The Orbit

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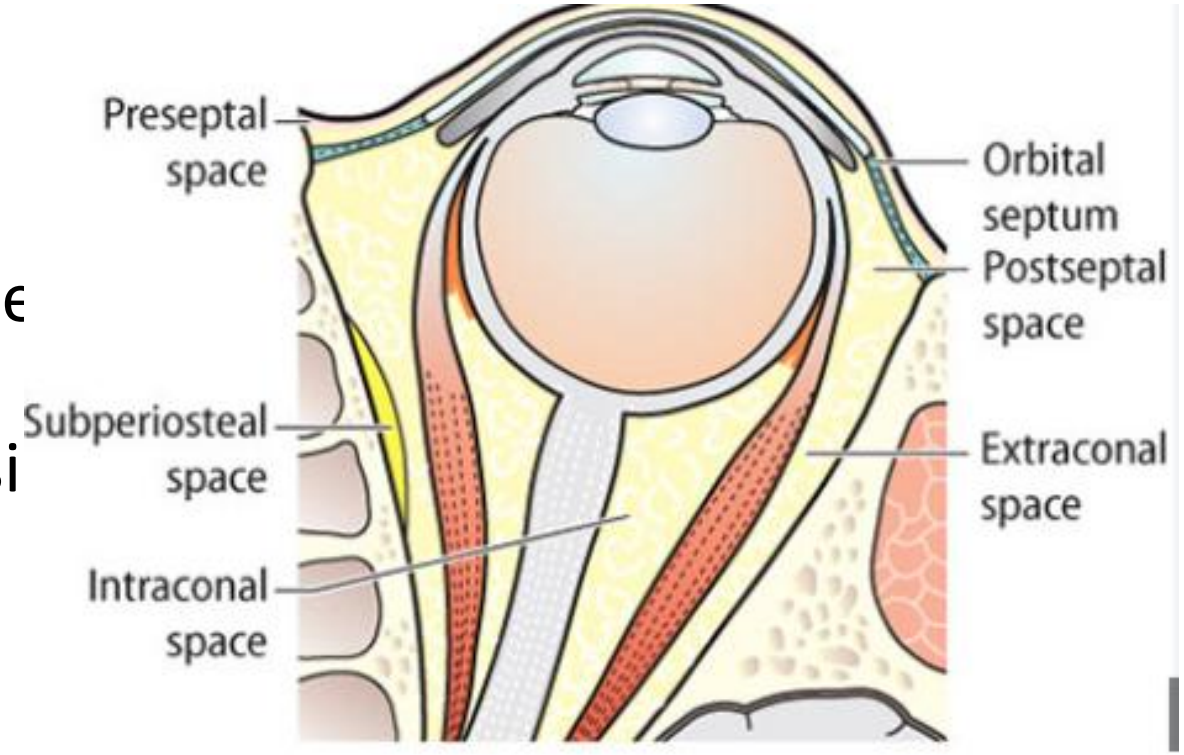
Anatomy

