US EYE

CRANIAL CONUNDRUMS:

CLINICAL PEARLS FOR CRANIAL DISEASE

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Center for Sight/ US EYE

COVD

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DISCLOSURE:

Dr. Joseph Sowka, in the past 24 months, has lectured for, consulted with, or advised B&L. All disclosures have ben mitigated. Dr. Sowka has no direct financial interest in any of the diseases, products or instrumentation mentioned in this presentation. He alone created this content. He is a co-owner of Optometric Education Consultants. www.optometricedu.com

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Further Disclosures

- I work in a large medical-surgical practice, not an academic referral center.
- I book 25-30 patients per day, including primary care, glaucoma, cornea, emergencies, etc.
- I function much as everyone here today.
- I don't have 2 hours to do a neuro-op evaluation.

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WHY DO NEURO-OP?

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NEURO-OP IS A FINANCIALLY REWARDING SPECIALTY

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NEURO-OP IS A FINANCIALLY REWARDING SPECIALTY…SAID NOBODY EVER

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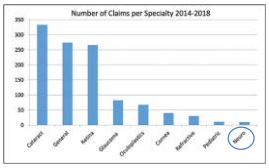

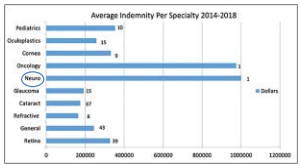

Courtesy of Ophthalmic Mutual Insurance Company

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Neuro-Op

- Not enough neuro-ophthalmologists
  - 45 fellowship spots; only 25 filled
- High risk
- Is this urgent? Can it wait?
- Complicated
- Diagnose and Adios
- Schedule-busting
- There is no 99206 or 99207 codes
- No RVU or bonus for saving a life

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Courtesy Andy Lee, MD

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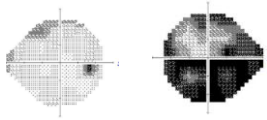
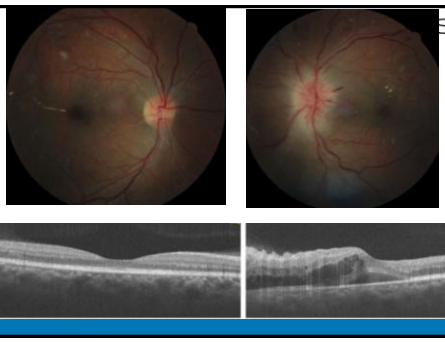
When in Doubt…just send to the ER. They Always Get it Right…Right?

- 36 YOM- Sudden painless loss of vision OS- 1 day
- 20/20 OD, 20/200 OS; RAPD OS
- T2 DM- metformin





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36 YOM

- DDx: Infection, infiltration, inflammation, demyelination, compression
- Evaluation ordered:
  - MRI Brain w/wo contrast & MRI orbits and chiasm w contrast and fat suppression
  - CBC, ESR, CRP, ANA, RPR, FTA-Abs, ACE, zoster IgM and IgG, rubella IgG and IgM, toxoplasmosis, Lyme, Bartonella henselae and quintana panels, P-ANCA, C-ANCA
  - NPDR with DME- Retina referral for macular edema
- F/U with retina- had not obtained any imaging or serology
  - Sent directly to ER for evaluation
- On-Call OMD (resident)
  - CBC done and normal (glucose elevated)
  - Patient has diabetic retinopathy only
  - Doesn't need MRI
  - *Story about the older man with orbital pain*

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60 YOWM

- Presents urgently for "visual disturbance following severe migraine"
- Went to hospital ER- CT head "normal" – refused MRI; left AMA
- Double vision- mostly horizontal with vertical component
- Extreme head pain- right periorbital region- rapid onset
  - Diplopia developed one day after headache/ periorbital pain
  - Neither are currently worsening or improving- constant
- No fatigue, vision loss, nausea, vomiting, malaise, lethargy, mentation changes, confusion
- No PCP
- BP 164/84

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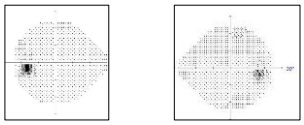
- 20/20 OD, 20/15 OS
- PERRL (-) RAPD
- Optic discs and retinas normal OU; 0.35/0.3 OU



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Polling Question 1: What is the likely etiology?

- Mass lesion
- Aneurysm
- Ischemia
- Inflammation

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What is the needed testing?

- MRI: brain, orbits, chiasm with gadolinium and Fat saturation
- ESR, CRP, platelets for GCA
- ACH antibodies for myasthenia gravis

Diagnosis: 6th Nerve Palsy (378.54) (H49.21)
Urgency: STAT
Comment: Attention to right cavernous sinus/ parasellar area. Rule out intracavernous aneurysm, cavernous sinus and posterior orbital inflammation, and pituitary apoplexy. Please perform contrast with both brain and orbital images and fat suppression for orbit.

Lab: MRI of Brain and Orbit with and without contrast.

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- Difficulty with MRI scheduling
- First available with imaging center and pt schedule 2 weeks
- Moved up to 48 hours after negotiating with center and patient
  - *Radiology Let's Make a Deal*

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IMPRESSION:

Nonspecific abnormal enhancement at the right orbital apex, appearing most localized to the region of the right superior orbital fissure, detail above. Mild right-sided esotropia is noted. Infectious etiology would be possible, but thought unlikely given the lack of other inflammatory changes. Inflammatory etiology such as Tolosa Hunt possible, although this is typically a diagnosis of exclusion. Neoplastic etiology possible, although thought less likely. Could perform further workup with MRA circle of Willis and short-term follow-up MRI orbits in 1-2 months, without and with gadolinium.

Findings will be phoned to the referring clinicians office.

No acute intracranial process.

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Tolosa Hunt syndrome

- Likely inflammatory- consistent with Tolosa Hunt syndrome
- Initiated 60 mg oral prednisone
  - Pt felt better rapidly but diplopia persisted
- Steroid taper difficult in THS
- Worked him into neuro-ophthalmology as favor in 48 hours
- Pt no-show
  - "I have to run a business"

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Tolosa Hunt syndrome

- Severe and unilateral periorbital headache associated with painful ophthalmoplegia
- Recognized by the National Organization for Rare Disorders (NORD)
  - One case per million per year
- Idiopathic non-specific inflammation in the region of the cavernous sinus and/or superior orbital fissure
  - Not associated with systemic inflammation, infection, or autoimmune disease

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International Headache Society (IHS) Diagnostic Criteria

- Unilateral headache and includes both of the following:
  - Presence of granulomatous inflammation of the cavernous sinus, superior orbital fissure or orbit, as seen on MRI or biopsy
  - Palsies of one or more of the oculomotor nerves (cranial nerves III, IV, and/or VI) on the same side which have followed headache in two weeks or less, or have developed simultaneously with a headache
- Localization of a headache around the eye on the same side
- Not better explained by any other headache etiology

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Tolosa Hunt syndrome

- Dramatic improvement in pain with oral steroids
  - Ophthalmoparesis slower to resolve
- Can spontaneously resolve
- No specific data to give recommendations about dose, duration, or route of administration
  - Initial high-dose therapy for few days followed by a gradual taper over weeks to months.

