Optic Nerve Basics

OPT 243
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Clinical evaluation of the ONH (optic disc)

- Visual Acuity
- Stereoscopic examination (live)
- Digital photography
- Digital imaging
  - HRT
  - OCT
  - GDx
- Color vision testing
- Pupillary examination (for RAPD)

Evaluation of the Optic Nerve Head and beyond

- Visual Acuity
- Stereoscopic examination (live)
- Digital photography
- Digital imaging
  - HRT
  - OCT
  - GDx
- Color vision testing
- Pupillary examination (for RAPD)
- Subjective (functional) testing = visual field
- Electrodiagnostic testing

Relevant Clinical Optic Nerve and NFL Anatomy

- ~1 million ganglion cell axons (nerve fibers) converge to form the optic nerve
- The optic cup has no capillaries nor nerve fibers
- Capillaries, astrocytes, and glial cells support the neuroretinal rim tissue
- Lamina cribrosa

Normal optic nerve x-section
The retinal nerve fiber layer

Relevant Clinical Optic Nerve and NFL Anatomy
- The optic cup has no capillaries nor nerve fibers
- Capillaries, astrocytes, and glial cells support the neuroretinal rim tissue
- Vascular supply is abundant: several sources

Optic Nerve Divisions
- Surface NFL
- Prelaminar
- Lamina cribrosa
- Retrolaminar

Size Issues – Large Disc, Large Cup
- 20° field; Large disc / moderate cupping

Size issues – Small disc, small cup
- 20° field; Small disc / minimal cupping

Relevant Clinical Optic Nerve and NFL Anatomy
- Genetics is the major determinant of disc and cup size - mean C/D ~ 0.4
- C/D ratios > 0.7 occur in < 2% of normals
- Asymmetry of > 0.2 occurs in only 1% of normals
Normal optic disc

From the reading centre at Moorfields Eye Hospital, London, England.

C/D ratio estimated with direct ophthalmoscopy

- 0.4
- 0.5
- 0.55
- 0.6
- 0.65
- 0.7

Cilioretinal artery

- Derived from the choroidal circulation
- May interfere with observation of the neural retinal rim
- May occlude preferential to CRA or BRA

Size Issues – Compare Micro/macro

Microdisc

Macrodisc

Optic disc size and shape

- African-Americans have larger discs than Caucasians
- Diameter (DD) is 1.88 mm V X 1.77 mm H [average]
- Generally circular; may appear oval due to oblique insertion and be normal
- Hyperopic discs are relatively smaller while myopic discs are relative larger [Outside the range +5.00 D to -5.00 D]
Optic Disc – Racial Differences

Caucasian disc
Medium size, shallow cup

Hispanic disc
Large size, large, deep cup

Asian disc
Medium size, large shallow cup

African-American disc
Large size, large cup

Optic Nerve Head Morphology – Clinical Evaluation

- Disc and cup margin (configuration/regularity)
- Optic disc size and shape
- Color (pallor) / lamina
- Vasculature (of the nerve)
- Other observations
- Optic nerve description is more than C/D

Limitations of the cup-to-disc ratio

1. It ignores disc size.
2. It is based (erroneously) on the size of the cup. [Said another way, it would be like describing a donut based on a description of its hole.]
3. Discs with “normal” C/D ratio may have focal thinning or notching.
4. Focal changes occurring to the neuroretinal rim are not described.

Disc Margin Configuration/regularity

- **Disc margin** should be well defined and outlined by observation
  - Oblique insertion (myopia)
  - Tilted Disc
  - *Situs Inversus* (more later)

Elevation: papilledema vs. Psuedopapilledema

Early papilledema, hyperemia inferiorly (arrows)

Elevation: papilledema vs. psuedopapilledema

Acute papilledema, with hemorrhages and dilated veins

Juxtapapillary Scleral crescent

(Myopia, obliquely inserted)

Pigmented crescent

VS.

[parapapillary atrophy, glaucoma]

Oblique insertion (myopia)
41 B/F
- 8.50 OD, OS
VA = 20/20 OD, OS
Note VF
Optic disc “ectasia”
- 27 WF
- -5.75 - 225 X 180
- Observations
  - Scleral ring
  - Optic disc margins
  - Vasculature
  - Optic cup
  - ?what is the C/D ratio?

Simplified mechanism of optic disc cupping in glaucoma

Note:
- Deepening of the cup
- "Bean potting"
- Deformation of LC
- Expansion of Bruch membrane

APON
- Acquired pit of the ONH
- Note deep excavation inferiorly
- Appearance consistent with glaucoma
Rim thinning

Localized rim thinning

Examples of obliquely inserted discs

(retinal nerve fiber layer)
RNFL

C/D asymmetry
Differentiating optic nerve from macular disorders in the context of reduced VA

**Macula**
- VA markedly reduced
- Metamorphopsia
- NO RAPD (unless widespread)
- Brightness sensation not usually reduced
- CV - variably reduced

**Optic Nerve**
- VA variably reduced
- Central scotoma or dimming
- RAPD more likely
- Brightness and color sensation reduced

**What is your evaluation?**
37 BM/ HIV + VA = 20/20 in each eye

**Normal?**
Normal?

19 WM with 20/20 in each eye

Close up
58 BM with 20/50, 20/80; normal IOP

58 WM 20/20; 39 yr Hx. Diab. Normal IOP