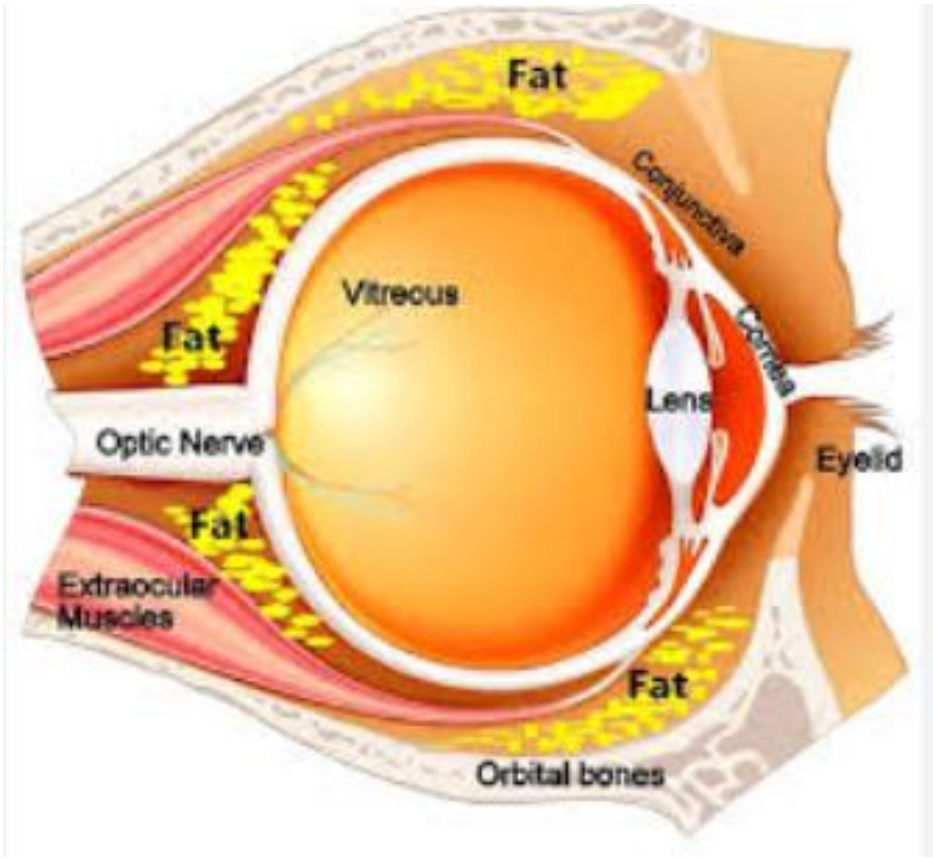
Orbital spaces

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



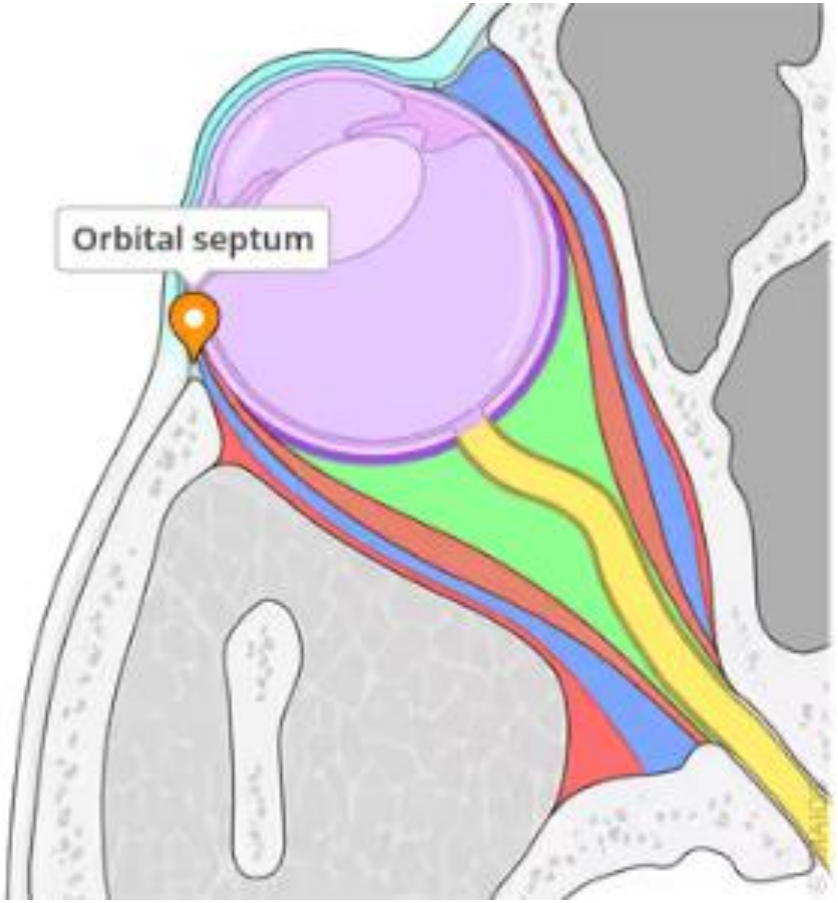
Orbital structures

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



Orbital septum

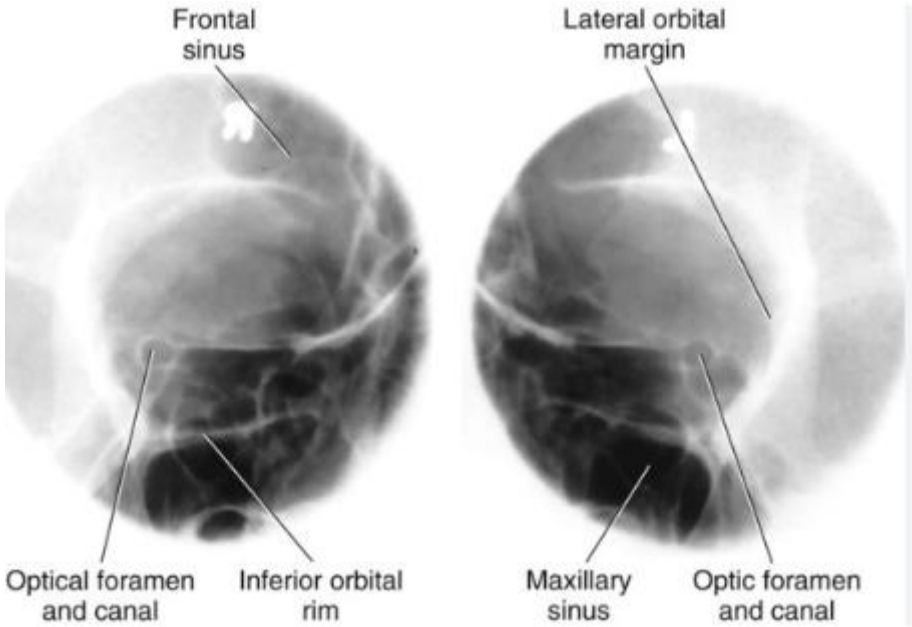
Represents condensed **orbital rim periosteum** ,Attaches to outer margins of bony orbit and deep tissues of lids , it separates all the structures in the orbit from soft tissues in the face (preseptal vs. postseptal)

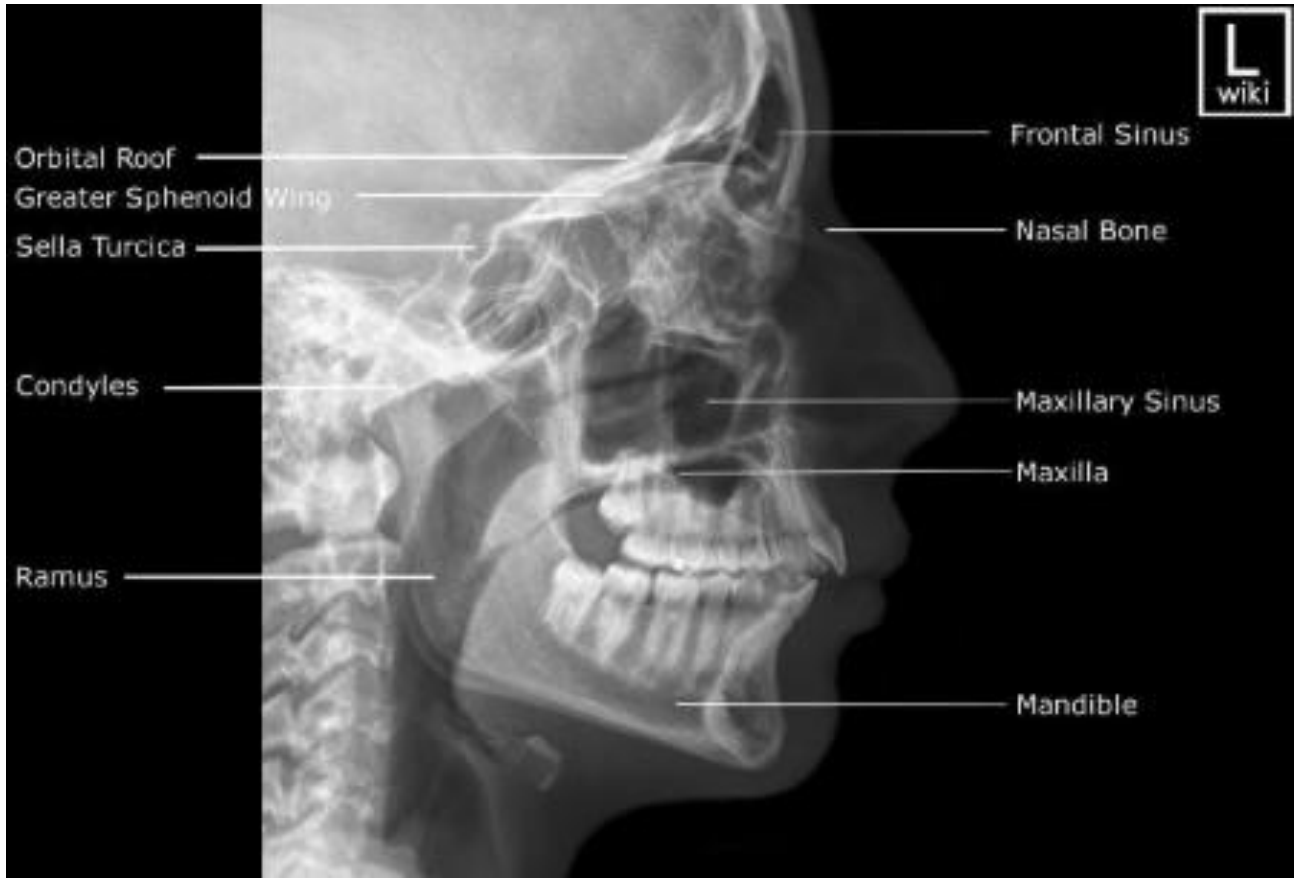


Orbital Imaging Techniques

X-Ray

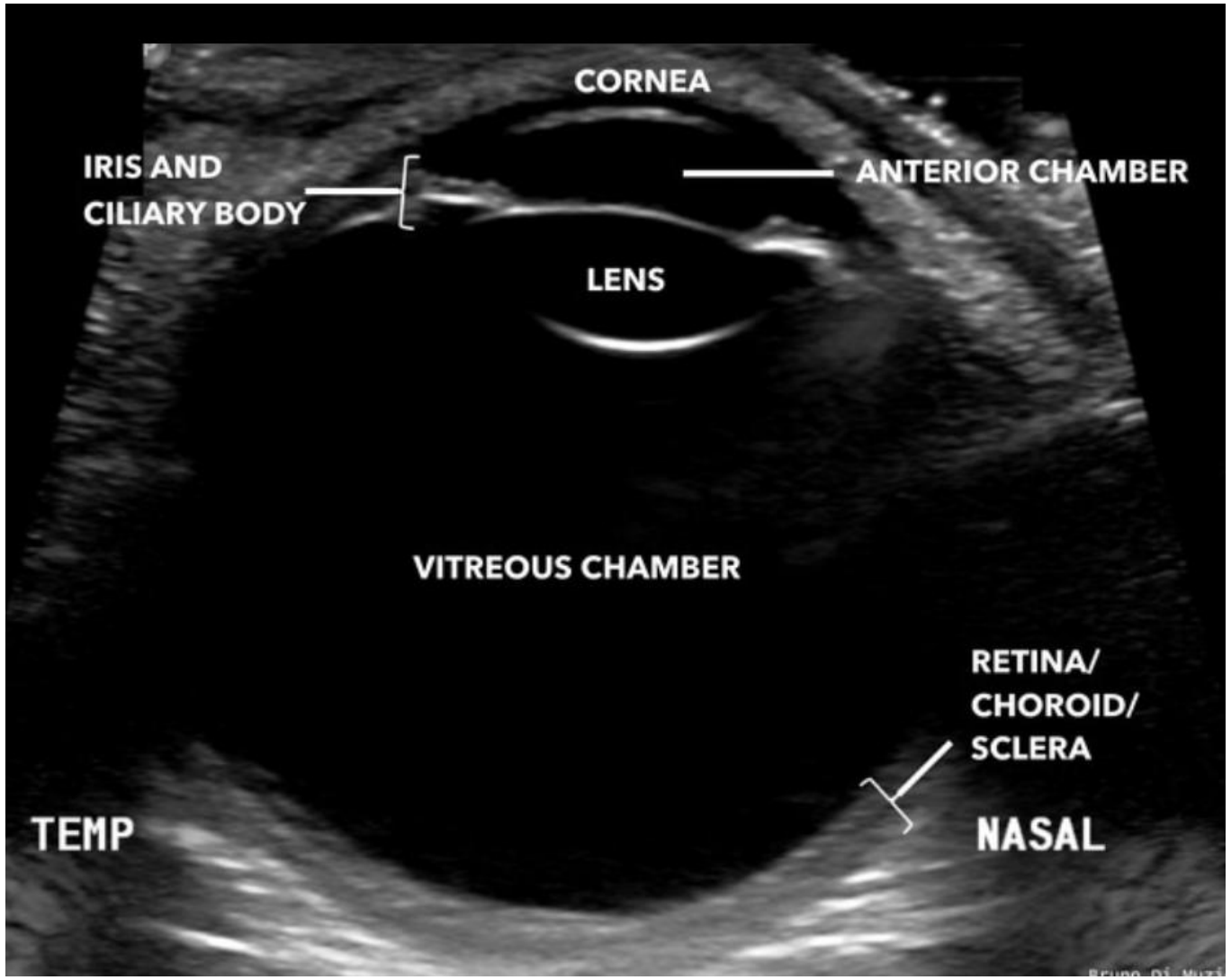
- The use of x-ray is limited to patients with trauma or suspected intraorbital foreign body.
- Standard views include PA view, lateral view and optic foramen view.
- In a **true lateral radiograph**, there should be superimposition of the floor of anterior cranial on both sides.
- For optic foramen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