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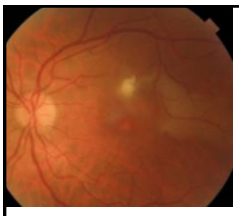
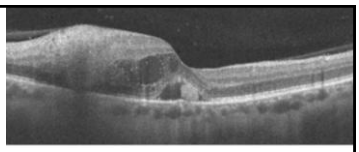
Good News…Bad News

- Pt never went to neuro
- Returns after 1.5 years
- Very happy with his care- short term steroid therapy relieved headache and diplopia
- Reports painless field loss OS…





NOW OFF TO THE STROKE UNIT…

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POST-OP RED EYE

- 73 YOM- cataract and mild glaucoma
- Underwent cataract extraction with iStent the day before
- On-Call emergency call- 6:30 am
- "Woke up and my eye was all red"
- "Can't really see"

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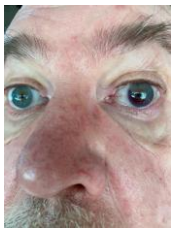

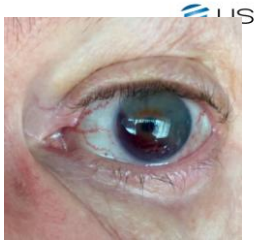

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Polling question 2

- Not a problem because hyphema commonly occurs after iStent
- Not a problem because blurred vision is from corneal edema
- Problem because the IOL dislocated
- Problem but I'm not sure why

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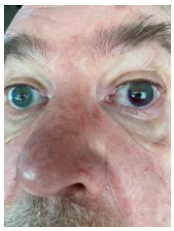

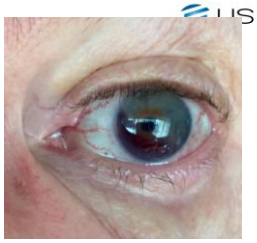

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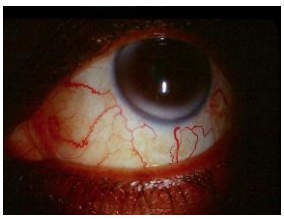
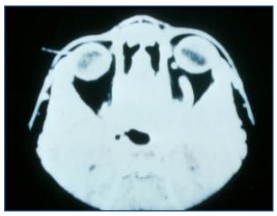
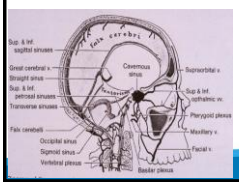
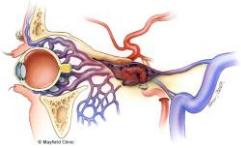


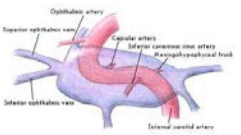


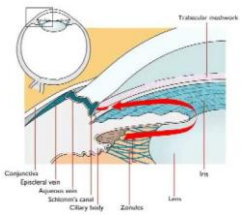
CAROTID CAVERNOUS SINUS FISTULA

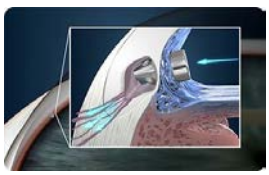
- Cavernous sinus…
  - Trabeculated venous cavern
  - Houses CN III, IV, VI, V1, oculosympathetics, and ICA
  - Drains eye and Adnexa via inferior and superior ophthalmic veins to petrosal sinuses and jugular vein
- Fistula…
  - Rupture of ICA or meningeal branches within sinus
    - Meningeohypohyseal, McConnell's Capsular, Inferior Cavernous
  - Mixing of arterial blood in venous system





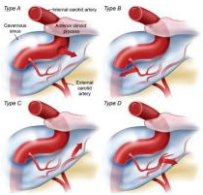


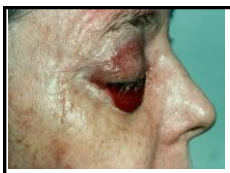


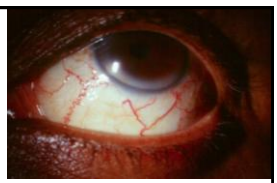


CAROTID CAVERNOUS SINUS FISTULA

- Hemodynamic
  - High flow vs low flow
- Angiographic
  - ICA vs meningeal branches
- Etiology
  - spontaneous vs traumatic





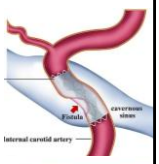


CAROTID CAVERNOUS SINUS FISTULA

- Increased venous pressure
- Orbital congestion
- Proptosis (pulsatile)
- Corneal exposure
- Arteriolization
- Orbital bruit
- Myopathies and cranial neuropathies with diplopia
- Secondary glaucoma
- *Blood in Schlemm's canal on gonio*

CAROTID CAVERNOUS SINUS FISTULA

- Vision threatening – not life threatening
- Spontaneous etiology – spontaneous resolution
  - ICA compression with contralateral hand
- Traumatic – clipping and ligation
- Balloon or particulate embolization
- Manage glaucoma aggressively
  - Prostaglandin analogs



Rule: Beware the Chronic Red Eye

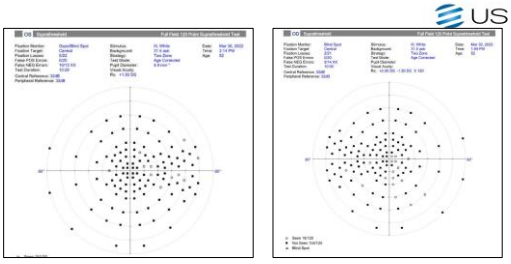
- Dilated & tortuous episcleral vessels that go to the limbus and back (omega loops) Ω
- Intervening "clear conjunctiva"
- Red eye that doesn't respond to any topical treatments
  - Bag-o-Meds
- Other non-red eye findings: Chemosis, IOP elevation, proptosis, ophthalmoplegia, ptosis, lid edema

Ode to a Fistula

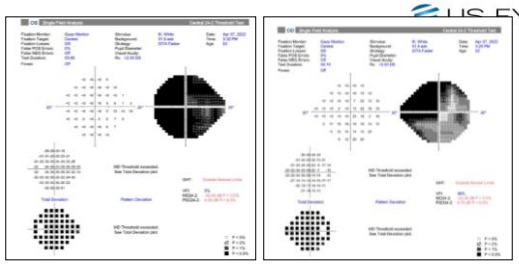
Beware the chronic red eye
It isn't infected, inflamed, or dry.
When corkscrew vessels makes the eye red
And the patient has bag-o-med.
The problem is deep
And arterial blood has begun to seep.
Your first fistula you will always miss
But on your second case you will never be remiss

52 YOWM

- States LEE was about 2 years ago w/o dilation
- Pt reports that he has noticed peripheral "blind spot" OS>OD mostly when driving. Pt has not noticed an overall change in VA with other daily activities other than driving. States that glasses do not seem to improve the "blind spot".
- BVA 20/20 OD, OS
- PERRL (-) RAPD
- Examination normal; C/D 0.2/0.2 OD, OS; pink and distinct



Thoughts? Next Steps?



