

The Orbit

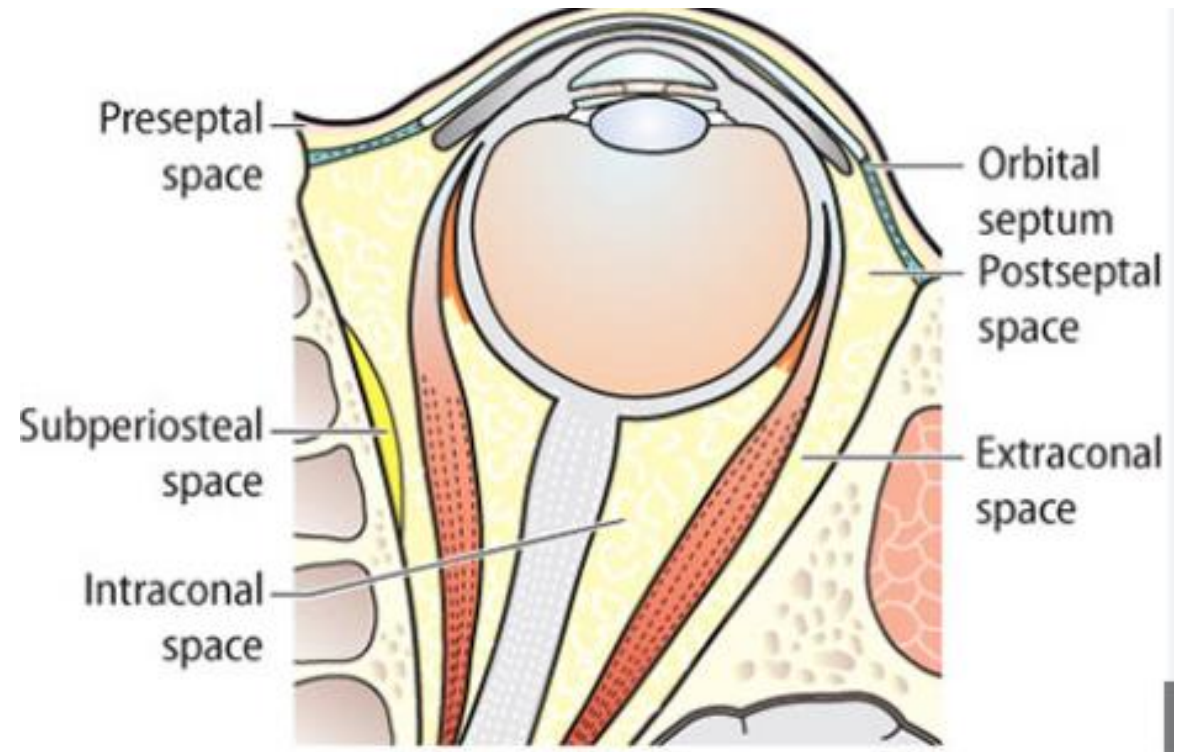
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Anatomy

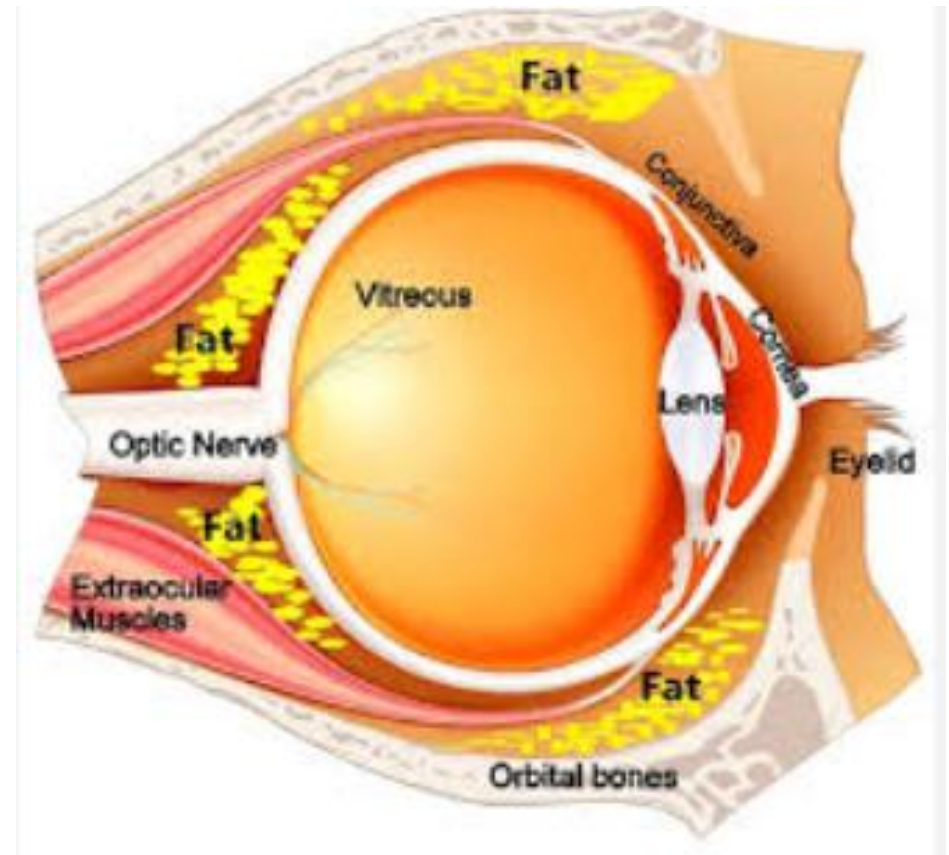
Orbital spaces

- **Intraconal space:** space inside the rectus muscle pyramid
- **Extraconal space:** space outside the rectus muscle pyramid
- **Preseptal space**
- **Postseptal space**
- **Lacrimal fossa**



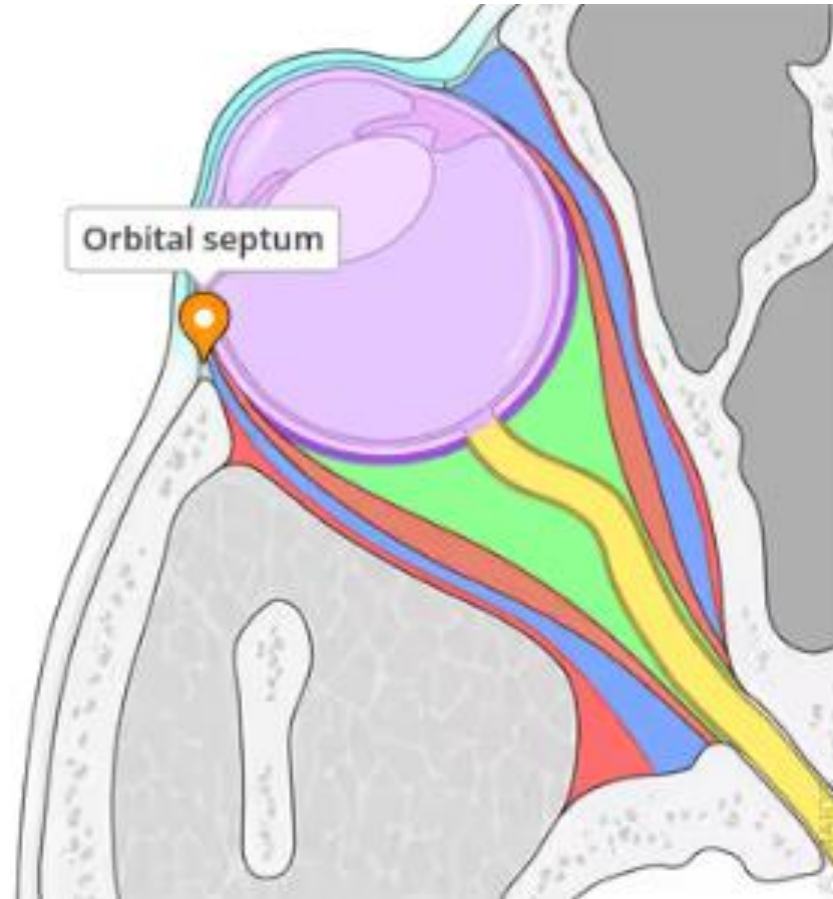
Orbital structures

- Globe (lens, anterior chamber, posterior chamber, vitreous, sclerouveal coat)
- Intraconal, extraconal fat
- Optic nerve and sheath
- Ophthalmic artery and vein
- Rectus muscles



