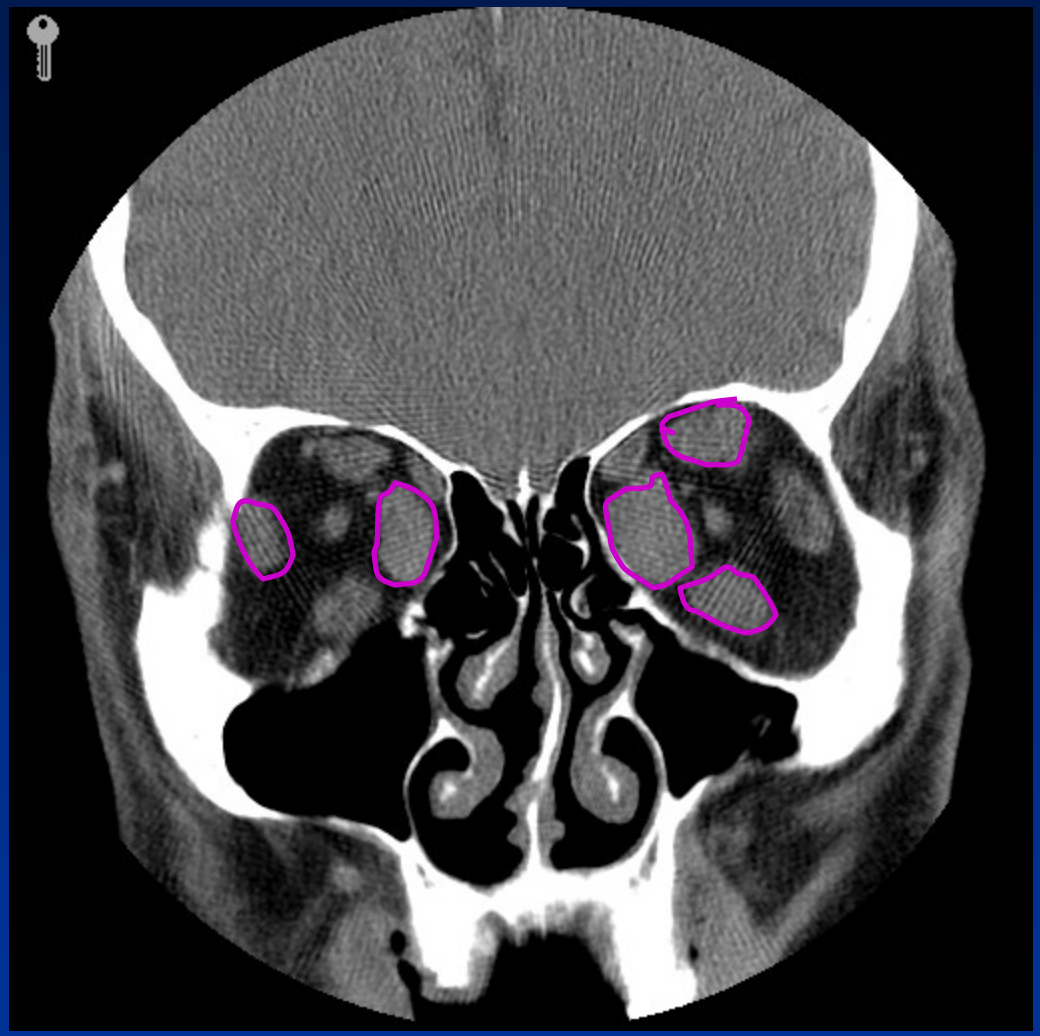
Bilateral massive, asymmetric enlargement of extraocular muscles