Thoughts? Next Steps?

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- MRI brain with and without contrast:
- 3.4 x 2.3 x 3.9 cm lobulated sellar/ suprasellar mass. Compression and displacement of chiasm and posterior displacement of midbrain. Differentials include macroadenoma with infarction and hemorrhage, epidermoid cyst, craniopharyngioma. Mild hydrocephalus.
- Craniotomy with near complete removal of tumor.
- **Lost to follow up but spouse has called twice thankful for finding his brain tumor.**

US EYE

- **FULL FIELD 120-POINT SCREENING FIELDS ARE NOT HELPFUL.**
30-2 IS NO BETTER THAN 24-2.
SITA STANDARD IS NOT NEEDED. USE A FAST PROGRAM
LOOK AT THE GRAYSCALE

US EYE

68 YOWM

- Cataract surgery OU
- Capsule haze- YAG OU
- BVA 20/25 OD, OS
- *"VISION IS WORSE NOW THEN BEFORE MY SURGERY"." BRIGHT LIGHTS BOTHER ME AND I AM MISSING LETTERS WHEN I READ"*
  - *Feels surgery was botched*
- Exam normal- referred to retina
- Retinal referral- few drusen; mild RPE changes; mild VMT
  - Possible old NAAION- neuro referral

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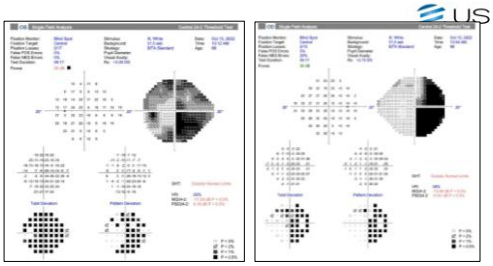

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- MRI with and without contrast- brain

CONCLUSION:
1. Thin-walled suprasellar lobulated cystic lesion which follow CSF signal in all sequences, measuring 3.2 x 4.7 x 3.4 cm and extends predominantly to the left, exerting mass effect and the left optic pathways, left medial temporal lobe structures, left cerebral peduncle, as well as on the left lateral and third ventricles. There is 4 mm left to right midline shift, at the level of the anterior third ventricle. No definite solid component, restricted diffusion, or internal enhancement identified. The finding is most suggestive of a suprasellar arachnoid cyst.

- Outcome?

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33 YOM

- Occipital HA x 4 mos
  - Visual aura with HA
- Worsens when standing after sitting
- Relieved by sleep
- Denies vision loss, nausea, diplopia, pain on eye movement, behavioral changes
- Age appropriate physical normal
- Referred by PCP

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33 YOM

- 20/20 OD, OS with myopic correction
- Pupils, EOMs, conf fields normal OU
- Biomicroscopy normal OU
- IOP 12 mm Hg OU
- Nasally obliquely inserted nerves
- C/D 0.3/0.3 OU

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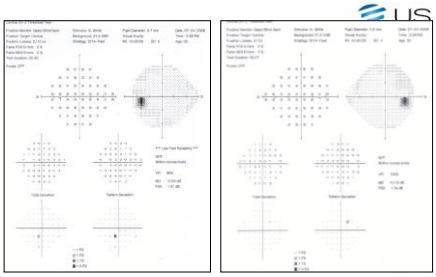

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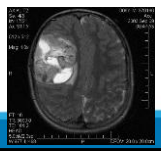
33 YOM

- Co-manage with PCP- internist
- Complete blood work blood work up including FTA-ABS/RPR; Lyme titer; CBC w/differential
- MRI w and w/o contrast of brain and orbits
  - Pt had MRI done and mass was identified in fronto/parietal region more toward right side
  - Outcome?



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A NORMAL VISUAL FIELD DOES NOT MEAN THAT THERE ISN'T ANYTHING WRONG. IT JUST MEANS THAT THE VISUAL SYSTEM IS NOT IMPACTED

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39 YOM: COVID lockdown

- Previous history of migraine developed lethargy and a new and worsening headache.
- He presented to a hospital emergency room where he underwent a non-contrast enhanced computed tomography (CT) and magnetic resonance imaging (MRI) which were subsequently interpreted as normal.
  - His headache was attributed to migraine, and he was medicated as such and discharged.
- Three days later, he developed horizontal and vertical diplopia

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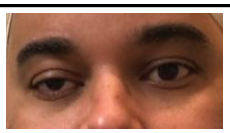

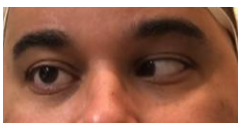

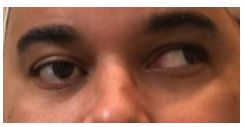

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39 YOM: COVID lockdown

- His visual acuity and visual fields were normal.
- He manifested a right pupil-sparing, external partial cranial nerve three palsy and concurrent right sixth nerve palsy. He also complained of worsening headache and lethargy.
- Where is the lesion?
- Let's contact the radiologist for a second reading…

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39 YOM: COVID lockdown

- He was immediately sent for repeat imaging to include contrast-enhanced MRI of the parasellar area and MRA to rule out intracavernous aneurysm and pituitary apoplexy.
- Imaging revealed a pituitary macroadenoma with intratumor hemorrhage consistent with pituitary apoplexy.
- Lateral spread into the right cavernous sinus and possible spread into the left cavernous sinus as well.
- No mass effect on the optic chiasm or prechiasmal intracranial portion of the optic nerve.
  - Hence normal acuity and fields
- The patient was immediately admitted for endocrinological and neurosurgical evaluation

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Pituitary apoplexy

- Pituitary apoplexy is a severe and potentially fatal medical condition complicating 2-12% of pituitary adenomas and characterized by the variable association of headache, vomiting, visual impairment, ophthalmoplegia, altered mental state and consciousness, lethargy, and panhypopituitarism.
- Hemodynamic instability may be result from adrenocorticotrophic hormone deficiency, which can be fatal.
- Occurs due to a rapid expansion, mainly caused by hemorrhage or infarction of a preexisting (known or unknown) adenoma
- Cranial nerve palsy (CN III) or palsies
  - Cranial nerve VI most common, followed by CN III
- Visual field defects
  - Bitemporal hemianopsia

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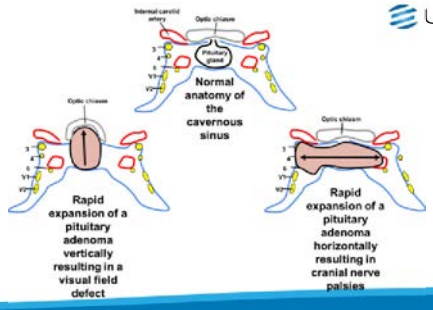

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Pituitary apoplexy

- Most common presenting symptom occurring in 90% of patients is sudden onset of severe headache
  - Commonly described as frontal or retro-orbital.
    - Pituitary apoplexy is often overlooked as a possible cause of "thunderclap headache" where diagnostic evaluations tend to direct to more common causes of this presentation including subarachnoid hemorrhage, cerebral venous sinus thrombosis, and cervical artery dissection.
- Approximately 50% have visual abnormalities
  - Blurred vision
- Cranial nerve palsy (CN III) or palsies
  - Cranial nerve VI most common, followed by CN III
- Visual field defects
  - Bitemporal hemianopsia
- Facial weakness

