WHEN GLAUCOMA IS NOT GLAUCOMA

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Conundrum: Is This Really Glaucoma?
IS THIS REALLY GLAUCOMA? WHY DOES IT MATTER?

- Treating a disease that they don’t have
  - Expense and adverse effects
- Treating one disease when its really another
  - Vision loss and potentially worse
- Not treating a disease that they do have
  - Vision loss
- In reality, when encountering patients with mimicking and confounding conditions, the diagnosis is challenging
NOT ALL – ’OMAS’ ARE GLAUCOMA

- Pituitary adenoma
- Craniopharyngioma
- Meningioma
- Glioma
- Ischemioma
  - Anterior ischemic optic neuropathy (AION)/ Retinal infarcts
- Retinaloma
- Congenitaloma
- Coincidentaloma
- Misdiagnosoma
RULE #1

- Pallor in excess of cupping indicates something other than glaucoma.
- When the rim tissue is pale, suspect some cause other than, or in addition to, glaucoma.
- Rim pallor in glaucoma is very rare and is the exception, not the rule.
  - Disc pallor can only be accepted as part of glaucoma when other potential causes have been eliminated.
RULE #2

- Nothing notches a nerve like glaucoma.
- Focal damage to the neuroretinal rim is very specific to glaucoma.
  - Tumors don’t notch a nerve, nor do inflammations, infections, ischemia, etc.
RULE #3

- In glaucoma, the field should match the nerve
  - The field is allowed to be *better* than the nerve, but not *worse*.
  - Look for something else:
    - Look for neurogenicity in field loss pattern
    - Don’t forget the retina
CASE

- 72 YOM
- Long term glaucoma suspect OS
- Fields and imaging not changing
- Treated intermittently for NTG
  - IOP ranges from 09 – 12 OU
- Problem: Nerve does not match field
  - Mild disc pallor

Violates Rules 1-3
Sclerosed, occluded arteriole and retinal collaterals

DX: Old BRAO: Retinal-oma
Misdiagnos-oma
CASE: 29 YOM

- Treated for glaucoma for 4 years based upon disc appearance and field loss
- Hx of uveitis OD
  - Reports that his vision was reduced during episode “very foggy”
BY THE WAY, HE ALSO HAD THIS OD...
CASE: 29 YOM

- Normal disc, RNFL, GCC
- Chorioretinal scar and hx consistent with toxoplasmosis
- PVD
- Field loss due to retinaloma
- Stopped meds- 18 mm OD, 16 mm OS; CCT 570 OD; 557 OS
- Retinaloma/ Misdiagnosoma
63 YOF: GLAUCOMA OS X 5 YEARS

- IOP typical range: 14-18 OD; 15-18 OS; CCT: 556 OD; 543 OS
- Unilateral disease; symmetrical IOP
- Pt chooses observation.
- **Cataracts**
- **No frank notching, pallor, signs of retinal disease**
IS IT ONLY GLAUCOMA?

- 53 YOBF- No complaints
- BVA 20/20 OD, OS
- Perrl (+) RAPD OS
- IOP 30 mm Hg OD and 32 mm Hg OS
- Unilateral sectorial disc pallor with minimal rim damage
- Color vision testing normal
- SLE normal OU
- Anterior chamber angles open gonioscopically.
Is this glaucoma or something else like a tumor?

Unilateral disc pallor? Glaucoma, something else, or both?
Neuroimage or not?
The Cupped Disc

Who Needs Neuroimaging?

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**Objective:** To determine the incidence of positive neuroradiologic studies in consecutive patients with glaucoma associated with normal intraocular pressure and to compare the psychophysical and clinical characteristics of these eyes with eyes with disc cupping associated with intracranial masses.

**Design:** Retrospective case-controlled study.

**Participants:** Fifty-two eyes of 29 patients with glaucoma associated with normal intraocular pressure and 44 eyes of 28 control patients with compressive lesions were reviewed.