Orbital septum

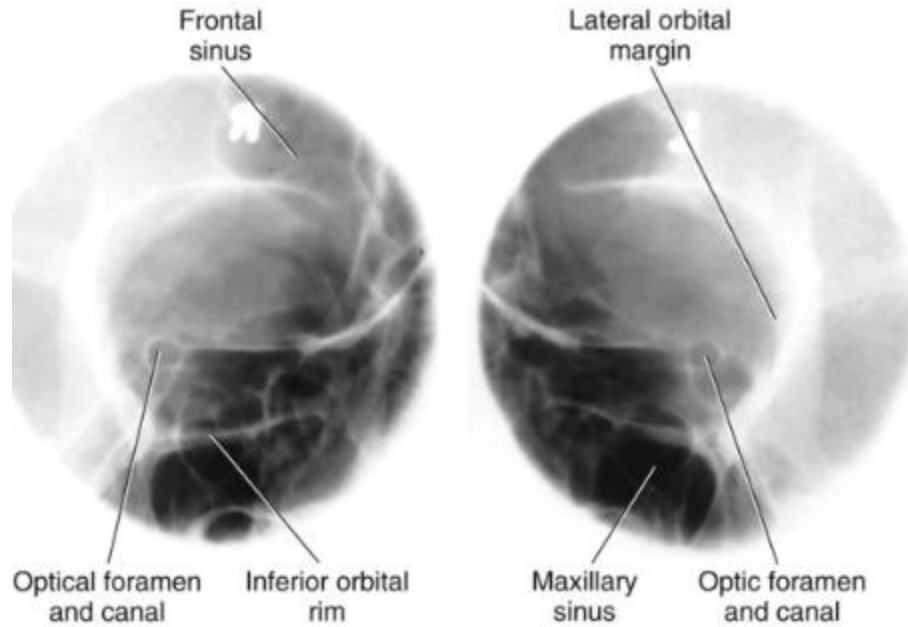
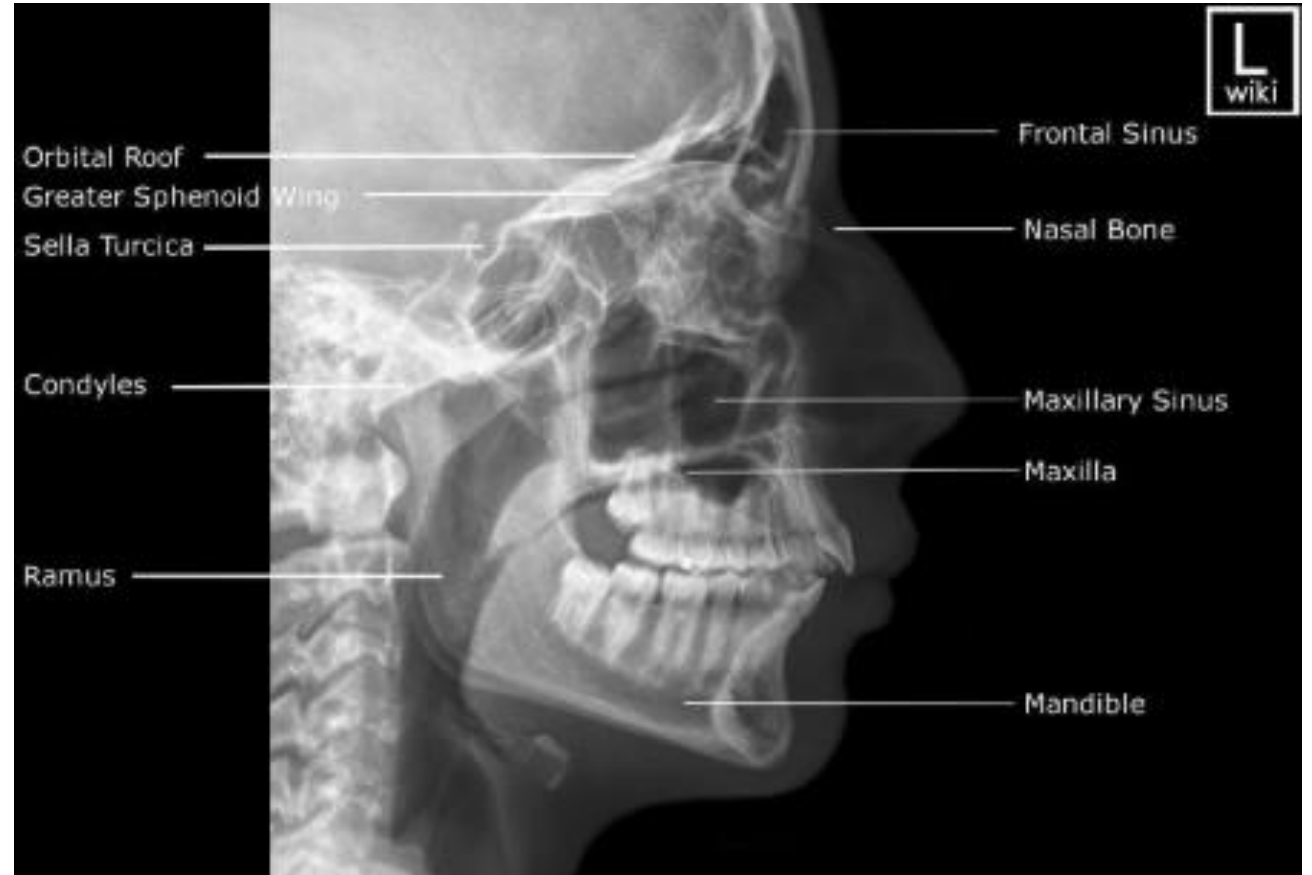
Represents condensed **orbital rim periosteum** ,Attaches to outer margins of bony orbit and deep tissues of lids , it separates all the structures in the orbit from soft tissues in the face (preseptal vs. postseptal)



