Imaging of adult ocular abnormalities.

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Learning Objectives

Review the anatomy of the globe

Describe the features of traumatic globe injuries.

Describe the imaging features of non-traumatic globe abnormalities such as detachments and provide a differential for globe calcification.

Provide an approach to evaluating ocular neoplasms.

Review the common post-surgical changes of the globe.
Anatomy

- **Globe has 3 layers**:
  
  1. **Fibrous coat**
  - formed by *cornea* anteriorly and *sclera* posteriorly

  2. **Uvea**
  - formed by *choroid*, *ciliary body* and the iris

  3. **Retina**
  - neural layer, converts light into neural signals

Axial T1w, contrast enhanced fat saturated image
Globe Rupture – Findings\textsuperscript{2-5}

- Loss of \textit{volume} or \textit{contour} abnormality
- \textit{Discontinuity} of the \textit{fibrous coat} (sclera or cornea)
- Intra-ocular \textit{foreign body}
  - Intra-ocular \textit{gas}
- \textit{Collapsed globe} (‘\textit{Flat tire}’ sign)

Axial CT – contour abnormality of globe with increased density within posterior chamber in keeping with vitreous hemorrhage and globe rupture
Globe Rupture - Pitfalls

Axial CT – scleral buckle and intra-ocular gas used in treatment of retinal detachment

Axial CT – contour abnormality of the posterior globe in keeping with a staphyloma
Anterior Chamber Injuries

- Hyphema or hemorrhage in anterior chamber is often clinically evident (assess for increased density)
- Imaged to rule-out corneal rupture or other injuries
- Corneal tear or rupture – decreased volume of anterior chamber is suggestive²

Axial CT – subtle flattening and volume loss of left anterior chamber compared to right – surgically proven corneal tear

Axial CT – increased density within anterior chamber making the lens look large in patient with clinical hyphema
Lens Injuries

- Include lens dislocation and subluxation
- Can be traumatic or non-traumatic
- If non-traumatic, suggest work-up for connective tissue disorders such as Marfan’s or Ehlers-Danlos syndrome

Axial CT – tilted appearance to this dislocated lens. Note the intra-ocular gas in keeping with globe rupture.

Axial CT – lens dislocated and sitting within posterior chamber
Posterior Chamber Injuries

- Vitreous hemorrhage is common
- Retinal detachment – assess for funnel shaped density or signal along retinal layer

Axial CT – Increased density along posterior globe (arrows) is in keeping with retinal detachment. Loss of globe volume and gas are in keeping with traumatic globe rupture.

Serial CT’s in the same patient imaged on Day 1, 4, and 12 show progression of posterior chamber hemorrhage.
Retinal Detachment

- Retina is firmly attached at optic nerve and oro-serrata (point at which choroid and ciliary body fibers converge)
- Fluid tracking between layers leads to ‘funnel’ shape density\(^6\)\(^-\)\(^7\)

Axial CT – Increased funnel-shaped density along posterior globe (arrows) is in keeping with retinal detachment.

Axial T2w (left) and T1w contrast enhanced (right) images from the same patient – arrows demonstrate a retinal detachment.
Choroidal Detachment

- Fluid accumulates between choroid and sclera
- Fluid tracks in a circumferential pattern along the lateral walls of the globe

Axial CT – Increased density along lateral globe (arrows) is in keeping with hemorrhagic choroidal detachment in this trauma patient.

Axial T2w (left) and T1w (right) images– arrows demonstrate choroidal detachment.
Globe Calcification

- Wide differential that ranges from benign to malignant
- Most common entities include drusen, dystrophic calcification and phthisis bulbi

Axial CT demonstrates an atrophic, collapsed, calcified globe in keeping with phthisis bulbi.

Axial CT demonstrates likely dystrophic calcification of the choroid in this patient who had undergone previous radiation for an optic glioma.
Globe Calcification

Axial contrast-enhanced CT demonstrates an enhancing mass within the left eye associated with calcification in this patient with primary breast cancer.

Axial non-contrast CT demonstrates calcification at the optic discs bilaterally in keeping with drusen.
Ophthalmitis

- Inflammation of the globe can be due to extrinsic process such as orbital cellulitis.
- Can be due to primary intraocular inflammation (endo-ophthalmitis) from an infectious etiology or from extrinsic delivery of infectious agents via surgery or trauma.

CT - stranding around globe with subtle increased density along lateral margins (arrows) suggestive of choroidal detachment or effusion in this case of orbital cellulitis.

CT – thickening of the globe with choroidal detachment in this case of endo-ophthalmitis.
Coat’s disease

- Exudative retinitis
- Predominantly occurs in young males around age 10, but can present in adult males

Axial CT shows increased density of exudate between layers of retina (arrow) with associated calcification in this 20 year old male with Coat’s disease.
Ocular Neoplasms

- Often present with vision changes, but can be asymptomatic

- Metastases are most common malignant neoplasm presenting within the globe in adults

- Uveal melanoma is most common primary malignant neoplasm in adults

- Intraocular schwannoma is a benign neoplasm which can mimic an uveal melanoma
Metastases

- Breast and lung cancers tend to be most frequent primary site of metastases presenting within the globe
- Look for additional lesions on rest of images

Axial contrast-enhanced CT demonstrates an enhancing mass within the left eye associated with calcification in this patient with primary breast cancer.

Axial contrast-enhanced CT shows a mass within the left mandible that was at the inferior most aspect of the orbital exam in the same patient.
Uveal Melanoma

- Account for the majority of melanomas whose primary site is not the skin⁹
- Most commonly present in patients in their 50’s

Axial T2w, axial T1w and axial T1w contrast-enhanced images – demonstrate a low T2 signal, high T1 signal, enhancing mass in posterior chamber that was pathologically an uveal melanoma with retinal detachment.
Intra-ocular Schwannoma

- Mimic uveal melanomas on imaging
- Tend to be located in cilio-choroidal region\textsuperscript{10}
- Often diagnosed on pathology after surgical removal

Axial T1w, fat-saturated, Axial T2w and Axial T1 contrast-enhanced images – demonstrate a high T1 signal, low T2 signal, enhancing mass in the region of the ciliary body that was pathologically a schwannoma.
Post-surgical appearance

- Post surgical appearances are commonly mistaken for pathology

Axial CT demonstrates intra-ocular silicone implant used to treat a retinal detachment. Axial CT demonstrates a normal bilateral post-cataract appearance (arrow on left)
Post-surgical appearance

- Varying procedures used to treat retinal detachments

Axial CT shows a scleral buckle around the right globe.

Axial CT demonstrates a scleral buckle with air inside the globe.
Post-surgical appearance

- Prostheses can have varying appearances

A. Axial CT demonstrates a prosthesis within the left orbit
B. Sagittal CT with bone algorithm demonstrates the same prosthesis.

Axial CT demonstrates an ocular prosthesis within the right orbit.
Summary

- Traumatic injuries to the globe include: globe rupture, anterior and posterior chamber hemorrhage, lens subluxation/dislocation, and detachments.

- Retinal detachments have a **funnel shape** towards the optic disc while choroidal detachments are more **lateral** and **circumferential**.

- Globe calcification can be of benign or malignant etiology.

- Most common malignant globe masses in adults are **metastases** and **uveal melanoma**.

- Post-surgical changes of the globe can have varying appearance.
Thanks

References: