Ultrasound Findings in Disorders of the Posterior Segment
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OPS Annual Educational Program
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First Things First
- Must have knowledge of the eye and pathology
- Know patient history before beginning
- Understand ultrasound principles and proper technique

Use Proper Technique
- Eye open, unless patient has open wound or small child!
- If you must perform through closed lids, document!

Why eye open?
- Probe placement in relation to patient gaze
- Marker then in relation to probe placement
- Eyes turn upward with lids closed
- Absorption from lid causes loss of weak signals

Why eye open?
- Leaking bleb, pain
- Rule out endophthalmitis
**Diagnostic A-Scan**
- Calibrated A-scan probe to specific gain setting
- Amplitude of spikes compared to knowns
- Differentiate mass lesions, membranes
- Available from few manufacturers
- Also known as “Standardized A-scan”

**Center Pathology and Adjust Gain**
- Center of display is area of best resolution
- High gain, weaker signals displayed
- Low gain, weaker signals disappear, better resolution of strong signals

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**B-Scan Interpretation**
Most pathologies demonstrate as either opacities, membranes, or masses

**Vitreous Hemorrhage**
- Reflectivity low, weak signal, density varies
- Use highest gain setting to evaluate
- Usually diffuse, disperse, mobile opacity
- May layer inferiorly due to gravity, “pseudo-membrane”

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**Vitreous Hemorrhage**
Most common causes:
- Diabetes
- Trauma
- Hemorrhagic PVD

**Vitreous Hemorrhage**
- If use low gain setting, may miss completely
- Use same gain settings and probe positions on subsequent scans for comparison
Vitreous Hemorrhage

- If scanning through lens, won’t seem as dense as when ultrasound bypasses lens

Vitreous Hemorrhage

- May be associated with a submacular hemorrhage secondary to macular degeneration

Endophthalmitis

- Ocular infection, usually following injury or surgery though can be endogenous
- Painful, may be accompanied by hypopyon
- Use high gain to see opacities & membranes

Endophthalmitis

- Density varies, pseudomembranes vary
- Doesn’t layer inferiorly
- Subsequent scans a necessity following treatment to determine if eye is responding, if retina attached

Asteroid Hyalosis

- Gel degeneration with calcium deposits suspended in vitreous, density varies, usually no decrease in vision
- Very highly reflective opacities as compared to hemorrhage or endophthalmitis

Posterior Vitreous Detachment

- Separation of posterior vitreous hyaloid from retina and possibly optic disc
- Normal phenomenon or may accompany trauma or surgery
- Thin mobile membrane of low reflectivity
- Floaters probably also apparent in vitreous
**Posterior Vitreous Detachment**

- Use high gain to appreciate this weak signal
- Turn gain down to prove not retinal detachment

**Intraocular Gas or Air**

- Temporary tamponade for retinal detachment
- Cannot penetrate the bubble with sound, so produces artifact
- Keep patient sitting upright to move bubble upward out of the way

**Silicone Oil**

- Used as tamponade for recurrent retinal detachment, removed months later
- Due to the slow velocity of oil as compared to normal vitreous, the globe appears elongated and unfocused

**Posterior Rupture Sites**

- Look where vitreous tracking leads
- Reduce gain to see break in eye wall
- Look for blood in orbit (echolucency)

**Vitreomacular Traction Syndrome**

- Non-clearing macular edema associated with traction from the posterior hyaloid

**Macular Disorders**

- Can detect macular edema, sometimes macular holes
**Retinal Detachment**

- Rhegmatogenous caused by break that allows fluid underneath the neurosensory retina, which separates from the pigment epithelium
- Mobile, highly reflective membrane
- Surgically treated

**Retinal Detachment**

- Cannot separate from optic disc, rarely from ora serrata (only if dialysis or giant tear), so forms funnel configuration when total

**Retinal Detachment**

- Membrane remains when gain reduced

**Retinal Detachment**

- Total RD’s will demonstrate open or closed circular formation in mid-vitreous on transverse scanning of the quadrants, funnel on axial and longitudinal

**Retinal Detachment**

- If longstanding, may present with cysts or may have necrosed and no longer appear highly reflective

**Exudative Retinal Detachment**

- Exudative retinal detachment caused by fluid exuded underneath retina from underlying source, such as uveitis or tumor. Treat underlying cause.
**Traction Retinal Detachment**
- Traction retinal detachment caused from adherence of vitreous hyaloid to retina with contraction, mostly diabetics, “tent” or “table-top” configuration
- Surgically treated

**RD vs PVD**
- If blood layering along posterior hyaloid, can be difficult to determine
- Retina does not detach from optic disc, so if detached from disc it is a PVD

**Is it an RD or a PVD?**

**Retinal Tear**
- Occur in association with vitreoretinal traction
- Most common in superotemporal quadrant where hyaloid most firmly attached near vitreous base
- Can’t be seen clinically if associated with vitreous hemorrhage

**Retinal Tear**
- Flap will point from the periphery to the posterior pole
- Must use longitudinal cuts to image
**Choroidal Detachment**
- Caused by leakage from choroidal vessels, can follow injury or surgery or rapid IOP decrease
- Can be serous (no opacity) or hemorrhagic (opacity)
- Smooth, dome-shaped, thick, highly reflective membrane with sharp insertions