Orbital Imaging Techniques

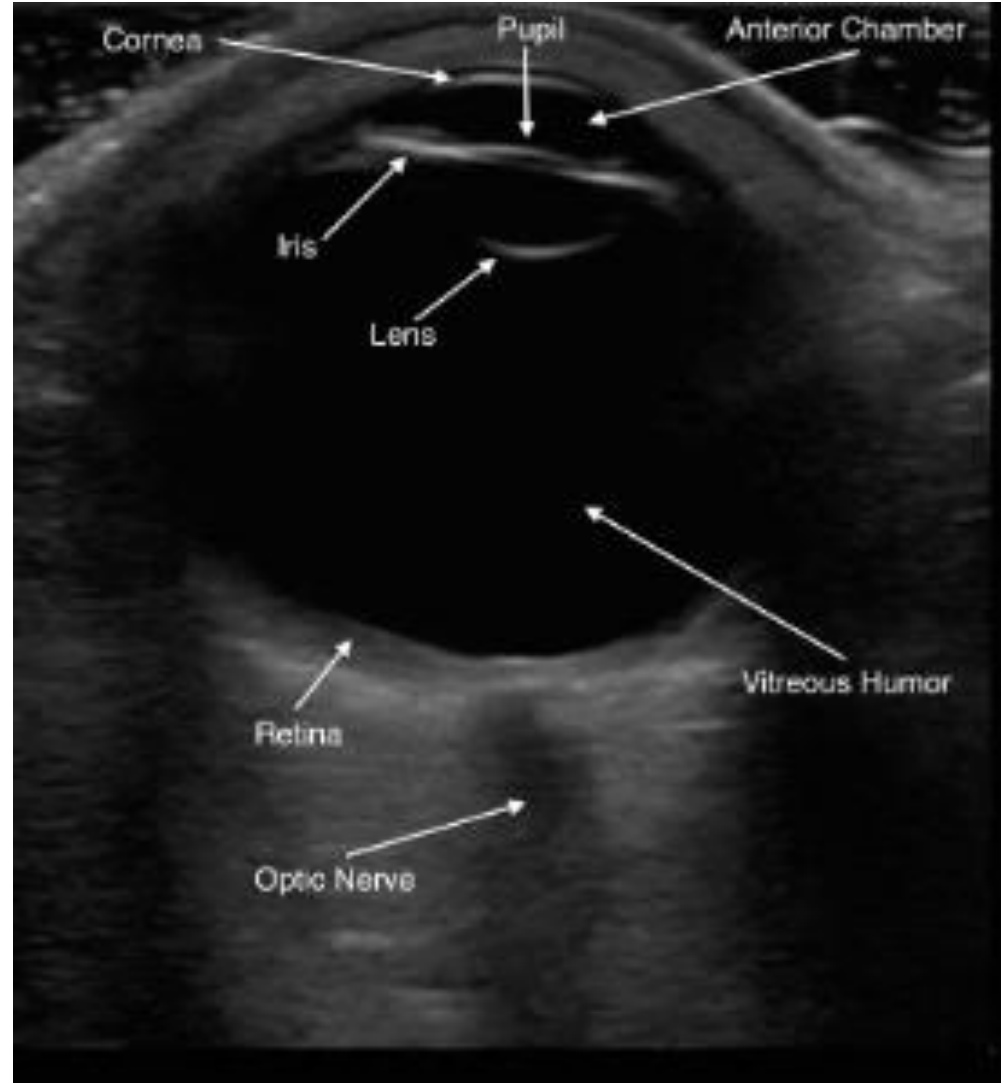
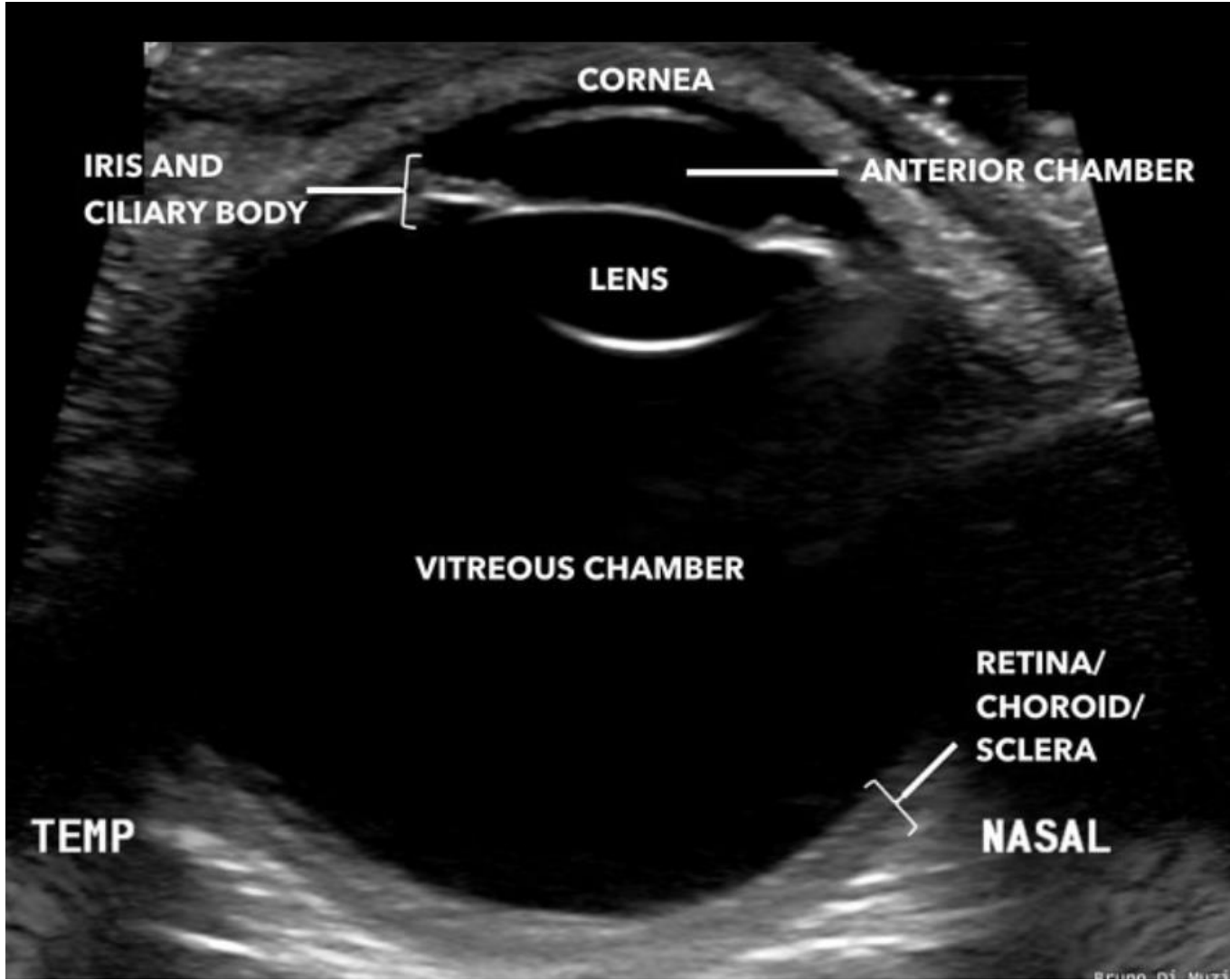
X-Ray