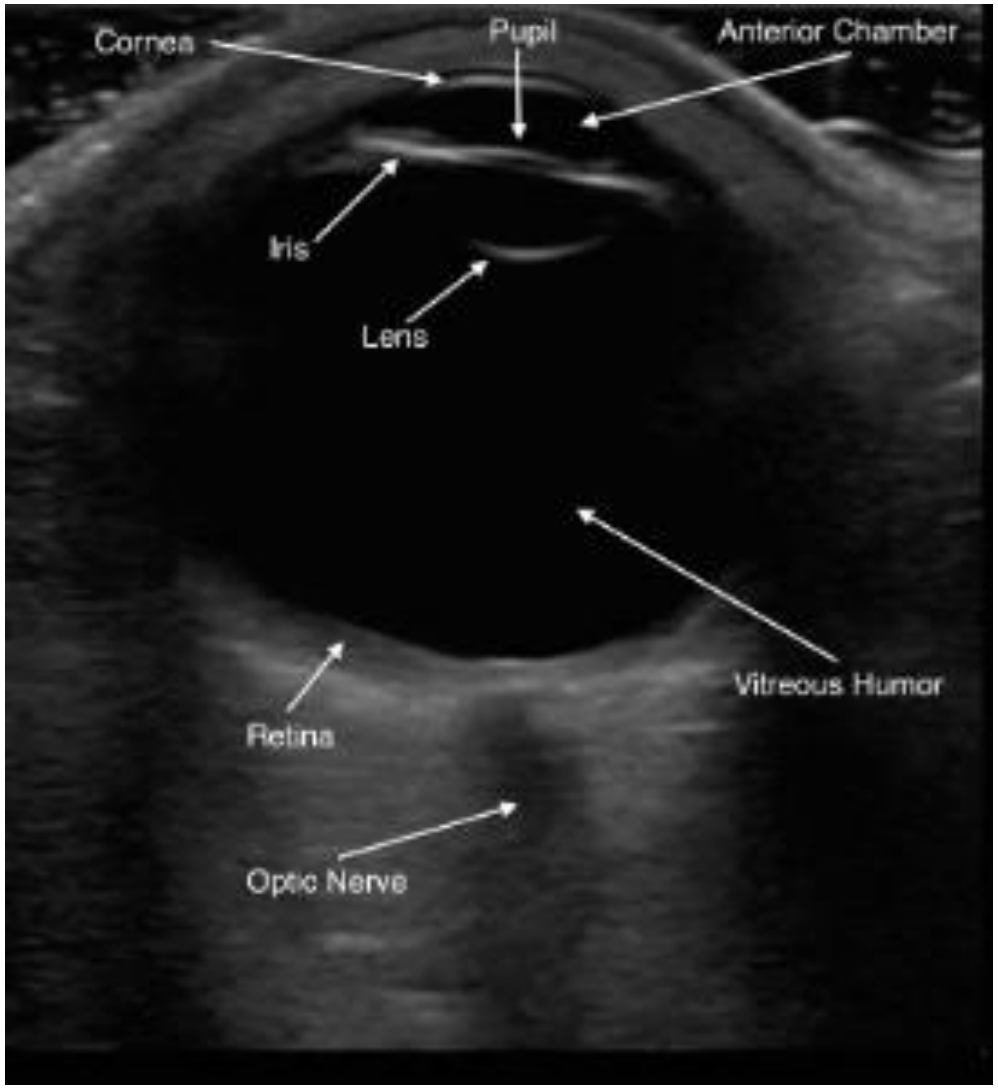

Frontal sinus
Lateral orbital margin
Optical foramen and canal
Inferior orbital rim
Maxillary sinus
Optic foramen and canal


Orbital Roof
Greater Sphenoid Wing
Sella Turcica
Condyles
Ramus
Frontal Sinus
Nasal Bone
Maxillary Sinus
Maxilla
Mandible
L wiki

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.

