ONH Grand Rounds

Differential Diagnosis of ONH “Edema”

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Some things make you look twice….

Worrisome findings….
• Elevation
• Pallor
• Discoloration
• NFL defects
• Vascular changes

Tools you have…
• Stereoscopic DFE!
• Swinging flashlight test
• Pupil cycle time
• Red-free filter
• SVP
• VF
• OCT
• FAF
• B-scan

Disclosures – Dr. Beth Steele

<table>
<thead>
<tr>
<th>Company</th>
<th>Position</th>
<th>Received</th>
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<tbody>
<tr>
<td>Optos</td>
<td>Advisory Board</td>
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<tr>
<td>Med Op</td>
<td>Consultant</td>
<td>Honorarium</td>
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Fundus Autofluorescence

• Drusen - Hyper AF
• Buried – harder to visualize


**Causes of disc edema ...**

**Unilateral**
- Vascular
- Infectious
- Diabetic Papillopathy

**Bilateral**
- Hypertensive
- Toxic
- Inflammatory
- Infectious
- Compressive
- Hydrocephalus
- IIChtn
Optic Neuritis: Most likely etiology based on age

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<th>Age Range</th>
<th>Likely Etiology</th>
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<td>Post infectious (idiopathic)</td>
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Is it...? And if so then why is it?

Pseudopapilledema

- ONH drusen
- Anatomically crowded discs
- Hyperopic disc
- Myopic / tilted / obliquely inserted disc

Myopic / tilted discs?
Be careful not to hide behind a comfortable label...

Spectral Domain OCT

<table>
<thead>
<tr>
<th>Clinical Tool</th>
<th>Papilledema</th>
<th>Buried ONH Drusen</th>
<th>Anatomically Crowded Disc</th>
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<tbody>
<tr>
<td>Topography</td>
<td>Smooth, continuous elevation</td>
<td>Non-uniform elevation</td>
<td>Smooth, continuous elevation</td>
</tr>
<tr>
<td>RNFL scan</td>
<td>Thicker RNFL, especially nasal sub-retinal cavitation</td>
<td>Increased in acutely damaged tissue, may be decreased over time</td>
<td>Normal</td>
</tr>
<tr>
<td>Globe convexity</td>
<td>Flattened / pushed forward</td>
<td>Normal/concave</td>
<td>Normal/increased concavity for hyperopes</td>
</tr>
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</table>
Key features disc edema on OCT:
- Smooth contour of elevation
- Nasal RNFL >86um – 80% specificity
- Thick hyporeflective space adjacent to disc “lazy V” (esp nasally) – 90% specificity

Or is that old news, and imaging artifact?
- EDI superior to AF...
Globe Convexity

- Increased ICP will push the globe anteriorly
- Easiest to appreciate with a 9mm scan
- With EDI, can see an anteriorly displaced Bruch’s membrane

Ultrasonography – B-scan

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<tr>
<td>Reflectivity</td>
<td>Normal</td>
<td>Hyper-reflectivity with reduced gain</td>
<td>Normal</td>
</tr>
<tr>
<td>ON sheath diameter</td>
<td>Increased</td>
<td>Normal</td>
<td>Decreased</td>
</tr>
<tr>
<td>Crescent shadow</td>
<td>Present</td>
<td>absent</td>
<td>absent</td>
</tr>
<tr>
<td>30° Test</td>
<td>Positive</td>
<td>Negative</td>
<td>Negative</td>
</tr>
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B-scan Ultrasonography – Review of Tools

1. **ONH Sheath Diameter <5mm**
2. Elevation of ONH <1mm
3. Crescent sign
4. **30 degree test**
   - (+) when >15% ↓ in nerve sheath width following a 30-degree eccentric gaze
   - highly sensitive (100%) but non-specific (36.4%)
43 AA Female

- 20/15
- 140/90
- DFE: drance heme
  OD and disc elevated nasally

Recommendations from the ODD Consortium

- Radial ONH scans with EDI
- RNFL scans (no EDI)
- FAF

- Located above lamina
- Signal poor core, with superficial hyperreflectivity
- Often conglomerates

Malmqvist et al. Optic Disc Consortium
Optic Disc Drusen – review and new...

- Up to 2.4% of population
- Hereditary component
- 75% bilateral
- *Benign?*


34 WF

- 20/20, pupils normal, CF normal
- -7.00 OU
- BMI 31
- Denies H/A
- Elevated ONH
  - .1/.1 CD
  - +SVP

Globe convexity is normal

- Normal RNFL thickness
- No subretinal cavitation (but...??)
Measuring the ONH Sheath Diameter

- Axial images of the optic nerve (V and H)
  - 3 mm behind the posterior eye wall

In summary...

- (-) hyperreflectivity consistent with drusen
- (-) crescent sign
- Normal ONH sheath diameter
- Normal RNFL thickness
- +SVP
- Normal globe convexity
- Stability...
  - Presumed crowded discs but careful follow up

32 AA FM
Severe headaches, BMI 42
Papilledema Suspected? Now what...

- Brain Imaging
  - MRI – rule out space occupying mass
  - MRV – rule out cerebral venous thrombosis
- Lumbar Puncture
  - With opening pressure
  - Higher than 25/30 cm H2O is abnormal
- Referral?
- Determine underlying cause/association if any
  - Weight
  - Associated medications

MRI features

- Order with/without contrast, T1/T2-weighted, with fat suppression
  - Empty sella
  - Enlarged ON sheath
  - Increased tortuosity of ON
  - Flattened sclera
  - Anterior protrusion of ONH
  - Attenuation of cerebrovenous sinuses

Idiopathic Intracranial HTN

- 90-98% complain of headache
- Nausea/vomiting/dizziness – 40%
- Pulsatile tinnitus – 16-60%
- Visual disturbances – 30%
- No other neurologic findings (some with VIth palsy)

Mollan SP, et al. Pract Neurol 2018
IIHT – Who Gets It?