- The use of x-ray is limited to patients with trauma or suspected intraorbital foreign body.
- Standard views include PA view, lateral view and optic foramen view.
- In a **true lateral radiograph**, there should be superimposition of the floor of anterior cranial on both sides.
- For optic foramen and superior oblique fissure, **Rheese projections** are used.



Ultrasound

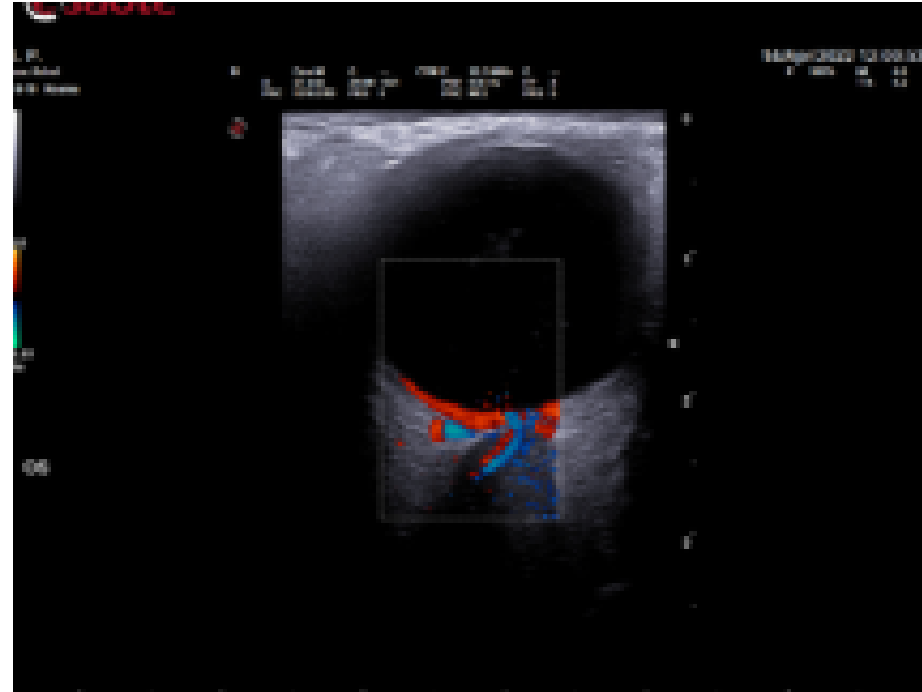
- It is non-invasive, cost-effective and easy to perform.
- It is an important first line investigation for evaluating **intraocular pathology** especially in opaque media.
- It helps in **differentiating** cystic from solid lesions.
- It has two modes A scan and B scan.
- In normal eyes anterior and posterior chamber are cystic with echogenic lens present in between.
- Posterior to the globe, fat (echogenic) along with optic nerve sheath complex is seen as a central hypoechoic linear structure.
- Ultrasound **has limited use** in **deep-seated, orbital lesions** due to decreased resolution with depth.
- Its use is **contraindicated** in open globes.



Contrast enhanced ultrasound is **microbubble-based ultrasound** with contrast agents helping in differentiating masses from **pseudo masses (RD, haemorrhage)**.