**Choroidal Detachment**
- May be "baseball stitch", "kissing", "scalloped" peripherally only, or localized
- A-scan will have one spike with a double peak, representing retina/choroid interface

**Choroidal Detachment**
- Are they kissing?

**RD and CD**
- Because choroid detached does not mean retina detached, but can have combination

**Choroidal Thickening**
- Associated with hypotony, uveitis, scleritis, endophthalmitis, sympathetic ophthalmia

**Scleritis**
- Patient presents with red, extremely painful eye
- Seen on ultrasound as thickened choroid and excess fluid in Tenon’s capsule
- If fluid surrounds optic nerve insertion, appears as “T-sign”
- May or may not present with inflammatory nodule
Scleritis

Optic Disc Elevation
- True papilledema caused from increased intracranial pressure
- Seen as elevated disc without highly reflective echodensity as seen with drusen
- Use lower gain for better resolution

Optic Disc Drusen
- Deposit of calcium in disc
- Highly reflective echodensity
- Do 3P and 3L for OD, 9P and 9L for OS to avoid lens
- Reduce gain to appreciate high reflectivity

Optic Disc Cupping
- Caused by increased intraocular pressure
- Seen as excavation if significant
- Use lower gain for better resolution

Increased Subarachnoid Fluid (ISAF)
- Fluid in subarachnoid space surrounding optic nerve caused by pseudotumor cerebri, optic neuritis, compressive optic neuropathy, uveal effusion
- Look for “crescent” or “doughnut” sign

Choroidal Nevus
- Choroidal “mole”, brown in pigment, benign
- True nevi are highly reflective internally and grow very little over a long period of time
- Measure all parameters each visit and get photos
**Choroidal Nevus**

- If less than 2.0 mm in elevation, but low-to-medium in internal reflectivity, classified as “suspicious nevus” and watched very closely for growth.

**Do we scan a flat nevus?**

Yes!!!! For two reasons:
- To document it is flat
- To rule out posterior growth or extrascleral extension

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**“High Risk Nevus”**

Mnemonic of risk factors:

“**To Find Small Ocular Melanomas Using Helpful Hints Daily**”

- Thickness > 2mm
- Fluid
- Symptomatic
- Orange pigment
- Margin at disc
- US “Hollow” (low internal reflectivity)
- Halo-absent (yellow halo around pigmented center has much less risk for ocular MM, but greater risk of skin melanoma and should be checked)
- Drusen absent (drusen is a good thing!)

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**Choroidal Melanoma**

- Malignant, primary to eye
- Typically brown pigment, but may be amelanotic
- May have associated exudative detachment

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**Choroidal Melanoma**

- Typically dome or “collar-button” shaped, but may be multi-lobed or irregular
- Low-to-medium internal reflectivity, vascular, regular internal structure
Choroidal Melanoma

• Why do they have “regular” internal structure?

Visible Extrascleral Extension

• Treatment varies depending on size and location
• Size classifications:
  - Small = < 2.5 mm height and base < 16.0 mm
  - Medium = 2.5 mm-9.9 mm height, & base < 16.0 mm
  - Large = > 10.0 mm height, or base > 16.0 mm
• Treatment options:
  - Transpupillary thermal therapy (TTT) for small?
  - Radiation plaque therapy or enucleation for small or medium (COMS showed they were equal)
  - Enucleation for large (COMS showed no need to external beam radiate first)

Choroidal Melanoma

• COMS showed that neither plaque nor enucleation could be proven to prevent metastasis
• Proton beam used in some centers, but more likely to cause cataracts and neovascular glaucoma than plaque
• Each millimeter of thickness of a melanoma adds a 5% risk of metastasis
• Genetic testing can now be done to classify melanoma as Class 1 or Class 2
  - Class 1 (disomy 3) is good – less risk for mets, 95% survival at 8 years
  - Class 2 (monosomy) is bad – higher risk for mets, 30% survival at 8 years

Choroidal Melanoma

• Ultrasound extremely important in plaque placement surgery
**Choroidal Melanoma**

*Transverse and Longitudinals performed to check plaque placement*

- **Transverse of 9:00**
- **Longitudinal of 9:00**

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**Metastatic Carcinoma**

- Malignant, secondary to eye
- Find and treat primary, not eye
- Typically creamy, yellow-white in color
- Medium-to-high irregular internal reflectivity, can have vascularity

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**Choroidal Hemangioma**

- Benign, composed of tightly compacted blood vessels
- Non-pigmented, usually dome shaped
- Mimics amelanotic melanoma, may have ERD
- High internal reflectivity
- Little if any appreciable vascularity due to compactness

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**So What is It?**
**Retinoblastoma**

- Highly malignant tumor of infancy
- Usually detected by age 18 months when leukocoria noted, can be hereditary or non-hereditary
- Creamy, yellow-white lesion, varying shape and size

**Retinoblastoma**

- Irregular internal reflectivity
- Usually contains calcium,
- extremely highly reflective with “shadowing” effect posteriorly

**Large Retinoblastoma**

**Thank You for Your Attention**

- B-scan can demonstrate a wide variety of ocular disorders of both the anterior and posterior segments
- Useful for virtually all specialties in ophthalmology
- Must know eye anatomy and diseases
- Must use proper techniques to be certain no pathology missed

Come find me on facebook! rhonda.waldron.98@facebook.com
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The End