US EYE

Pituitary apoplexy

- Most symptomatic patients undergo CT scanning in an emergency setting due to the clinical suspicion of acute intracranial hemorrhage
- Acute hemorrhagic infarct may be seen on CT
  - Non-hemorrhagic infarcts will usually show no abnormalities without intravenous contrast
- MRI with contrast is the most effective imaging in cases of suspected pituitary apoplexy
  - MRI is superior to CT

US EYE

Pituitary apoplexy

- Positive outcome in most cases
  - Conservative medical treatment
  - Stabilize and replace diminished pituitary hormones
- Surgical decompression
  - Trans-sphenoidal or subfrontal transcranial approach
  - Patients with visual impairment and neuro-ophthalmic dysfunction will be selected for surgery.
- Patient was medically stabilized, and surgery delayed due to COVID lock down
- Ultimately underwent successful surgical decompression

US EYE

46 YOWF

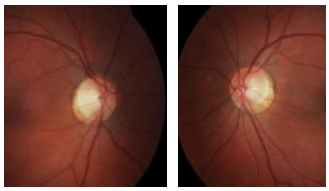
- Referred from local OD for new/ sudden onset blurred vision OD x 1 month
- No pain
- Missing piece of vision
- No diplopia
- No head pain
- Feels she might have had COVID one week before vision loss
- Omeprazole for heart burn
- Unspecified vision loss

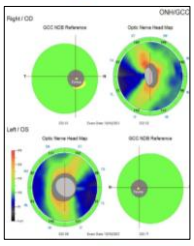
US EYE

46 YOWF

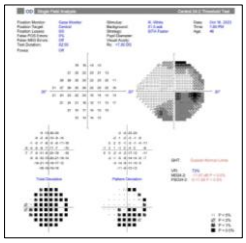
- Additional hx: had left side head trauma from fall last year
- Noted vision loss one month ago and feels it has gotten progressively worse
- No pain on eye movements
- Corrected VA 20/200 OD PH 20/60; 20/20 OS
- (+) RAPD OD
- 0.6/0.6 OD, OS; obliquely inserted discs without pallor or edema
- Color 8/14 OD; 14/14 OS
- Fundus and macula OCT normal OU

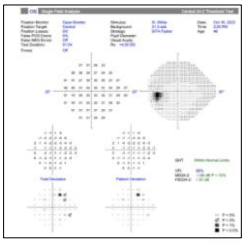
US EYE





US EYE





US EYE

Polling question 3: What is the likely diagnosis?

- Optic neuritis
- Neuromyelitis optica spectrum disorder (NMOSD)
- Myelin oligodendrocyte glycoprotein antibody disease (MOGAD)
- Non-arteritic anterior ischemic optic neuropathy (NAAION)
- Infection
- Infiltration
- Compressive lesion

US EYE

Taking a Second Look

- Painless loss of vision
- Progressive over past month?
- Examining the history- pt reports having trouble with contact lens and kept replacing
- Acknowledges vision loss may have been longer than past month
  - Contact lens problem

US EYE

Study/Referral: Neuroophthalmology Evaluation
Date: 10/16/2023
Diagnosis: Unspecified Disorder of Optic Nerve and Visual Pathways (377.9)
Urgency: Urgent
Comment: Please fax results to 941-496-4223. Please rule out demyelination, compression, infiltration. Right optic neuropathy. Please perform both studies (brain; orbits/chiasm) with contrast.

Lab: MRI of Brain and Orbit with and without contrast.

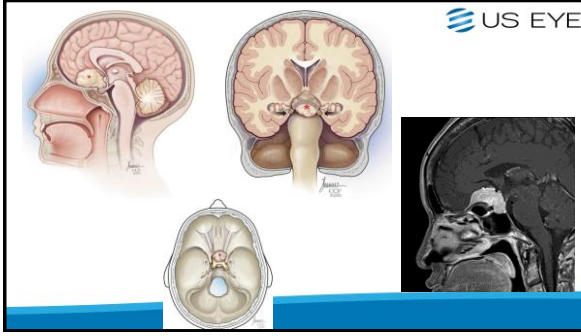
There is mass effect upon the optic chiasm which is displaced superiorly, see image 19 of series 1301. The infundibulum is minimally displaced to the left. The mass displaces portions of the prachiasmatic right optic nerve laterally and superiorly. No evidence of invasion of the cavernous sinuses, although it does abut approximately 50% of the supraclinoid right ICA. No evidence of hemorrhage.

IMPRESSION:

Extra-axial mass lesion intimately connected to the planum sphenoid alley most consistant with a planum sphenoidale meningioma. Mass effect upon the prechiasmatic right optic nerve and optic chiasm as detailed above. The infundibulum is minimally deviated from the right to the left. Complete description above.

Findings will be phoned to referring clinicians office.

US EYE



US EYE

Planum sphenoidale meningioma

- Meningiomas arising from the midline anterior cranial fossa may be classified as planum sphenoidale and/or olfactory groove meningiomas
- 10% of intracranial meningiomas
- Meningiomas of the planum sphenoidale may manifest with cognitive dysfunction or visual loss later
- They may cause superior/posterior displacement of the frontal lobes, inferior/posterior compression of the optic chiasm
- Most commonly treated with surgery

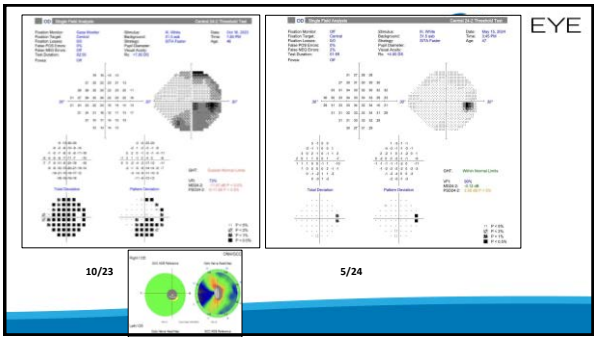
US EYE

Why wasn't it…?

- Optic neuritis
- NMOSD
- MOGAD
- NAAION

Outcome

- Surgical removal via craniotomy (4 months after diagnosis)
  - Local orbital and neurosurgeons passed due to chiasmal and ICA involvement
  - Top skull-based surgeon at university
- Tightly wrapped around optic nerve
  - Had to leave a bit of tumor
- 5/2024- f/u- feels vision is better and less dim- but not as bright as OS
- No RAPD OU now
- Color and contrast not tested
- BCVA: 20/15-2 OD, OS



BUCKLE YOUR SEATBELTS AND BRACE FOR IMPACT. YOU ARE NOT GOING TO LIKE WHAT I AM ABOUT TO SAY NEXT.

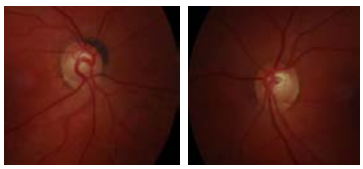
Summary of 5 mass lesions

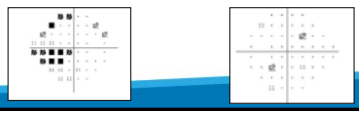
- Vision normal in 4 cases, abnormal in 1
- Vertical field loss in 2 cases; 2 cases normal fields; 1 case unilateral loss
- Headache in 2 cases; none in 3 cases
- Diplopia and ophthalmoparesis in 1 case, none in 4 cases
- No disc pallor in any case
- No disc edema in any case
- Conclusion: mass lesions do not follow expected rules

48 YOF

- Sudden painful vision loss OD
  - 2 days
  - ER: CT Head- "normal"
  - PCP diagnosed Zoster
    - Valtrex
    - Prednisone (neither used yet- doesn't think she has zoster)
    - Referred to R/U HZO
- 20/60 OD, 20/20 OS
- RAPD OD
- Color 14/14 OD (struggle), OS
- Retro-orbital and temporal pain

48 YOF





Plan: MRI brain, orbits, chiasm with gadolinium and fat suppression of orbits

US EYE

FINDINGS :
MRI ORBITS:
There is edema and enhancement of both optic nerves with optic nerve thickening worse on the right, suspicious for optic neuritis. The orbital contents are otherwise just unremarkable

MRI BRAIN:
There are fairly extensive nonenhancing punctate and confluent foci of abnormal T2 prolongation predominantly about the lateral ventricles. Many of these are oriented perpendicular to the lateral ventricles, raising the possibility of demyelination with optic neuritis.

No acute hemorrhage or infarct. No mass-effect or midline shift.

no discrete suspicious enhancing intracranial lesion

the ventricles and cortical sulci are normal for the patient's age.

US EYE

Patient's Questions

- Are you sure its optic neuritis?
  - Pain, RAPD, female, disc edema, MRI enhancement
- Is it an isolated demyelinating optic neuritis?
  - Clinically isolated syndrome
- Do I have multiple sclerosis? (polling question)
- What is my risk of developing multiple sclerosis?
- Should I be treated?

US EYE

Polling Question 4: Does she have multiple sclerosis?

- Yes
- No
- I don't know

US EYE

Demyelinating optic neuritis

- Focal inflammatory/ demyelinating event of optic nerve that may be idiopathic and involving only the optic nerve or associated with other systemic illness, particularly multiple sclerosis
  - 90% of demyelinating optic neuritis is MS; 10% is NMOSD and MOGAD
- 1/3 papillitis, 2/3 retrobulbar
- Abrupt vision loss
  - 20/60 average (20/20-NLP)
  - RAPD
  - Dyschromatopsia
  - Decreased brightness/ contrast
  - 2-week progression
  - Gradual recovery (with deficits)
  - Typically Caucasian
    - Rare in Asians/ people of color
- 92% have pain

US EYE

- **Optic neuritis is usually painful but sometimes not – misdiagnosis**
- **Anyone using the term, "*occult optic neuritis*" is really saying, "*I don't understand optic neuritis*"**

US EYE

ONTT Results

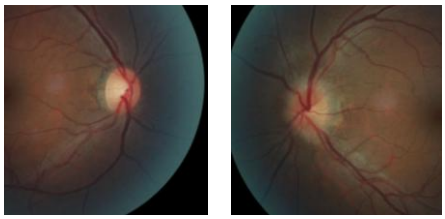
- 15 US clinical centers randomized 457 acute optic neuritis patients within 8 days of onset to treatment with:
  - Oral Prednisone: 1 mg/kg daily x 14 days
  - Intravenous methylprednisolone (250 mg every 6 hours x 3 days) followed by oral prednisone (1 mg/kg daily x 11 days)
  - Oral Placebo
- At 6 months, patients in all groups showed good recovery of vision.
  - Patients in the IV group recovered vision faster
  - By 30 days difference was insignificant
- Oral prednisone group: 2x more likely to experience recurrent optic neuritis than other groups
  - Insufficient dosing?
- Visual function after treated or untreated episode of optic neuritis recovers within the first 2 weeks of onset
  - Most recovery by end of 1 month & further slow recovery over several months (upto 1 yr)
  - Lack of recovery within the first 3 weeks after onset should be considered atypical

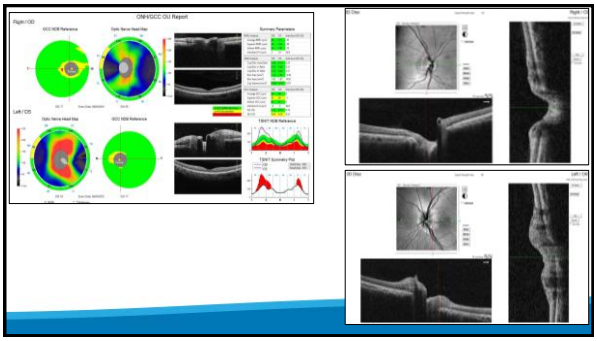
Demyelinating optic neuritis

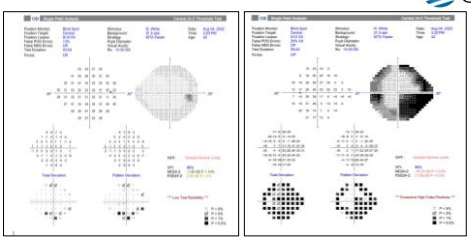
- MRI critical in diagnosis and management
- ONTT 15-year results:
  - Conversion to CDMS- 50% overall
    - Normal MRI at baseline- 25%
    - Abnormal MRI at baseline = 75%
  - Lowest risk of conversion to CDMS:
    - Males
    - Papillitis
    - No pain
    - NLP
    - Likely misdiagnoses
  - Normal MRI at baseline and no CDMS at 10 years, then 2% risk at 15 years
  - Dissemination in time and space
- Don't ask- don't tell or rush to diagnosis?
  - Interferon therapies
  - There is a penalty for not starting immunomodulatory therapy at onset

45 YOF

- April: Comprehensive eye exam
  - Diagnosed with MS- no treatment, not following with neurologist
  - Had been on Capaxone but not using for past several years since her last pregnancy
    - Exam normal except for retinal snow banking in both eye suggestive of old pars planitis
- August: Vision blur OS for past several days followed by OS pain- worse with eye movements
  - VA: 20/20 OD, 20/20-1 OS; RAPD OS







45 YOF

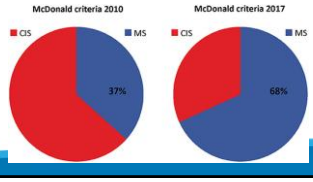
- Evidence of demyelinating optic neuritis
- Penalty for non-treatment
- Reconnected with past neurologist
- Now on ocrelizumab (Ocrevus) infusion q6mos
  - Approved RRMS and PMS
- Next 3 annual exams normal
  - No accumulation of disabilities

Diagnosing MS

- Demyelinating events disseminated in time (DIT) or space (DIS)
  - DIT- 2 or more events occurring at different times or MRI brain lesions identified as old and new
  - DIS- 2 or more events occurring at different neurological areas
- Clinically isolated syndrome (CIS)- first episode of inflammation and demyelination in the central nervous system.
  - Neuroimaging often normal
  - Doesn't necessarily indicate MS conversion
  - A person with MS has experienced more than one episode.
  - 63% go on to CDMS