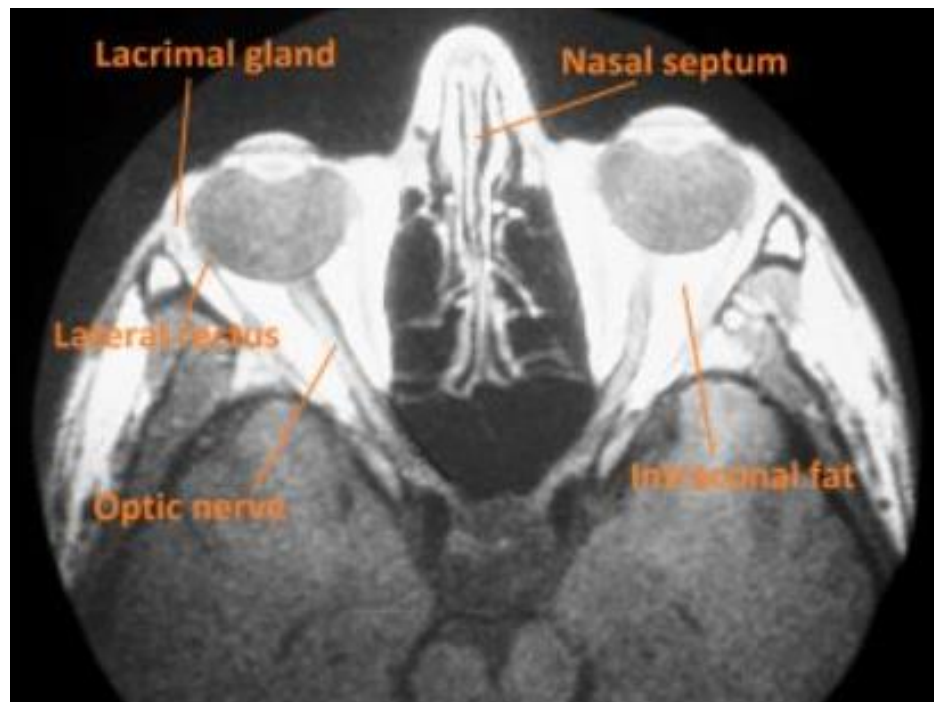
Color Doppler

Helpful in evaluating blood flow in vascular lesions like vascular malformations, arterial/venous tumours, AVM & CCF.

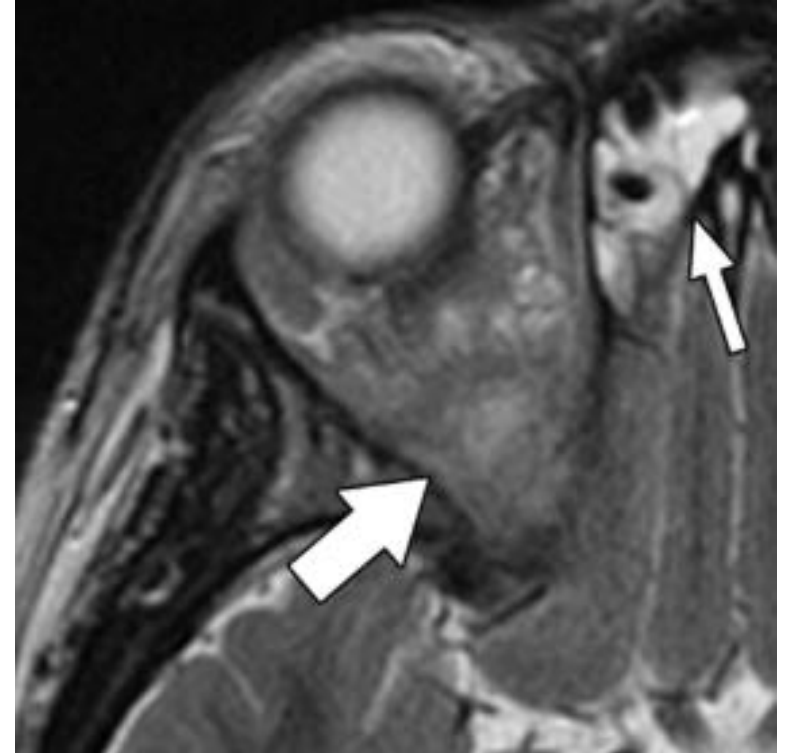


Computed Tomography (CT scan)

- CT is an important modality of orbital imaging.
- It provides volumetric cross-sectional image acquisitions.
- It is useful for orbital trauma to assess **bony fracture or extraocular muscle entrapment and in intraorbital foreign body** localization.
- It has an advantage over MRI **in assessing orbital osseous** lesions or soft tissue lesions that cause bony erosion, presence of calcification, and to differentiate acute hemorrhage from mass lesions.
- It is also useful to evaluate anatomy of extraocular muscles and orbital apex in thyroid eye disease.



- Contrast enhanced CT is performed following intravenous administration of iodine rated contrast media like iohexol (omnipaque) & iodixanol (visipaque).
- It is performed to evaluate different orbital lesions with different enhancement patterns.
- Enhancement is based on the blood flow and vascular permeability.
- It is also useful in identifying abscesses in the orbit by portraying a **"ring enhancement."**





Magnetic Resonance Imaging (MRI)

- MRI provides higher soft issue resolution and tissue characterization, with better delineation of different orbital components.
- It helps in the diagnosis of neoplasm, vascular malformation, inflammatory disorders, and optic nerve lesions.
- Diffusion Weighted Images (DWI) help in further characterization of orbital masses.
- It also separates abscess which is more diffusion restricted from other inflammatory processes.