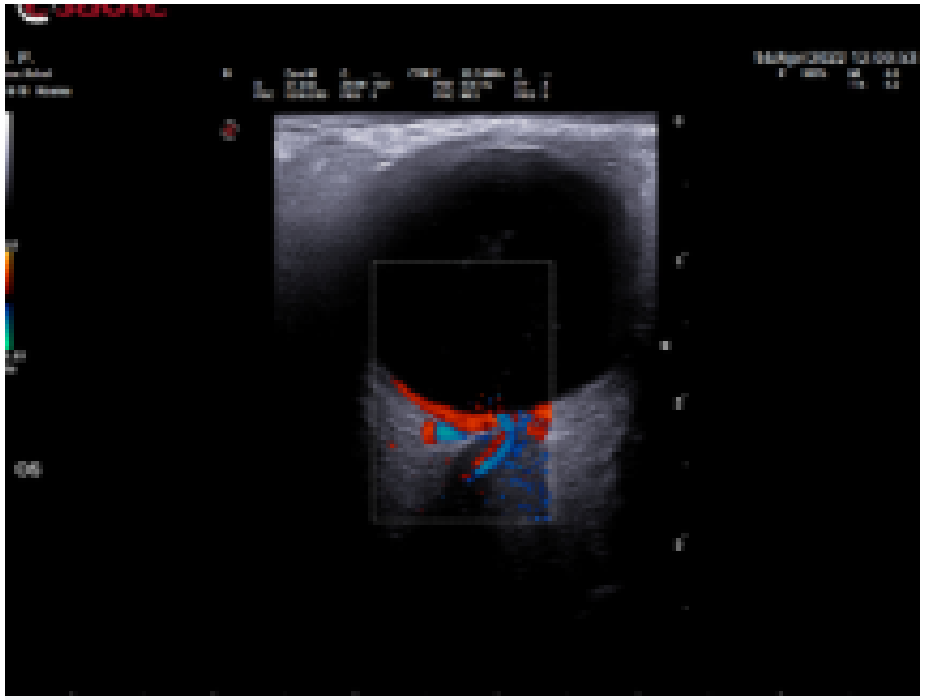

CORNEA
IRIS AND
CILIARY BODY
ANTERIOR CHAMBER
LENS
VITREOUS CHAMBER
RETINA/
CHOROID/
SCLERA
TEMP
NASAL


Cornea
Pupil
Anterior Chamber
Iris
Lens
Vitreous Humor
Retina
Optic Nerve

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

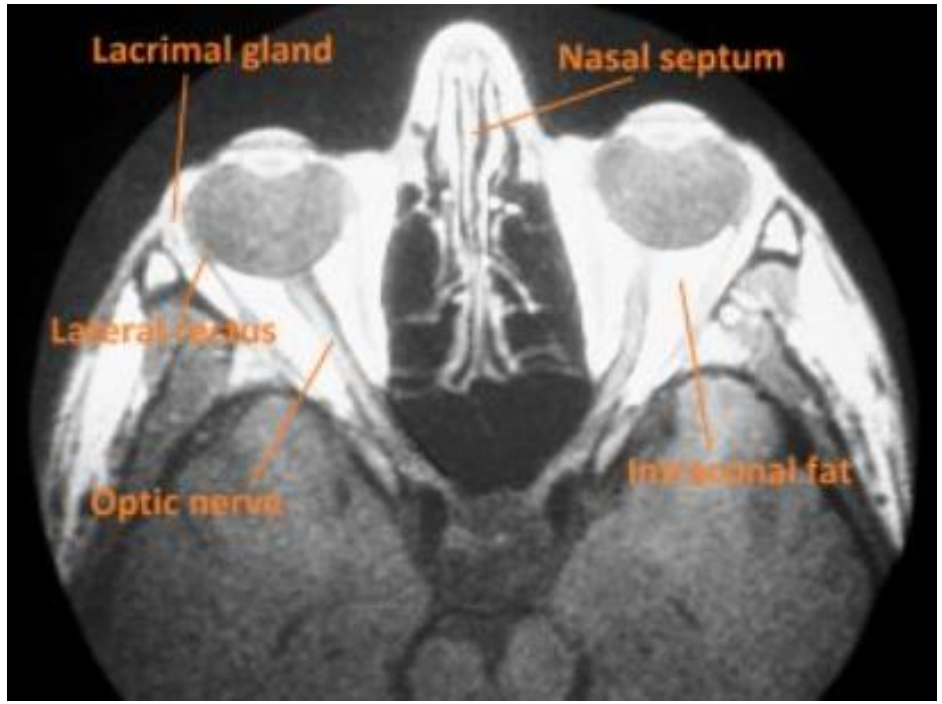
Color Doppler