Diagnosing MS

- One of the most important changes in the 2017 revised McDonald criteria is that oligoclonal bands (CSF proteins indicating CNS inflammation) can be taken as a substitute for DIT, and thus, can be used to establish the diagnosis of multiple sclerosis after the first clinical event and a single brain MRI



Optic Neuritis Thoughts

- 2017 revised diagnostic criteria for MS do *not* allow the optic nerve to be considered an anatomical region for demonstrating dissemination in space.
  - DIS can be demonstrated by one or more T2-hyperintense lesions that are characteristic of multiple sclerosis in two or more of four areas of the CNS: periventricular, cortical or juxtacortical, and infratentorial brain regions, and the spinal cord
- Neurologists have encountered clinical cases where the only limitation to provide a clinically definite diagnosis of MS was the inability to consider the optic nerve.
  - This has resulted in many diagnoses of clinically isolated syndrome, sometimes, delaying medication access.
- Adding the optic nerve as an anatomical site to meet the dissemination in space criterion in patients with possible MS improves the performance of the criteria and allows for the diagnosis of additional patients with clinically definite MS.

Amezcua et al. Inclusion of optic neuritis in dissemination in space improves the performance of McDonald 2017 criteria in Hispanic people with suspected multiple sclerosis. *Multiple Sclerosis Journal*. November 9, 2023

Optic Neuritis Thoughts

- Adding optic nerve involvement (whether confirmed by MRI, OCT, or visual evoked potential measurement) to the diagnostic criteria resulted in significantly improved sensitivity at the expense of slightly reduced specificity but similar accuracy.
- The results of this investigation are most likely to influence the upcoming revised McDonald criteria by allowing for the optic nerve to represent a fifth topographic area to be used to fulfill dissemination in space.
  - Clinical suspicion of optic neuritis combined with MRI ON enhancement or OCT abnormality could count in the diagnosis of CDMS

Vidal-Jordana A et al. Adding the Optic Nerve in Multiple Sclerosis Diagnostic Criteria. Neurology 2024

Diagnostic Evolution 2025

- The 2024 McDonald criteria, officially published in September 2025, now include the optic nerve as a fifth topographic location for diagnosing multiple sclerosis (MS), making it easier to meet the "dissemination in space" (DIS) requirement.
  - This revision incorporates evidence of optic nerve involvement from methods like high-resolution MRI, OCT, VEPs. These tools help detect clinically silent damage and improve the sensitivity of early MS diagnosis.

Diagnostic Evolution 2025

- 5 areas are now allowed for DIS: optic nerve, periventricular, cortical or juxtacortical, infratentorial brain regions, spinal cord
- Optic nerve:
  - MRI enhancing lesions
  - OCT; inter-eye differences in RNFL of > 6 microns or >4 microns in GCC (allows for asymptomatic ON involvement (Pts. with MS often have thinned RNFL/GCC without optic neuritis hx) have
  - VEP: delayed latency
- To meet the DIS criteria, lesions must now be found in at least two of the five locations, including the optic nerve.
- This inclusion enhances the diagnostic process, especially for individuals with clinically isolated syndromes.

US EYE

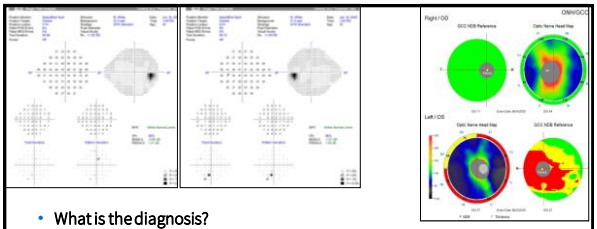
Diagnostic Evolution 2025

- The inclusion of the optic nerve as a location speeds up the diagnostic process, potentially allowing for earlier treatment.
- Dissemination in time (DIT) is no longer always mandatory for diagnosis.
  - If there is involvement in four or more central nervous system regions, a diagnosis can be made without having to wait for proof of past attacks.

US EYE

42 YOWM

- Pt had hx optic neuritis 10 years ago
- Pt states that had painless total vision loss OS and took about 2 months to completely recover
- Reportedly, MRI was clear of MS.
- Pt had a stroke 3 weeks ago, another MRI was done, result was clear- no MS and was advice to follow up with neuro specialist.
  - Now vision is adequate.
- 20/20 OD, OS; no RAPD



- What is the diagnosis?
- What is the prognosis?
  - He's 10 years out now. What about 15 years?
- What is the significance of the OCT now and in the future?

US EYE

Neuromyelitis Optica Syndrome Disorder (NMOSD)

- ON + transverse myelitis
- Aquaporin 4-IgG antibody against transmembrane water channel protein in the CNS expressed on astrocytic end-feet
  - Accounts for ~3% of optic neuritis cases (22,000 in US)
  - Median age of onset = 39 years (later than MS)
  - Strong female preference (70-90%)
  - Increased prevalence in Asians and African Americans
    - African American > Asian > Caucasian
- 30% of NMOSD is seronegative for AQP4-IgG
- Relapsing course-Seen in up to 90% of patients

US EYE

Neuromyelitis Optica Syndrome Disorder (NMOSD)

- VA < 20/200
- ⅓ have a final VA < 20/200 (MS ON > 20/40)
- Bilateral simultaneous presentation in ~20% vs. 1% in MS
- Central scotoma most common
- Bitemporal from chiasmal involvement
- MRI
  - Simultaneous bilateral optic nerve enhancement
  - Longitudinally extensive enhancement (>50% of optic nerve)
  - Chiasmal involvement

US EYE

Neuromyelitis Optica Syndrome Disorder (NMOSD)

- IV methylprednisolone 1000 mg/day x 3 to 5 consecutive days
- Plasma exchange (first line or in corticosteroid-refractory NMOSD-ON)
- Early treatment important in reducing the risk of visual morbidity
- ALL patients require long-term immunosuppressive therapy given rates of relapses and high risk of morbidity.

US EYE

Myelin oligodendrocyte glycoprotein antibody associated disease (MOGAD)

- Demyelinating disorder associated with anti-myelin oligodendrocyte glycoprotein (MOG) antibody
- MOG found on outermost myelin sheath layers
- Median age of onset mid-30s
- No clear gender or racial predilection
- Accounts for 5% of adult optic neuritis cases
  - Anti-MOG antibodies
- MRI
  - Longitudinally extensive enhancement typically involving > 50% of optic nerve in 90% of cases
  - Perineural enhancement involving the optic nerve sheath & peribulbar fat in 50% of cases
  - 15% of cases may extend posteriorly to involve chiasm

US EYE

Myelin oligodendrocyte glycoprotein antibody associated disease (MOGAD)

- One core clinical demyelinating event: optic neuritis, myelitis, acute disseminated encephalomyelitis, cerebral monofocal or polyfocal deficits, brainstem or cerebellar deficits, or cerebral cortical encephalitis.
- Presence of MOG-IgG detected using a cell-based assay.
- Exclusion of a better explanation, including MS.