**Intervention:** The medical records of consecutive glaucoma patients with normal intraocular pressure who underwent brain magnetic resonance imaging or computed tomography scanning as part of a diagnostic evaluation between January 1, 1985, and July 1, 1995, were reviewed. A masked reading of optic nerve photographs and visual fields was performed by one observer. A similar analysis was performed on a control group of consecutive patients with nonglaucomatous optic nerve cupping with known intracranial mass lesions.

**Main Outcome Measures:** The neuroradiologic findings, clinical characteristics, optic nerve head appearance, and patterns of visual field loss were compared between groups.

**Results:** None of the patients diagnosed with glaucoma had neuroradiologic evidence of a mass lesion involving the anterior visual pathway. Compared to control subjects, patients with glaucoma were older (P = 0.0001), had better visual acuity (P = 0.002), greater vertical loss of neuroretinal rim tissue (P = 0.0001), more frequent optic disc hemorrhages (P = 0.01), less neuroretinal rim pallor (P = 0.0001), and more nerve fiber bundle visual field defects aligned at the horizontal midline (P = 0.0001). Visual acuity less than 20/40, vertically aligned visual field defects, optic nerve pallor in excess of cupping, and age younger than 50 years were 77%, 81%, 90%, and 93% specific for nonglaucomatous cupping associated with compressive lesions, respectively.

**Conclusions:** Anterior visual pathway compression is an uncommon finding in the neuroradiologic evaluation of patients with a presumptive diagnosis of normal-tension glaucoma. Younger age, lower levels of visual acuity, vertically aligned visual field defects, and neuroretinal rim pallor may increase the likelihood of identifying an intracranial mass lesion. *Ophthalmology* 1998;105:1866–1874
Patients with glaucoma were:
- Older
- Better visual acuity
- Greater vertical loss of neuroretinal rim
- More frequent disc hemorrhages
- Less neuroretinal rim pallor
- Field defects along the horizontal

"THE CUPPED DISC: WHO NEEDS NEUROIMAGING?"

- Patients with mass lesions:
  - Visual acuity less than 20/40
  - Vertically aligned visual fields defects
  - Optic disc pallor in excess of cupping
  - Age younger than 50 years

MORE INDICATIVE OF A COMPRESSIVE MASS LESION THAN GLAUCOMA

- Younger age
- Lower levels of visual acuity
- Vertically aligned visual field defects
- Neuroretinal rim pallor

BACK TO THE PATIENT...

- Rim minimally notched 😞
- Disc pallor 😞
- Unilateral damage 😞
- No disc hemorrhage/ parapapillary atrophy 😞
- Age over 50 😊
- Arcuate defect- glaucomatous 😊
- Risk factor- IOP 30s 😊
- Acuity and color normal 😊
INDICATION: Concern is for optic nerve compression. The patient has a history of glaucoma diagnosed two weeks prior to examination. No history of specific trauma or previous surgery in this region is provided.

TECHNIQUE: Standard pulse sequences of the orbits were obtained prior to and following the intravenous administration of gadolinium contrast. Images were obtained to include the optic chiasm.

FINDINGS: In scanning images through the brain, the lateral ventricles and cortical sulci are normal in appearance without midline shift or mass-effect. The gray white matter interface is well delineated. There is normal signal flow void within the carotid siphons bilaterally. On the precontrast images, there is no abnormal extra axial fluid collection. The posterior fossa has a normal MRI appearance. The 7th and 8th cranial nerve roots have a normal MRI appearance. There is thickening of the mucosa of the left maxillary sinus and opacification of scattered ethmoid air cells. There are normal regions of signal drop out in the topography of the mastoid air cells. The neurohypophysis has a normal MRI appearance. The infundibulum is normal in signal and morphology without evidence of deviation. The adenohypophysis of the pituitary appears within normal limits. There is no evidence of elevation of the optic chiasm.

The globes are normal in signal and morphology. The pre and post septal regions have a normal MRI appearance. The optic nerves are normal in signal and morphology. The extraocular muscles have a normal MRI appearance. The extraconal fat planes are preserved.

IMPRESSION:

1. No MRI abnormality of the orbits is identified.

2. Thickening of the mucosa of the left maxillary sinus and opacification of scattered ethmoid air cells which may be related to sinusitis.