MRI vs CT

- MRI is the preferred imaging modality as it **provides excellent soft tissue resolution** of orbital contents, images the **optic nerve** along its entire course without any bony shadow and has no exposure of radiation.
- However, it **is costly**, requires the patient **to lie still for a long time** and is an **absolute contraindication in metallic intraorbital foreign bodies and cardiac pacemakers** .

Some eye diseases

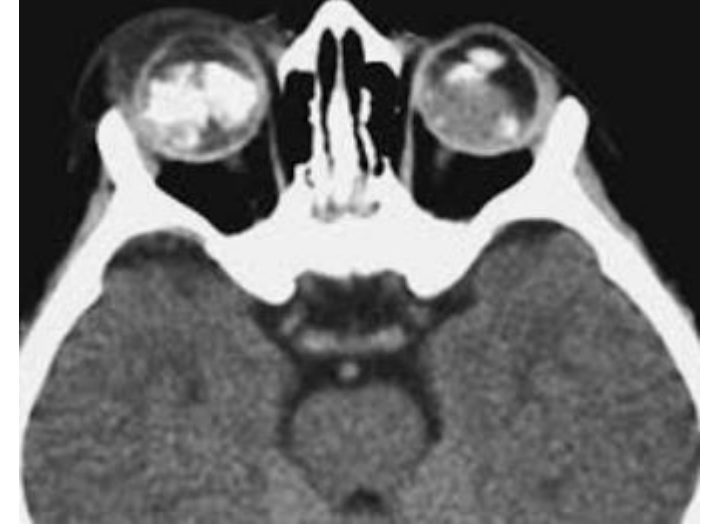
- CT is the ideal modality in bony pathologies, calcification, intraorbital foreign bodies and fracture.
- It is economical and requires a shorter duration of time. However, it has exposure of radiation specially in cases when required in repeated imaging and in children.
- It is also less sensitive for soft tissues, optic nerve, and cavernous sinus disorders.
- Orbital structure imaging requires slice thickness of 3 or 4 mm and inter slice thickness of 0.5 to 1mm.

RETINOBLASTOMA

Malignant tumor that arises from neuroectodermal cells of retina . Age: < 3 years (70%) 30% bilateral, 30% multifocal within one eye 10% of patients have a familial history of retinoblastoma

Radiographic features

1. Intraocular mass
2. High density (calcification, hemorrhage)
3. Dense vitreous, common
4. Calcifications are common (90%); in absence of calcifications suspect other mass lesions



MELANOMA

Most common (75%) ocular malignancy in adults. Arises from pigmented choroidal layer; retinal detachment is common.

Radiographic features:

- Thickening or irregularity of choroid (localized, polypoid or flat)
- Exophytic, biconvex mass lesion usually unilateral, posterior location
- Retinal detachment, common Contrast enhancement
- MRI: T1 hyperintense, T2 hypointense



OPTIC NERVE GLIOMA

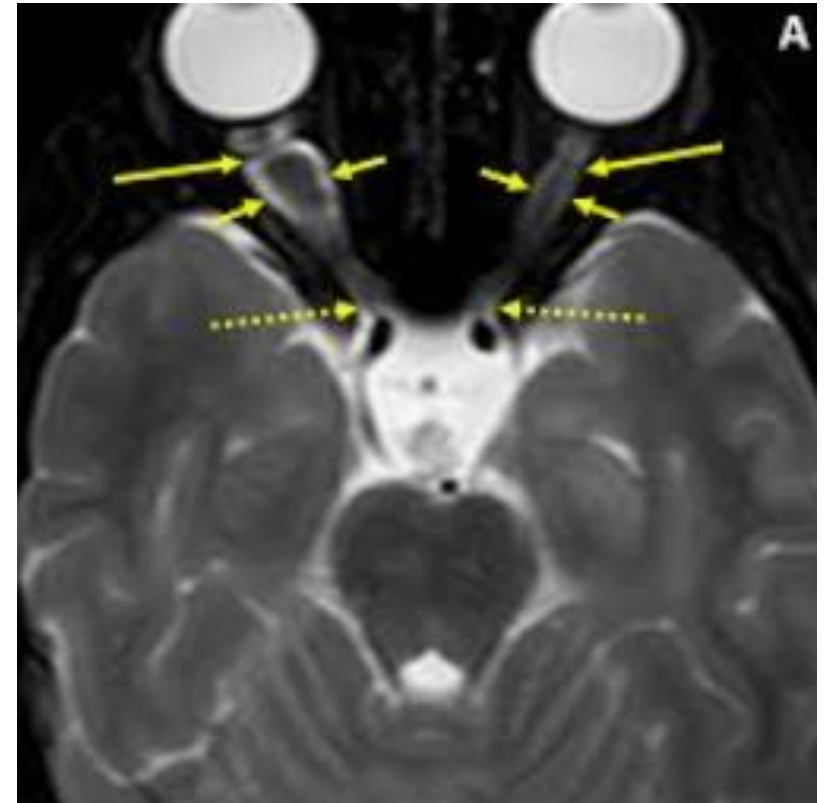
Most common cause of diffuse optic nerve enlargement, especially in childhood.