US EYE

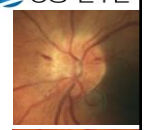
Myelin oligodendrocyte glycoprotein antibody associated disease (MOGAD)

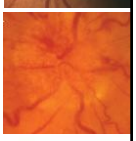
- Optic disc edema in about 80%
- 50% bilateral
- Pain/headache
- Severe vision loss similar to NMOSD but better visual outcome
  - 5-14% have a final VA of < 20/200
- Treatment similar to NMOSD

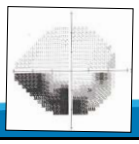
US EYE

How NAAION Should Present

- Ischemic risk factors:
  - Hypertension, diabetes, atherosclerotic disease, cholesterol, sleep apnea
- 6:1- Inferior field defects- arcuate not altitudinal
- Hyperemic swollen nerve- disc at risk OU
  - 97% have <0.2 C/D (and the others were misdiagnosed)
- Progressive moderate vision loss (20/20-20/200)
- Unilateral
  - Bilaterality uncommon
- Late 30s/ early 40s and beyond
- Often noted upon awakening
- Painless





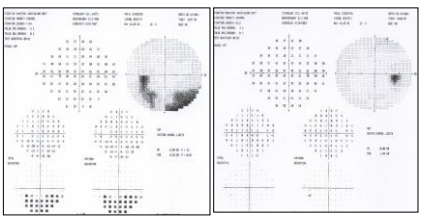


US EYE

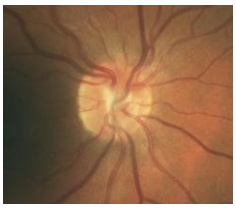
48 YOM

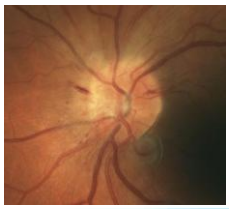
- Painless loss of visual field OS
  - 20/20 OD, OS
  - Noticed upon waking
- Med Hx: T2DM, HTN

US EYE



NAAION OS
Disc at risk OD





Non-Arteritic Anterior Ischemic Optic Neuropathy (NAAION)

- NAAION is the second most common (after glaucoma) optic neuropathy
  - Except that it is over diagnosed
  - Diagnosis of convenience
- Nomenclature
  - Diagnosed in the negative
    - Not what it is, but what it isn't
    - Serology for all ischemic neuropathies?
  - NAAION is a *primary* clinical diagnosis
    - Other diseases may cause optic nerve ischemia, but aren't truly *NAAION*
      - Lack of investigation
    - Best term: Small vessel anterior ischemic optic neuropathy
      - NAAION or SVAION? AAION or LVAION?

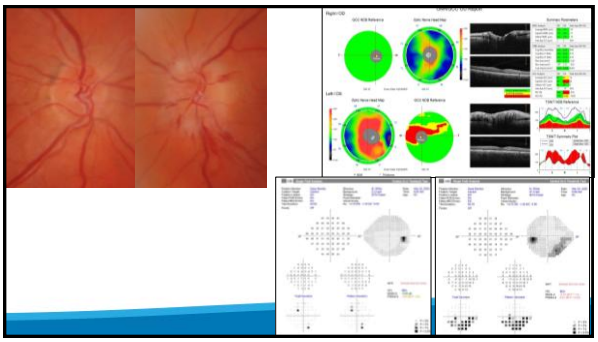
NAAION Progression

- Twenty-two percent of eyes demonstrated worsening of BCVA by ≥2 lines.
  - Of these, 55% worsened by ≥4 lines and 27% by ≥8 lines.
- Subacute deterioration of BCVA and/or VF following acute NAAION is not uncommon while optic disc edema is present
- Deterioration in visual function within the first 10 weeks of presentation does not exclude the diagnosis of NAAION and further investigations should only be performed if additional clinical features are discordant with this diagnosis.

McDonald HM, et al. Short-term deterioration of visual acuity and visual fields in non-arteritic anterior ischemic optic neuropathy. Am J Ophthalmol. 2024 Jul 30:S0002-9394(24)00319-2.

Is this NAAION (SVAION)?

- 63 YOM
- Some blurry vision OS
  - Time uncertain ~ 2 weeks?
- 20/30 OD, 20/30-1 OS; no pain
- Mild RAPD OS
- Swollen disc OD
- No symptoms GCA
- Sent to ER by another OD STAT for ESR, CRP
- ER- not sure what to make of it- does blood work and CTA, MRI brain and orbits- WWO contrast



More History- Next Day

- All neuroimaging normal; serology reportedly normal
- +HTN, high cholesterol, 'borderline' diabetes
  - Losartan, amlodipine, pravastatin
- Not under the care of any PCP
- Uses wife's Ozempic for weight loss and blood sugar control
- Used Cialis around time of vision loss
  - Used at 1 am and went to bed after taking his HTN meds
- *"Did I do this to myself?"*

Polling question 5: Is this NAAION (SVAAION)?

- Yes
- No

THE HYSTERIA IS REAL

Susan [redacted]
10h

Just a heads up, colleagues. The risk of NAION with semaglutides is real. Saw a friend yesterday with classic signs. No major underlying other risk factors other than mild diabetes. 74 year old male in very good health Hyperope with small discs/cups. Had started Ozempic 5 months earlier. Not a happy day.

Susan [redacted] Author Group expert +1
Jessica [redacted] great question! moderate hyperopia, typical small disc and small cup. Although I do not think those are risk factors. I think more related to vein occlusion.
10h Like Edited 2

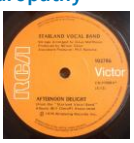
Elissa [redacted] Top contributor
I have had one patient as well. It's real

NAAION Risk Meds- GLP-1/ EDs*

- M/F- normal disc/ cup, no vascular diseases
  - Minimal/no risk
- M/F- vascular diseases (HTN, DM, OSA, Cholesterol)- normal disc/cup
  - Minimal/no risk
- M/F- vascular diseases, disc-at-risk
  - Minimal risk
- M/F- vascular diseases, disc-at-risk, previous NAAION
  - Highest but unknown risk
  - Need to modify risk factors

*Patients getting/ using meds without supervision

Non-Arteritic Anterior Ischemic Optic Neuropathy (NAAION)



- Biggest risk factor- small crowded disc
  - NAAION in Black patients
    - Demographic typically has large C/D ratios
    - Those undergoing NAAION all had disc-at-risk
- GLP-1?
  - Association is not causation; Stop using lifesaving drug?
- Erectile dysfunctions meds?
  - Association is not causation; Stop using lifechanging drugs?
  - *"I used it once a long time ago"*: Translation
  - HTN/DM, apnea, small disc, use ED med, intercourse, take BP meds, go to bed, nocturnal hypotension= best (but very small) potential for infarct
    - ***"Why wait until the middle of a cold dark night?"***