3. No MRI abnormality of the optic chiasm is identified.
54 YOM

- Referred for glaucoma management
- Told he had glaucoma 6 years earlier in Nigeria - no Tx
- 20/30 OD; HM OS
- 30 mm Hg OD; 23 mm Hg OS
Distinct rim pallor
OS 😞
Cupping does not match vision 😞
Yes, we still need to do fields in the age of RNFL imaging. Sometimes it's not glaucoma.

Pattern Deviation not shown for severely depressed fields. Refer to Total Deviation.

GHT
Outside normal limits

VFI 15%

MD -25.74 dB P < 0.5%

PSD 12.92 dB P < 0.5%

Pattern Deviation not shown for severely depressed fields. Refer to Total Deviation.

GHT
Outside normal limits

VFI 48%

MD -16.54 dB P < 0.5%

PSD 15.12 dB P < 0.5%
VF defects respecting the vertical meridian are **NOT** characteristic of glaucoma and need to be investigated further!

- Ordered MRI....
  - Pituitary adenoma
CASE: 56 YOF

- Dx POAG OU 5 years ago
- Slowly progressive vision loss
- LP OD; 20/30 OS
- Used combo med- ran out months ago
- IOP: 19 mm OD, 18 mm OS
- CCT: 560; 544
TECHNIQUE: MRI of the orbits without and with gadolinium contrast:

Magnetic resonance imaging was performed on the brain utilizing sagittal, axial and coronal T1-weighted images. Subsequently, axial T2-weighted dual-echo images were acquired. Sequences were obtained without and with gadolinium contrast.

FINDINGS: The globes are normal in signal and morphology. The optic nerves have a normal MRI appearance. The extra-ocular muscles are normal in signal and morphology. The intraconal and extraconal fat planes are preserved. The visualized portions of the paranasal sinuses are well aerated.

There is a cystic and solid enhancing mass within the sella with dimensions of 36.06 mm in craniocaudad dimension and anterior posterior dimension of approximately 26.3 mm. The mass is partially cystic with septations but has solid enhancing components and elevates the optic chiasm.

IMPRESSION:

ENHANCING CYSTIC SEPTATED MASS WITHIN THE ADENOHYPOPHYSIS OF THE PITUITARY WITH DIMENSIONS OF 36.06 MM IN CRANIOCAUDAD DIMENSION AND ANTERIOR POSTERIOR DIMENSION OF APPROXIMATELY 26.3 MM. DIAGNOSTIC CONSIDERATIONS INCLUDE PRIMARILY FOR MACROADENOMA BUT ADDITIONAL DIAGNOSTIC CONSIDERATIONS INCLUDING CRANIOPHARYNGIOMA CANNOT BE EXCLUDED. THERE IS ALSO INCIDENTALLY MILDLY DILATED BILATERAL LATERAL VENTRICLES.
DISCUSSION

- Retrospective study performed on patient’s with non-glaucmatous optic atrophy.

- 104 patients (157 eyes)

<table>
<thead>
<tr>
<th>Etiology</th>
<th>%</th>
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<tbody>
<tr>
<td>Unknown</td>
<td>45.2%</td>
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<tr>
<td>Chorioretinal disease</td>
<td>23.1%</td>
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<tr>
<td>Trauma</td>
<td>13.5%</td>
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<tr>
<td>Toxic-nutritional</td>
<td>7.7%</td>
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<tr>
<td>Compressive Lesions</td>
<td>4.8%</td>
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Another study examined the etiology of non-glaucomatous/non-retinal optic atrophy and concluded:

- 204 patients (353 eyes)

<table>
<thead>
<tr>
<th>Etiology</th>
<th>%</th>
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<tbody>
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<td>Non-hereditary neoplasia</td>
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<tr>
<td>Autoimmune</td>
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<tr>
<td>Hereditary neoplasia (neurofibromatosis, Leber’s etc)</td>
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<tr>
<td>Ischemic/vascular</td>
<td>5.9</td>
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<tr>
<td>Metabolic</td>
<td>4.4</td>
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<tr>
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<tr>
<td>Infection/Trauma</td>
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Tumor was the most COMMON cause in this study*

DISCUSSION

- Role of OCT in neuro-ophthalmology
  - RNFL does NOT correspond with the VF defect as clear as the GCL does.
  - Retrograde trans-synaptic degeneration of retinal ganglion cell layer has been proposed as one of the mechanisms contributing to permanent disability after visual pathway damage.