Pathology: usually well-differentiated, pilocytic astrocytoma.

Clinical: loss of vision, proptosis . 80% occur in first decade of life. In neurofibromatosis (NF) the disease may be bilateral.

Radiographic features

- 1.Types of tumor growth: tubular, excrescent, fusiform widening of optic nerve
- 2.Lower CT density than meningioma
- 3.Contrast enhancement is variable
- 4.Calcifications are rare (but are common in meningioma)
- 5.Tumor extension best detected by MRI



OPTIC NERVE MENINGIOMA

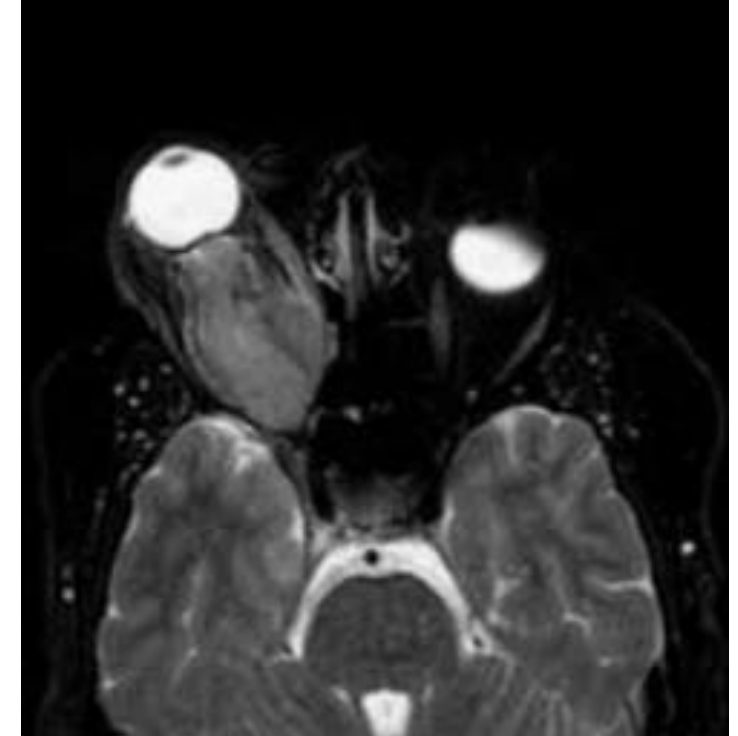
Optic nerve sheath meningiomas arise from arachnoid rests in meninges covering the optic nerve.

Age: 4th decade (80% female); younger patients typically have NF.

Clinical: progressive loss of vision.

Radiographic features

- Mass , Tubular, 60% , Fusiform, surrounding the optic nerve, 25% , Eccentric 15% , Calcification (common)
- Enhancement Intense contrast enhancement
Linear bands of enhancement (nerve within tumor)



HEMANGIOMA

- Common benign tumor of the intracranial space.
- Types: Capillary hemangioma (children; strawberry nevus): no capsule
- Cavernous hemangioma (adults): true capsule, benign Large dilated venous channels with fibrous capsule
- Both show dense enhancement with contrast Signal intensity similar to fluid (e.g., CSF) on T2W



DERMOID CYST

- Common orbital tumor in childhood.
- Age: 1st decade.
- Radiographic features : Low CT attenuation and T1 hyperintensity (fat) is diagnostic



THYROID OPHTHALMOPATHY

Radiographic features

Exophthalmos , Muscle involvement (Inferior is most common , Medial , Superior and Lateral) , spares tendon insertions , Often bilateral symmetric , Optic nerve thickening , Expansion of orbital fat



ORBITAL PSEUDOTUMOR

- Inflammation of orbital soft tissues of unknown origin.
- Clinical: painful proptosis, unilateral, steroid responsive.
- Causes: Idiopathic , Systemic disease: sarcoid, endocrine , Unrecognized focal infections, foreign bodies

Radiographic features

Infiltrating intraconal or extraconal inflammation presenting as ill-defined infiltrations or less commonly as a mass



Typical features : Unilateral , Unlike thyroid ophthalmopathy, pseudotumors involve tendons of muscles (because it is inflammatory disease) , Stranding of orbital fat (inflammation)

DIFFERENTIATION		
	Pseudotumor	Thyroid Ophthalmopathy
Involvement	Unilateral, 85%	Bilateral, 85%
Tendon	Involved	Normal
Muscle	Enlargement	Enlargement: I > M > S > L
Fat	Inflammation	Increased amount of fat
Lacrimal gland	Enlarged	
Steroids	Good response	Minimal response

ACUTE INFECTIONS

- Bacterial infection (extraconal > intraconal)
- are often due to sinusitis,
- complicated **by cavernous sinus thrombosis.**
- Types: Blunt trauma with orbital blowout fractures, 50% , Penetrating injury, 50%





'Blowout' fracture

Thyroid eye disease