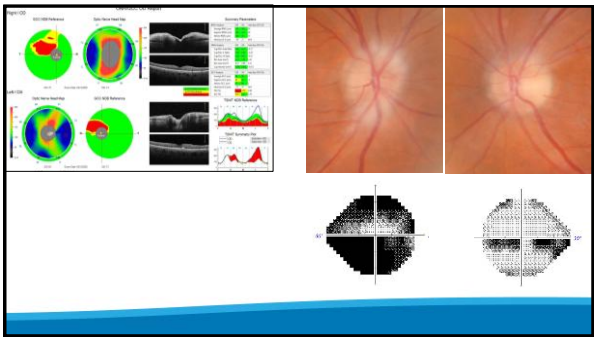
Never Diagnose Bilateral NAAION

AION bilaterality

- 65% progression to bilateral AAION at average of 10 days in GCA
- Bilateral progression in NAAION- 30+ months
- Incidence of NAAION bilaterality at 5 years is 15%
- Do Not make the diagnosis of bilateral NAAION
  - AAION until proven otherwise
  - Only exception…

US EYE

The Only Exception…



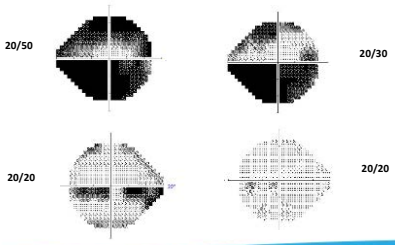
US EYE

The Only Exception…

- 70 YOM- TY2 DM and stage 3 kidney failure
- Hospitalized for pneumonia and sepsis
  - Treated and released
- Develops severe GI bleed
  - Readmitted for surgery- needed 7 units of blood
  - Awoke with inferior half of field obscured OD
  - No ophthalmology consult in hospital- would need ambulance transport
- Released and presents urgently
- 20/50 OS PHNI; 20/20 OS; RAPD OD

US EYE

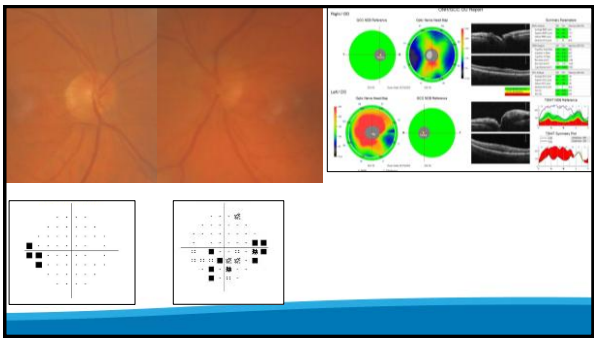
3 MONTHS LATER



US EYE

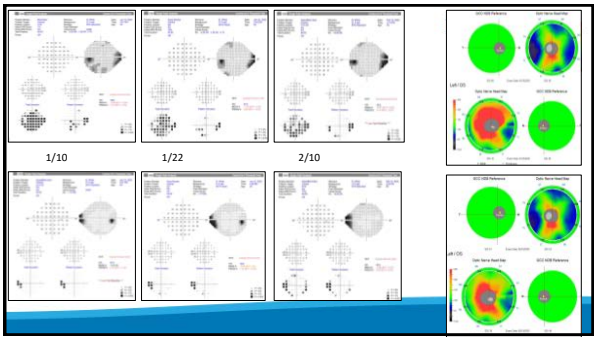
59 YOM

- Retinal detachment OS 9/24- surgically repaired
- Develops cataract; 20/25 OD; 20/70 OS- cataract surgery planned
- Referred for retinal specialist for surgical clearance
  - Retinal specialist notes disc edema OS; refers for neuro evaluation
  - Denies headache, weight loss, jaw claudication
- C/D 0.2/0.2 OU; hyperemic disc swelling superior OS
  - Visually asymptomatic except for cataract
  - Denies sleep apnea; ED med use
- Medical hx: A-fib
  - Metoprolol; amiodarone



US EYE

- AAION?
  - ESR: 2 mm; CRP <3.0; platelets 303
- NAAION?
  - No vascular risk factors
- What about that amiodarone?
  - HATE drugs
  - Amiodarone mimics AION



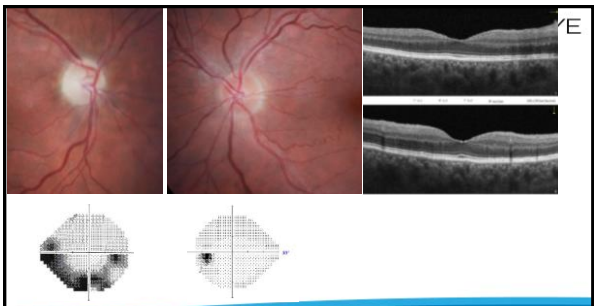
US EYE

A TALE OF TWO OPTIC NERVES

US EYE

Optic nerve #1

- 72 year old woman
- Notices a "darkness" OD of unknown duration
- Medical history: Asthma, hyperlipidemia, psoriasis; hx herpes
  - Valtrex, flonase, Otezla
- BVA: 20/25 OD, 20/20 OS
- RAPD OD



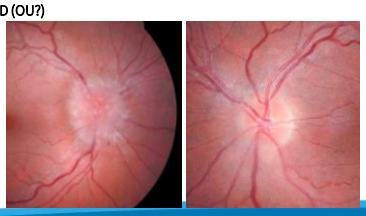
US EYE

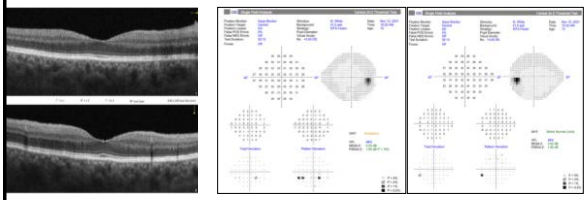
WHAT NEXT?
(PUT IT IN THE CHAT)

Optic nerve #2

- 72 year old woman
- New onset flashing lights OD (OU?)
  - No floaters
- 20/20 OD, OS
- PERRL (-) RAPD
- CF Full OD, OS
- MF IOL OU
- Asthma; hyperlipidemia
- Valtrex

Hint: she has been to a Lyme endemic area





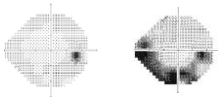
Optic nerve #2

- Presumptive diagnosis: Infectious optic perineuritis
- MRI Brain & MRI orbits and chiasm w contrast and fat suppression
- Normal ⊗
- Ask for neuroradiology re-read specifically looking for ONH sheath enlargement and perineuritis (*It's gotta be Lyme*).
- Normal again⊗⊗
- Now on to serology (working with PCP)
- CBC, ESR, CRP, ANA, RPR, FTA-Abs, ACE, zoster IgM and IgG, rubella IgG and IgM, toxoplasmosis, Lyme, Bartonella henselae and quintana panels were all normal. The only abnormalities were herpes simplex IgG and IgM, and Epstein Barr IgG and IgM. Subsequent EBV ab VCA IgM was normal
  - Old infections of HSV and EBV- non-contributory

A Tale of Two Optic Nerves

- It's the same patient

Initially
$20/20^{-2}$



4 months later
$20/25^{-2}$

DISCLOSURE: OPTIC NERVE DISEASE OFTEN DOES NOT END WELL

THE END