DISCUSSION

- Greater GCL thinning in the heminasal retina in a patient with bitemporal hemianopia.

DISCUSSION

Purpose: Measure the thickness of the circumpapillary retinal nerve fiber layer and the ganglion cell complex in patients with macroadenomas without physical chiasmal compression.

Methods: 22 Patients with pituitary macroadenoma without chiasmal compression and 18 patients as controls.
DISCUSSION

- Results:
  - PRNFL and GCC were significantly thinner in patients than controls.

- Conclusion:
  - Pituitary macroadenomas, even in the absence of chiasmal compression, may induce GCC and retinal nerve fiber layer thinning. SD-OCT may have a role in the early diagnosis and management of patients with pituitary tumours.

Evaluation of Macular Ganglion Cell Complex and Peripapillary Retinal Nerve Fiber Layer in Primary Craniopharyngioma by Fourier-Domain Optical Coherence Tomography

Liu Yang, A,G Yuanzhen Qu, B,C,D Wen Lu, E,F and Fengjun Liu B,C

Conclusion:
- GCC was more sensitive than pRNFL in detecting optic nerve damage in the eyes of craniopharyngioma patients.

ROLE OF SD-OCT

- Ganglion cell complex (GCC): Composed of NFL, ganglion cell layer, and the inner plexiform layer

- NFL thinning can reflect axonal degeneration of the optic nerve fibers caused by intracranial lesion.

- RNFL and GCC thickness measured by OCT has been identified as useful prognostic indicators in the preoperative assessment of chiasmal compression AND postoperative VA and VF recovery.


DISCUSSION

- One study showed RNFL and GCC loss on SD-OCT evaluation of the optic nerve.

- Right Eye (Arrow)

- Left Eye (Arrow)

CAN GCC PREDICT POST-SURGICAL VF?

- One study suggests that if GCC thinning does not occur, visual recovery may be possible even in the presence of profound VF loss in the preoperative test.⁷

A) Pre-op GCC

B) Pre-op VF

C) Post-op VF

One study examined the differences between RNFL and GCL thickness of glaucoma vs compressive optic neuropathy.

- Red = Significant
- Gray = Not Significant

GLAUCOMA VS COMPRESSIVE OPTIC NEUROPATHY

• Top image is compressive optic neuropathy. Visible thinning of the nasal and temporal hemiretina with arcuate RNFL sparring.
• Bottom image is glaucomatous optic neuropathy. Visible thinning of the arcuate RNFL area.
• Results: Macular analysis—specifically of the mGCL thickness was superior to circumpapillary analysis in discriminating between CON and GON.

USE OF OCT IN COMPRESSIVE OPTIC NEUROPATHY

• This case depicts a NORMAL optic nerve on fundoscopic examination and NORMAL visual field.

• ABNORMAL GCC in a patient with compressive optic neuropathy.

One study compared circumpapillary RNFL in eyes with compressive optic neuropathy (CON) and open-angle glaucoma (OAG) using SD-OCT and HRT.

Results:
- Compressive optic neuropathies demonstrate proportionally more cpRNFL thinning nasally and temporally compared with OAG.

TAKE HOME

- Although compressive lesions account for a small percentage of patients with optic atrophy, optic atrophy is the most common ocular sign for compressive lesions.

- Patients diagnosed or suspected of having glaucoma also demonstrating optic nerve head pallor in excess of cupping need to be further evaluated for alternate conditions or comorbidities.

- Because visual fields are often confused between glaucomatous and compressive optic neuropathy, GCC and pRNFL evaluation can be a valuable adjunct in identifying intracranial lesions.