Using OCT in Pediatric Neuro-ophthalmology

By Mays El-Dairi, MD
Associate Professor
Pediatric Ophthalmology and Strabismus
Neuro-ophthalmology
Duke Eye Center

7 yo girl with accommodative esotropia is newly noted to have this. She is asymptomatic.

Had OCT RNFL locally

RNFL 144 µm
BMO 1.5 mm²
Axially 1367 µm
Macular map is normal

Autofluorescence

Scan through the nerve
But her RNFL is thick, should we worry about superimposed papilledema?

RNFL 144 µm
BMO 1.5 mm²
Size of projected circle 3225 µm

GMPE protocol

RNFL 120
Size of projected circle 3489

Another patient: 13 yo with -5 myopia

RNFL 80
Circle projecting at 3710
Final diagnosis

- Pseudopapilledema/hyperopic eye
- No need for further workup other than reexamine in 3, 6 and 12 months

How to decide on which OCT protocol to obtain?

- RNFL: most commonly used protocol
- Macular scan
- Macular map
- Optic nerve scan
- Optic nerve map
- GMPE (Glaucoma Module Premium Edition)
Posterior Segment OCT Protocols

- Retinal Scans
  - Single line scans, easiest to obtain, will show retina pathology

Why look at the retina in neuro-op

Papilledema

MOG optic neuritis

Evidence of previous retinal vasculitis

More examples of retinal changes in presumed optic nerve disease

INL cysts: optic atrophy with severe loss of GCL in the papillomacular bundle

Evidence of previous retinal vasculitis

References:


Even pediatric glaucoma!

- Elevated Intraocular Pressure and Microvascular Retinal Injury Identified by Optical Coherence Tomography in Two Infants with Glaucoma
- First author: Samuel A. Alvarez-Falcon
- In print JAAPOS

OCT Protocols: Macular Map

- Customizable feature that can be generated by integrating multiple single-line macular scans.
- A topographical map centered on the foveal center is created.
- ETDRS macular map

Macular map in optic tract lesion
Retinal Nerve Fiber Layer Scan

- A circular scan of 3.4-3.5 mm (machine-dependent) that is centered on the optic nerve head.
- An indirect measure of all the retrobulbar optic nerve axons
- RNFL measurements were shown to correlate with severity of disc edema or optic atrophy

Methods of acquiring RNFL

- **Circular scan method**
  - Spectralis: can correct segmentation but can’t correct position. The single scan is faster to acquire
  - Cirrus, RTVue: Can correct circle position, cannot correct segmentation or skip lesions

Pitfalls of the RNFL scan

- Doesn’t correct for axial length as we saw in the above 2 examples
- Can’t differentiate the case of papilledema on top of atrophy
- Be careful interpreting the RNFL without a macular scan

Swelling on top of atrophy in a patient with hydrocephalus
Examples of artifacts RNFL

Optic Nerve Head Map
• Similar to the macular map but is instead centered on the optic nerve.
• It is useful for qualitatively assessing the peripapillary area, if a lesion is suspected
• Can measure BMO manually on a single slide

More examples of optic nerve head scans

PHOMS Optic nerve head drusen
CNV in optic nerve head drusen and in congenital optic nerve anomalies


Optic disc analysis

• Automatically outline of optic nerve head and cup
• Optic disc area
• Neuroretinal rim area
• Vertical cup-to-disc ratios.
• Based on the shortest perpendicular distance to ILM

Optic nerve head Rim Analysis

• Neuro-retinal rim assessment
• Integrating measures from the Bruch Membrane opening to the nearest point on the internal limiting membrane (ILM)
• Disc area and map of MRW
• RNFL at 3 distances
Normative data in children

- RNFL not very different from young adults.

What happens with growth

- As axial length increases, expect a mild drop in average RNFL (3 µm with 1 mm increase in RNFL, less than machine reproducibility)
- Effect of optic nerve tilting

How to prioritize OCT when we have a squirmy child

- At least a single line macular scan through the fovea especially if central vision is decreased
- RNFL
- If child can sit longer, macular map with GCL segmentation
- If really good child: GMPE
Conclusions

• Limited scan (e.g. just a macular scan) can give more information than a poor quality extensive scan with segmentation
• Pay attention to the macula look for retinal changes that may be optic neuropathy mimickers
• Pay attention to artifacts
• Pay attention to change in axial length with growth spurt and tilting of the optic nerve

Thank you!