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

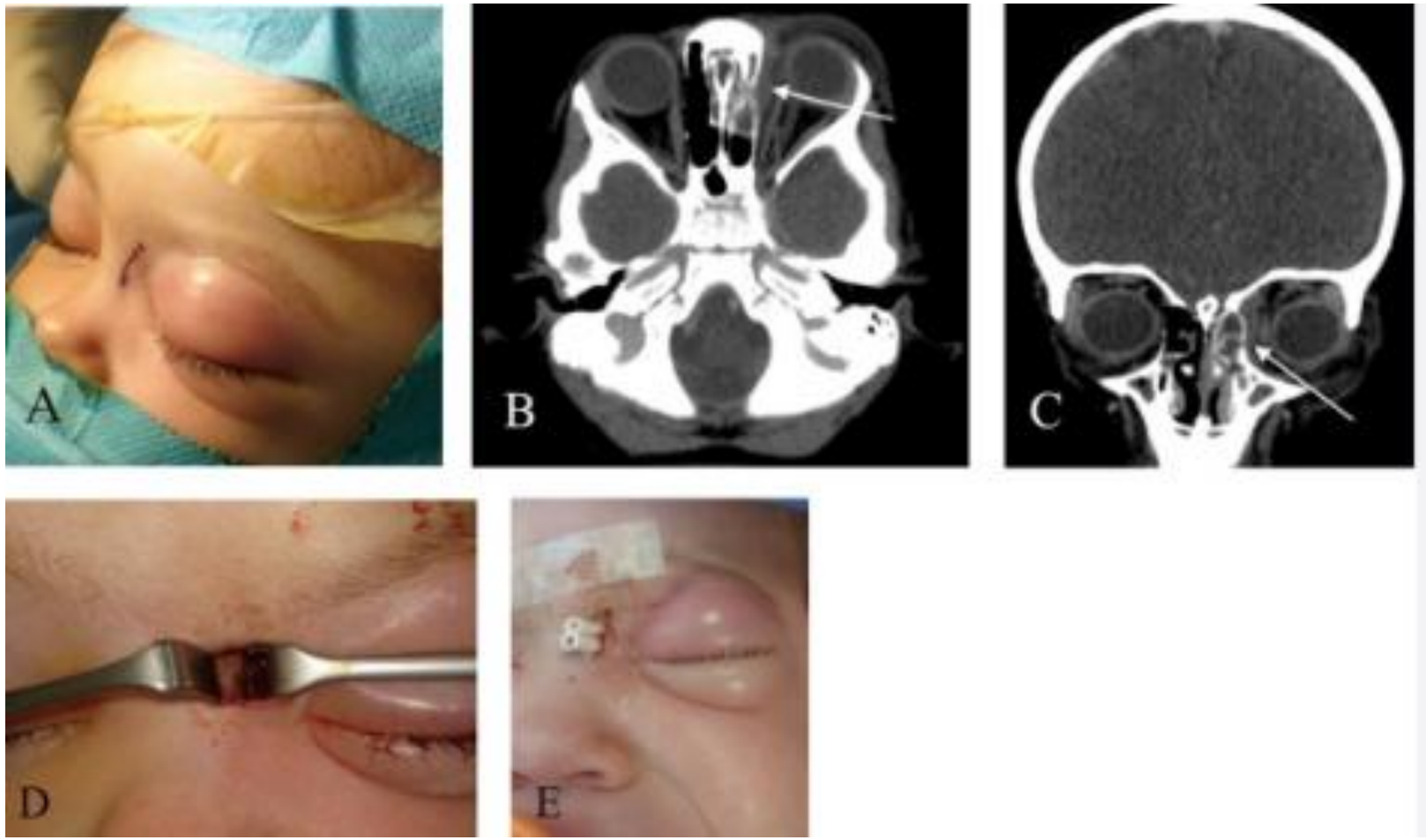


Computed Tomography (CT scan)

- 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.


Lacrimal gland
Nasal septum
Optic nerve

- 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."**


A
B
C
D
E

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.

