Pediatric Ocular Sonography

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Disclosures

None
Objectives of Presentation

Overview of differential diagnoses and sonographic findings of intra- and extraocular pediatric abnormalities
Ocular sonography - indications

Following ophthalmoscopic examination:

- Inconclusive examination
- Suspicion of mass underlying retinal detachment
- Work-up of mass
Technique

High-frequency linear transducer, small footprint
Eyes closed, scan through eyelid
Low power settings (MI < 0.28)
Lots of gel!
FOV to include retrobulbar structures
Eye anatomy

- Cornea
- Anterior Chamber
- Vitreous
- Ciliary Body
- Optic Disk
- Lens
- Optic Nerve
Lesions
Retinal Detachment

Separation of retinal layers
Fixation points at optic disk and ora serrata
Eye anatomy

- Cornea
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- Optic Disk
Retinal Detachment

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Causes:
• Trauma (most often)
• Retinoblastoma
• Coats’
• Retinopathy of prematurity
• Coloboma
• High myopia
• Complication of eye surgery
**Retinoblastoma**

- Most common pediatric ocular tumor; highly malignant; 1/3 bilateral
- Retinal detachment
- Heterogeneous solid mass w calcifications
- Increased risk for metastasis – invasion of:
  - Optic nerve
  - Anterior segment
  - Orbital rim (choroid/sclera)
- MRI for staging (extraocular and intracranial involvement)
- Ultrasound at diagnosis and follow-up
Cataract

- Any opacity in the lens (echogenic on sonography)
- Congenital: secondary to infection
- Childhood: steroids and radiotherapy (such as for retinoblastoma)
- Opacity in the lens obscures ophthalmoscopic view
  -> Ultrasound to evaluate for associated conditions:
    - Retinoblastoma
    - Vitreous inflammation
    - Persistent fetal vasculature
Persistent Fetal Vasculature

- Fetal blood supply to the eye fails to resorb
- Vascularized plaque from lens to optic disk
- Unilateral
- Cataract
**Coats’ disease**

- AKA primary retinal telangiectasia
- Blood-retinal barrier defect -> exudate -> retinal detachment
- Unilateral
- Peaks between 6 and 8 years
- Ultrasound to document absence of subretinal mass
Retinopathy of prematurity

- Proliferation of fibrovascular tissue in the retina
- Premature infants treated with oxygen
- Bilateral
- May extend to vitreous:
  - Hiperecoic tracts from retina to vitreous
  - Vitreous hemorrhage
- Advanced cases: retinal detachment
- Ultrasound to document absence of subretinal mass
Coloboma

- Incomplete closure of embryonic optical fissure
- Anywhere from eyelid to optic nerve
- Widening of optic disk
- Retinal detachment
- Differential: cupping of the optic disk

simple-med.blogspot.com
nei.nih.gov
Cupping of the optic disk

- Increased intra-ocular pressure (such as glaucoma)
- High myopia

Coloboma

myopia
Papilledema

- Elevation of the optic disk, due to elevated intracranial pressure
- Usually bilateral
- Increased optic nerve sheath diameter (normal ≤ 4-6 mm)
- Differential: Drusen
Drusen

- Benign calcium deposits at optic nerve head
- Usually bilateral
- Clinically may be confused with papilledema
- Echogenic focus in optic nerve head, not associated with increased ONSD
Differential between drusen and papilledema:

- Decrease gain
- Change probe orientation

=> Drusen remains echogenic
**Choroidal Detachment**

- Transudation or hemorrhage followed by detachment
- Spontaneous (glaucoma, high myopia), trauma or surgery
- Biconvex lateral lesions anchored outside optic disk
Vitreous Hemorrhage

- Bleed into the vitreous chamber
- Most cases from trauma
- Other causes: Coats’, retinopathy of prematurity, retinoblastoma, persistent fetal vasculature, leukemia, hemophilia
- Bleed obscures ophthalmoscopic view
  - Ultrasound to evaluate for underlying conditions
- Increased vitreous echogenicity to massive bleed w levels
- Differential: vitreous inflammation
Vitreous Inflammation

- Infection or autoimmune
- May be complicated by cataract
- Inflammation +/- cataract obscures ophthalmoscopic view
- Ultrasound: strands of increased echogenicity in vitreous
- Findings resemble vitreous hemorrhage
**Choroid inflammation**

- Infection, autoimmune, or trauma
- Ultrasound:
  - Thickening of orbital rim
  - Increased flow on Doppler
Mucopolysaccharidoses

- Reports of thickening of orbital rim, likely due to scleral deposition of mucopolysaccharides
- Differential with choroid inflammation
- Other reports: optic nerve head protrusion, widening of optic nerve sheath complex

Courtesy of José Jarrín, MD
Ocular Toxocariasis

- Parasites *Toxocara canis* and *Toxocara cati*
- Larvae may migrate to eye
- Usually unilateral
- One of three forms:
  - Focal lesion along peripheral retina (peripheral granuloma)
  - Focal lesion near optic disk (posterior pole granuloma)
  - Vitreous inflammation
- May be associated with retinal detachment
Retinal astrocytic hamartoma

- Congenital lesion, associated with tuberous sclerosis
- About 50% of TS patients have retinal astrocytic hamartomas
- Small focal lesions along orbital rim
- Bilateral in 50% of cases, stationary, requires no treatment, may calcify
- May be clinically indistinguishable from retinoblastoma

Courtesy of José Jarrín, MD
Hyphema

- Accumulation of blood in anterior chamber
- Trauma
- Ultrasound: fluid-fluid levels
- Bleed obscures ophthalmoscopic view
  -> Ultrasound to evaluate for associated conditions:
    - Retinal detachment
    - Globe rupture
    - Intraocular foreign body
Foreign Body

- Usually hyperechoic focus with posterior shadowing
Hypopyon

- Accumulation of sediments in anterior chamber
- Inflammation, infection, leukemia
- Ultrasonographic findings similar to hyphema
Juvenile Xanthogranuloma

- Rare
- Histiocytic proliferation, with skin papules and nodules
- Eye - most frequent extracutaneous site (up to 10%)
- Typically present before age 2 years
- Iris mass
- Differential with primary iris cyst
Primary Iris Cyst

- Controversial pathogenesis, probably congenital
- Differential with juvenile xanthogranuloma
Ciliary Body Cyst

- Common
- Most are congenital or from trauma
- Often too small and seen only on ultrasound biomicroscopy
- When large may displace iris anteriorly and cause glaucoma
Dacryoadenitis

- Inflammation of lachrymal gland
- Subtype of orbital pseudotumor (idiopathic orbital inflammation)
- Gland enlargement
- Hypervascularity
- Differential w neoplastic processes - biopsy in clinically equivocal
Infantile hemangioma

- Most common pediatric tumor overall
- Extraocular location
- Benign proliferation of endothelial cells
- Typical history
- Soft tissue mass
- High vessel density
- Vessels usually too small to be seen on grayscale
Lymphatic Malformation

- Lymphatic maldevelopment
- Congenital, grows with patient
- Extraocular location
- Multiseptate cystic lesions
- Flow only on septations, or no flow at all
Quiz
a. Retinal detachment
b. Vitreous hemorrhage
c. Coloboma
d. Foreign body
e. Choroidal detachment
a. Retinal detachment
b. Vitreous hemorrhage
c. Coloboma
d. Foreign body
e. Choroidal detachment
a. Coloboma
b. Choroidal detachment
c. Disk cupping
d. Papilledema
a. Coloboma
b. Choroidal detachment
c. Disk cupping
d. Papilledema
a. Retinal detachment
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