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
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.
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
Differential Diagnosis of Proptosis:

- Infectious
- Inflammatory
- Tumors
- Trauma
- Other
Infectious
- Bacterial: orbital cellulitis, abscess
- Fungal: aspergillosis, mucormycosis
- Parasitic: trichinosis, echinococcosis

Inflammatory
- Idiopathic orbital inflammatory syndrome (pseudotumor)
- Langerhans cell histiocytosis
- Sarcoidosis
- Graves’ ophthalmopathy
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)
Bony Orbit

Frontal bone

Lacrimal bone

Ethmoid bone

Zygomatic bone

Maxillary bone

Sphenoid bone

Extraocular Muscles

- Superior oblique
- Medial rectus
- Inferior oblique
- Superior rectus
- Lateral rectus
- Inferior rectus

Orbital Vessels

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

Orbital Imaging Modalities

- Plain film
- Ultrasound
- CT
- MRI
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

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
Coronal CT

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

Back to Patient 1…
Patient 1 - CT without contrast

Area of ↑ attenuation with soft tissue and bony components, involving sphenoid sinus & sphenoid wing
MR pre-gadolinium, T1
MR post-gadolinium, T1

Diffuse enhancement – but how to distinguish fat (also bright on T1) from abnormality?
MR w/gadolinium, fat saturation

With fat saturation MRI, can distinguish area of true enhancement
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.
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
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.


ED course: Rapidly rising IOP over few hours in ED, from 16 mmHg → 45 mmHg. Lateral canthotomy performed, bringing IOP down to 22.
CT with 100cc Optiray

Marked proptosis

Lateral displacement of MR & optic nerve

Soft tissue mass with enhancing margins projecting from ethmoid sinus into L orbit
Thickened mucosa of maxillary sinus

Mass extending from ethmoid sinus into left orbit

Bowing of medial wall of left orbit
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
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
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
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.
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.
CT without contrast

Fractures of superior, lateral, and inferior orbital walls

Opacification of R ethmoid and maxillary sinuses
CT without contrast

Bone fragment embedded in medial rectus and medial rectus hematoma
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
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
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.
Patient 4

HPI: Patient with known Graves’ disease
Eye exam: Marked bilateral proptosis with normal vision.
Studies ordered: CT without contrast.
Bilateral massive, asymmetric enlargement of extraocular muscles
Marked proptosis, L>R

Enlargement of muscle bellies with relative sparing of tendinous insertions

BIDMC PACS
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

www.revoptom.com/handbook
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
Summary

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


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