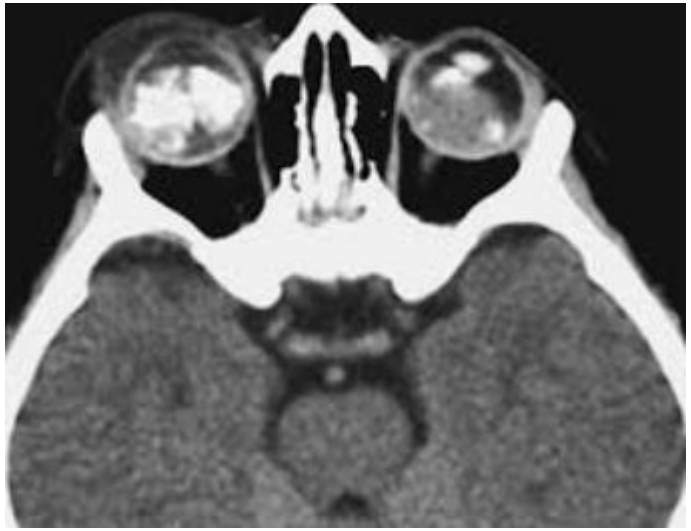
MRI vs CT

- 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: TI 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

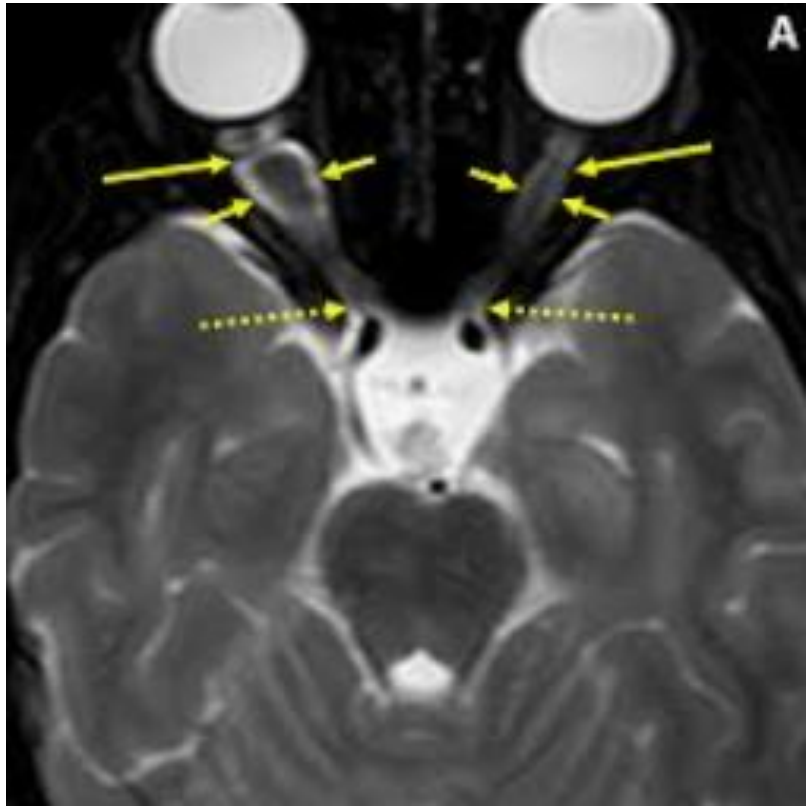
1.Types of tumor growth: tubular, excrescent, fusiform widening of optic nerve

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 intraconal 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

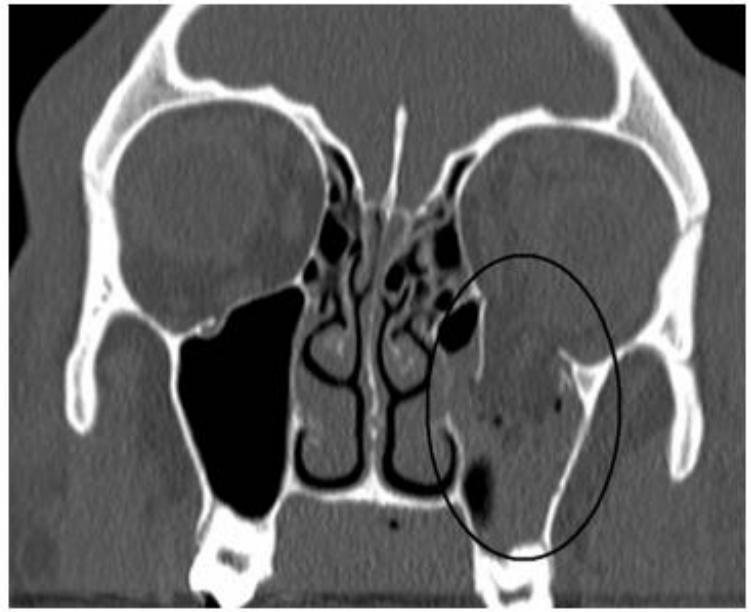
Infiltrating intraconal or extraconal inflammation presenting as ill-defined infiltrations or less commonly as a mass

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

DIFFERENTIATION		
	Pseudotumor	**Thyroid Opthalmopathy**
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