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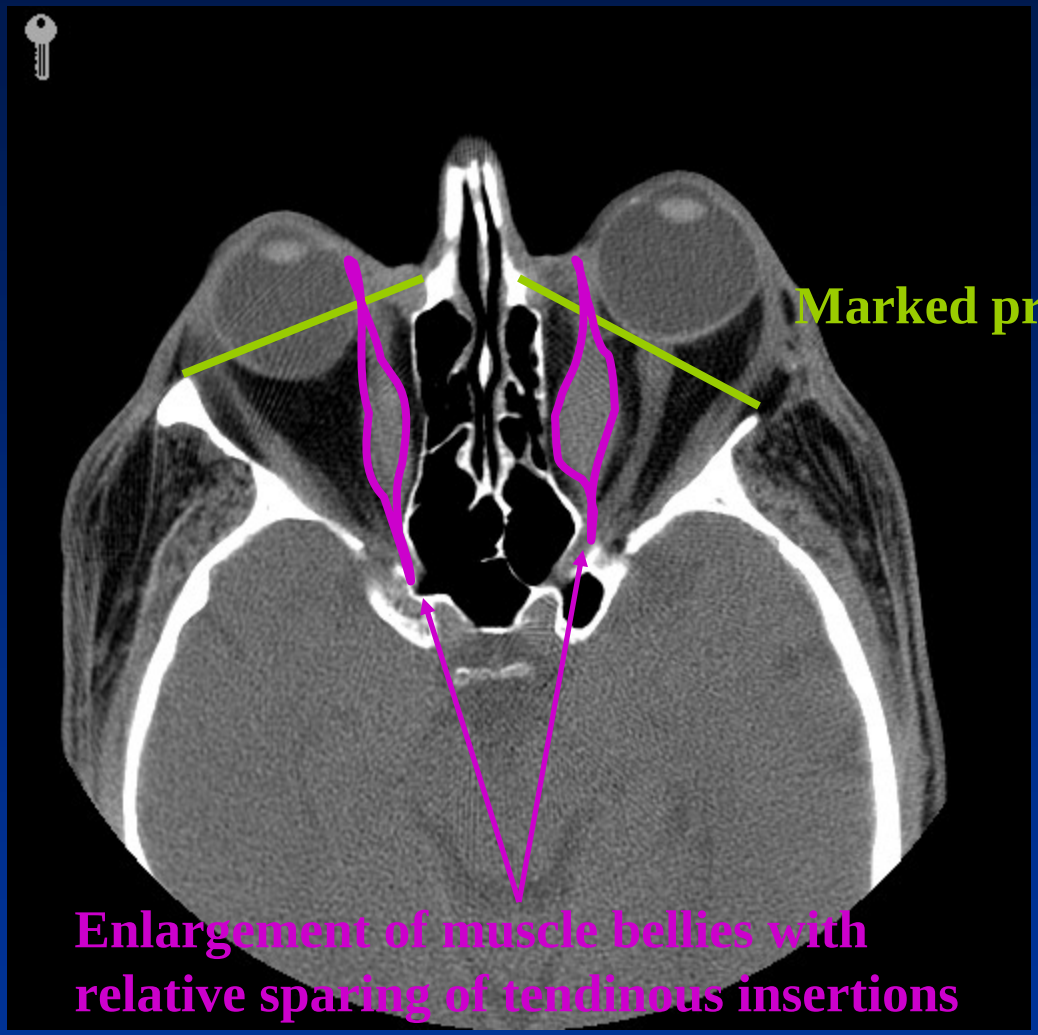

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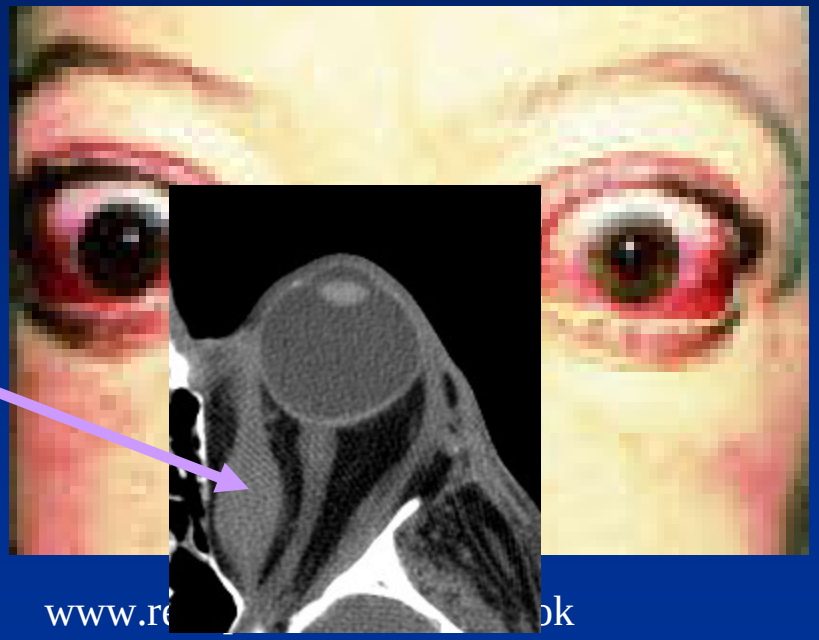
Graves' ophthalmopathy

- Most common cause of proptosis
- Occurs in 20-25% of adults with Graves' disease
- CT is imaging method of choice: characteristic extraocular muscle enlargement with sparing of tendinous insertions, increased retro-orbital fat
- 2 stages of orbital disease: inflammatory and fibrotic



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Graves' ophthalmopathy

Treatment

- 3 components:
  - Treatment of hyperthyroidism, if present
  - Symptomatic treatment
  - For severe or progressive disease → glucocorticoids, orbital irradiation, or surgical orbital decompression
  - Emergency: optic neuropathy due to compression → 22% of patients suffer severe visual loss if untreated
- Treatment of underlying thyroid disease may not alter acute orbital process

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Summary

- Orbital anatomy
- Imaging modalities for the orbit
- Differential diagnosis of proptosis
  - Tumor: meningioma
  - Infection: abscess/mucocele
  - Trauma: multiple orbital fractures
  - Inflammation: Graves' ophthalmopathy

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