- BMI >30
  - >40 – worse visual outcome
  - Rapid weight gain – more severe
- Mostly females
  - Males 10% of the time
  - Not as likely to have H/A – may not come in
- Race – more aggressive in AA
  - 3 x more likely to have vision loss
  - 5 x increase in blindness
- Co-morbidities
  - HTN
  - Sleep apnea

Etiologies

- Idiopathic
  But what causes the papilledema?
  Axoplasmic flow stasis → swollen nerve fibers → compression of venules in the area and so venous stasis/leakage → accumulation of extracellular fluid

Acetazolamide + Low Sodium/Wt Loss Diet

- Contraindications:
  - Sulfa allergy?
    - chemical structure different than antibiotics – little evidence of cross-sensitivity
    - consider avoiding if hx of severe reaction
  - Long-term: liver, kidney disease, severe COPD
  - Caution with sickle cell
  - Caution with low potassium

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<tr>
<td>paresthesia</td>
</tr>
<tr>
<td>metallic taste</td>
</tr>
<tr>
<td>fatigue</td>
</tr>
<tr>
<td>malaise</td>
</tr>
<tr>
<td>GI disturbances</td>
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<tr>
<td>decreased libido</td>
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Acetazolamide + a low-sodium weight-reduction diet vs. diet alone
→ modest improvement in visual field function

- OCT Substudy of the IITT, Ophthalmology, Sept 2015
  - RNFL and Total Retinal Thickness (TRT) useful in following and monitoring response to treatment
  - Better RNFL thickness, TRT, and ONH volume swelling measurements

Associated Medications

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<tr>
<td>Steroids</td>
</tr>
<tr>
<td>Tamoxifen</td>
</tr>
<tr>
<td>Vitamin A</td>
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<tr>
<td>Nitrofurantoin</td>
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<td>Tetracyclines</td>
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Risk of Intracranial hypertension with intrauterine levonorgestrel

Treatment Goals ...

Management Strategies

Principles of management

- Protect vision
- Manage underlying disease
- Reduce headache mortality

- Visual Fields – for life
- OCT
- Labs?
- Co-management?

Following TxDiamox 250mg BID... x 2 years

34 year old Caucasian FM

- (+) H/A
- BMI 34
- Meds – Mirena IUD
• MRI – empty sella, flattened sclera, distended ONH sheaths

31 AAF
“nasal margins mildly indistinct; RTC x 1 week for further evaluation”

Early on – can appear as a nasal “C-shaped” edema

• Temporal area spared
• VA often normal
6 years later....

Those tools can miss subtle elevation..... 3 years earlier was consistent with anatomical elevation; then lost to f/u x 3 years

...3 years later patient decides to come back

• 21 AAF
• High BMI
• MRI clear
• Initial opening pressure of 52
Watching VF carefully...

- H/A’s improved
- RNFL thickness reduced
- Total volume reduced

And now...

- Extracellular edema leads to venous stasis...
Other treatment options....

• Surgical – controversial and provider-dependent
  • Ventricular-peritoneal shunt
  • Optic nerve sheath fenestration

• Repeated lumbar puncture?
  • Not well reported
  • Procedure - causes anxiety, local discomfort, complications, headache
  • LP-induced reduction of ICP is only short-lived

• On the horizon
  • Topamax – off label
  • Bariatric surgery – in trials

4:30 on a Friday....

• 41 year old male – has never had an eye exam
• LPE: 11 years ago
• No medications
• BMI 38
• C/o: severe headache and blurred vision x 2 weeks
• BCVA: 20/30, 20/60
• Pupils: appeared normal
• CFs: reduced OD, OS
• EOM: normal
• -SVP

Pre/post-surgical RNFL scans

• Can drive decisions for surgery (i.e. urgency)
  • ↓ing: become permanent
  • Stable: may wait even if VF shows loss

• Comparison of pre- vs. post- surgical scans in neuro cases
  • Meningioma can grow back, so useful for monitoring progression
26 WF, “blurry vision”
Hx hydracephalous, multiple previous surgeries
VA 20/40 OD, OS
H/A developing with more intensity
-SVP
BMI 42

Optic Neuritis: Most likely etiology based on age

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MRI “all clear”  
... ICP was borderline

67 AA F, Unexplained Pallor; 20/40 OD, OS
Optic Neuritis in MS

- Autopsy studies – up to 99%
  - Often presenting sign—up to 30%
  - Up to 70% develop ON throughout disease course

- 92% have eye pain
- VEP – even without VA loss (↓ amp, ↑ latency)
- Contrast sensitivity
- OCT
  - Earlier detection, often subclinical findings

OCT Findings

- Acute: thickening of inner retinal layers
- Atrophy
  - ≤2mos thinning
  - 10–40 μm of RNFL loss within 3–6 months
- Disease activity: ↑ rate of GCL thinning
Other causes of optic neuritis

edematous ONH
pallor

63 AAF with history HIV, HTN, stroke, cancer, kidney disease
BP 200/120; Notable Pallor OD
Deep Superficial

OD-pallor

OS-healthy