Assessing the Optic Nerve

Thursday Jan 23, 2014
Healthy ONH

THE NORMAL OPTIC NERVE
1. Size: Normal size variable: Usually 1.2 mm to < 2 mm
2. Neuroretinal rim: pink in color
3. Borders distinct/well defined
4. ISNT rule usually obeyed in a normal optic nerve
   - The ISNT rule addresses disc rim thickness of the normal optic disc.
   - Inferior rim (I) greater than or equal to superior rim (S); greater than or equal to nasal rim (N); Greater than or equal to temporal rim (T) or (I>S>N>T)
   - The ISNT rule is useful in differentiating normal from glaucomatous optic nerves and is unaffected by race
5. Nerve fiber layer: Striations seen especially at superior and inferior pole
5. Blood vessels at rim are typically embedded in nerve fiber layer (NFL)
- Observe the scleral Ring to identify the limits of the optic disc and its size
- Identify the size of the Rim
- Examine the Retinal nerve fiber layer
- Examine the Region of parapapillary atrophy
- Look for Retinal and optic disc hemorrhages
Clinical Assessment of the ONH

Dilated with direct, 78D (or equivalent), contact lens

- Look at:
  - Media
  - General presentation/appearance of the disc
  - Disc margins
  - Neuroretinal rim
  - Cup (C/D)
  - SVP +/-
  - A/V ratio
  - Peripapillary area
  - NFL
Blood Supply to the Optic Nerve

- The central retinal artery supplies the prelaminar optic disc
- The laminar and retrolaminar ON are supplied by the branches of the short posterior arteries
  - Lamina cribrosa
  - Posterior ciliary artery
  - Pial vessels
ON & ONH Vasculature

Left: Diagram of blood vessels on surface of the optic disc and retina as seen with an ophthalmoscope in a left eye.

Right: Diagram showing the blood supply of the optic nerve, with the front part of the optic nerve (i.e. optic nerve head) toward the left.
The lamina cribrosa is a perforated fibrocollagenous support structure through which the optic nerve (or axons from the retina) traverse to exit the globe.

About 1/3 of eyes the lamina cribrosa clearly can be seen.

The lamina cribrosa is derived from the sclera with lesser contributions from the pia mater and the perivascular sheaths of the central retinal artery and vein.

Notice deep in the cup there are gray, pit-like indentations (arrows) of the lamina cribrosa.
Congenital Variations of the ONH

- Bergmeister’s papilla
- Prepapillary vascular loop
- Myelinated nerve fibers
- Scleral crescent
- Choroidal crescent
- Circumpapillary staphyloma
- Coloboma
- Morning glory disc
- Pits
- Buried drusen

- Cilioretinal artery
- Macrovessels
- Arteriovenous Anastomosis
- Megalopapilla
- Hypoplasia
- Aplasia
  - Absence of ONH
- Oblique/Tilted disc
- Optic atrophy
  - Inherited familial
  - AD Juvenile
  - AR congenital
  - Leber’s Hereditary
• Bergmeister’s papilla
  – Hyaloid artery remnant

• Vascular loops
  – Risk factor for retinal arterial occlusion
• Scleral Crescent
• Pigmented/Choroidal Crescent
• Coloboma

• Morning Glory Disc
• Pits
• Megalopapilla

• Hypoplasia
  – Double ring sign
• Oblique insertion
  – Dysversion, Malinsertion, Ectasia
  – Nasal or temporal dysversion

[Image of an eye with labeled structures: Optic Nerve Head, Conus, Cup, Stretched NFL]
• Tilted Optic Nerve Head
  – Dysversion, Malinsertion, Ectasia
  – Inferior or Superior dysversion
• **Toric Optic Nerve Head**
  – Difficult to have a dysversion without some toric
• Situs Inversus
  – Vessels head nasally prior to turning temporally
  – 80% seen with dysversions or hypoplastic ONH
  – 1-2% population

ONH OD/OS of same patient
Clinical Pearl

- Size (of the Optic Nerve Head) does matter.....
  - Varies from 0.96 to 2.91mm
    - As a result cupping can vary from .1 to .8
  - VVD

**Optic Disc Size**

Size of cup varies with size of disc
Large discs have large cups in healthy eyes

- Small: avg vertical diameter < 1.5 mm
- Average: avg vertical diameter = 1.9 mm
- Large: avg vertical diameter > 2.2 mm

*Vertical Disc Diameter*
- African-Americans 1.81 mm
- Caucasians 1.69 mm
- Male = Female

Pearlman, et al. AAO poster 2000
Crowded Disc

- Small scleral canal
- Hyperemic
- No cup
- “Disc at Risk”
Clinical Pearls

- Pallor VS Normal
- Glaucomatous Neuropathy VS Pallor
- Glaucomatous Neuropathy VS Others
- Elevation VS Swelling
Normal vs Pallor

- If you use the term “pallor” to describe your patient’s ONH, the rest of your exam better be to address that pallor.
- Pallor is NOT a descriptive term to describe the less “pinky” presentation of the disc temporally!!
- Pallor implies atrophy implies death
- Atrophy is bad!
- .... and you need to rule out
  - ischemic (AION?)
  - an inflammatory lesion (CMV papilitis?)
  - a compressive lesion (aneurysm, meningioma?)
  - a demyelinating lesion (e.g., MS)
  - A primary process (e.g., dominant optic atrophy)
Normal VS Pallor
Pallor

• Neuro-retinal rim is present, but pale.
Glaucomatous Neuropathy VS Pallor

- If the rim is pale, then it is NOT glaucoma!!!!
- Erosion of rim tissue
  - Excavation
## Clinical Features of an Optic Neuropathy

**Non-GLC ON:**
1. Decreased VA early
2. Acute, subacute, or chronic
3. Decreased color early
4. Any visual field defect
5. Ipsilateral APD
6. Optic disc edema or disc atrophy

**Glc ON:**
1. Decreased VA late
2. Usually chronic
3. May have decreased color
4. NFL defects
5. Usually no APD
   1. Unless visual field loss asymmetrical
6. Optic disc cupping
   1. Rim excavation
Clinical Features of an Optic Neuropathy

Non-GLC ON:

- VA 20/25 after 4-month recovery from optic neuritis (20/200 VA at worst)

Glc ON:

- Pallor without cupping
- VA 20/25 after 4-month recovery from optic neuritis (20/200 VA at worst)

PPA

Cupping without pallor
Examine the Disc With High Mag

The disc appearance is usually not enough to differentiate among the various possible etiologies that may exist (for normal swollen or pale discs).

- GLC typically presents with cupping
  - This produces focal loss of axons and secondary pallor WITHIN the cup

- Optic atrophy (nonglaucomatous) exists outside of the cup and keeps the rim intact
Cupping in Non-GLC Optic Neuropathy

- Cupping is a common feature of glaucoma and low-tension glaucoma, but can also present with ischemic optic neuropathy (typically the arteritic type).

- Cupping of the ONH can also occur following:
  - tumor (e.g., meningioma)
  - posterior ischemic optic neuropathy.

From: Practical Viewing of the Optic Nerve Head by Digre and Corbett
Red Flags for Non-GLC Optic Atrophy

1. Early loss of central acuity
2. Acute or rapidly progressive visual loss
3. Unilateral disease (with RAPD)
4. Pallor out of proportion to cupping (pale remaining neuroretinal rim)
5. Visual field loss uncorrelated with any cupping
6. Optociliary collateral vessels on the ONH
7. Band atrophy of the optic nerve
Elevation VS Swelling
Pseudopapilledema

• Appearance and false impression of disc swelling
• Associated with underlying anomalous condition
  – ONH Drusen
  – Disk at Risk
  – Dysversions
    • Oblique insertion
    • Tiled disc
  – Optic nerve hyperplasia
• Drusen
  – Calcified nodules within the ONH
Optic Nerve Swelling

Papilledema = bilateral swelling secondary to increased CSF
Signs of ON pathology

- Indistinct border
- Vessel obscuration
- Elevation
- Swelling
- Patton’s lines
- Pathologic C
- Rim Tissue thinning
  - Excavation
- Acquired Optic Pit
- Nerve Fiber Layer loss
- Parapapillary atrophy
- Optic atrophy
- Optociliary shunt
Etiology of Acquired Optic Nerve pathology: Neuropathies

- **Inflammatory** 1-10 years
- **Post-infectious** 11-20 year
- **Demyelinizing** 21-40 years
- **Ischemic**
  - Arteriosclerosis-HTN 50-70 years
  - Temporal arteritic 60-80 years
  - Diabetic
- **Toxic**
- **Compressive**
- **Papilledema**
- **Glaucomatous**
Evaluation of an Optic Neuropathy

Flow chart 1-1

Clinical Pathways

Neuro-Ophthalmology

by. Lee AG and Brazis PW