GLAUCOMA GRAND ROUNDS

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Lessons Learned from

MY WORST GLAUCOMA NIGHTMARES

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Glaucoma Grand Rounds

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- **Disclosures**
  - Research support from iCare

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Glaucoma Resources

- **Iowa Glaucoma Curriculum**
  - curriculum.iowaglaucoma.org
- **AAO Preferred Practice Patterns**
  - aao.org/guidelines
- **Hood Visual Science Lab**
  - hoodvisualscience.psychology.columbia.edu

Glaucoma Resources

Anterior Segment Laser Certification Course

8/7/2021 - 8/8/2021

Bloomington, IN

Indiana OPTOMETRY

LESSON #1

Hesitation Blues

Hesitation Blues

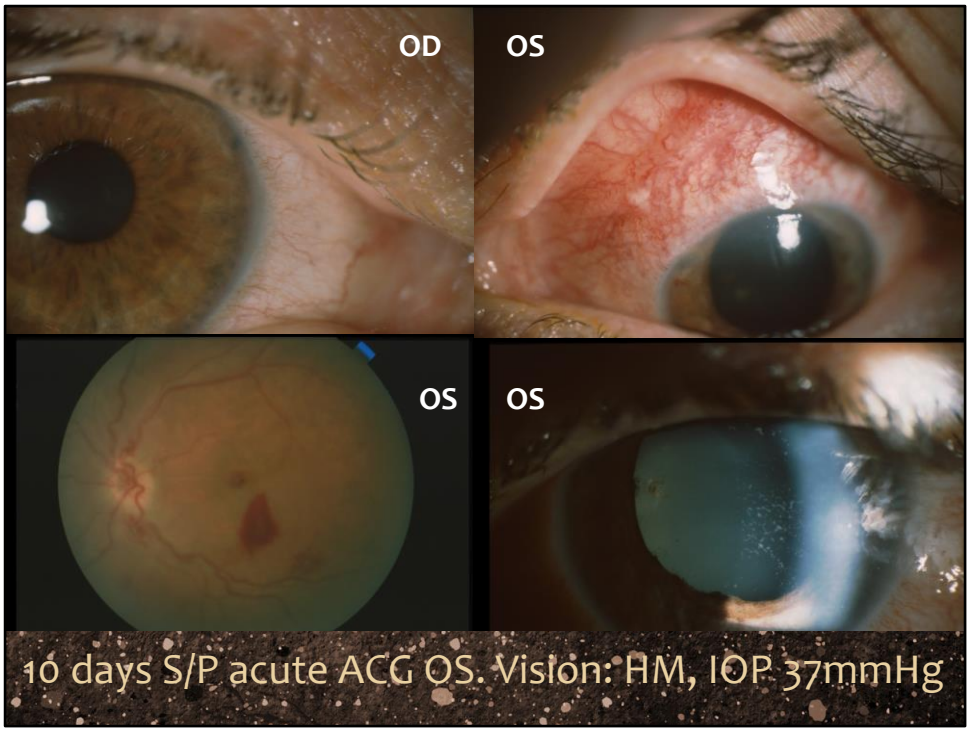
- 63yo WF presents with c/o intermittent periorbital headaches on the left side x several weeks.
- Primary care examination findings:
  - Normal exam. No optometric source for headaches detected.
  - Referred to Ocular Disease Clinic for visual field evaluation

Hesitation Blues

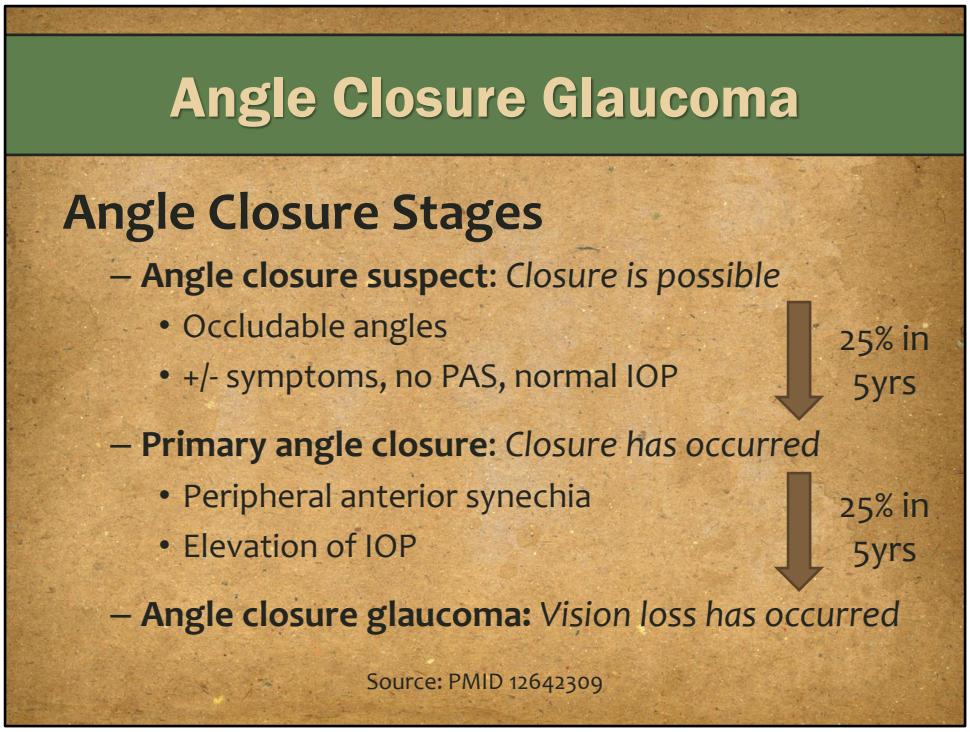
- Ocular disease clinic consultation:
  - Narrow, potentially occludable angles on gonioscopy.
  - Normal visual fields on SAP.
  - Pt advised to return in 1 week for iridotomy consultation.

Hesitation Blues

- 1 week follow-up visit:
  - Red painful left eye x 3d.
  - Vision: 20/20 OD, HM OS
  - Pupil: R&R OD, Fixed and mid-dilated OS
  - Ext: W&Q OD, 3+ inj with cloudy cornea OS
  - IOP: 13 OD, 56 OS
  - DX: Acute ACG OS
  - TX: Diamox PO, topical meds. LPI OU



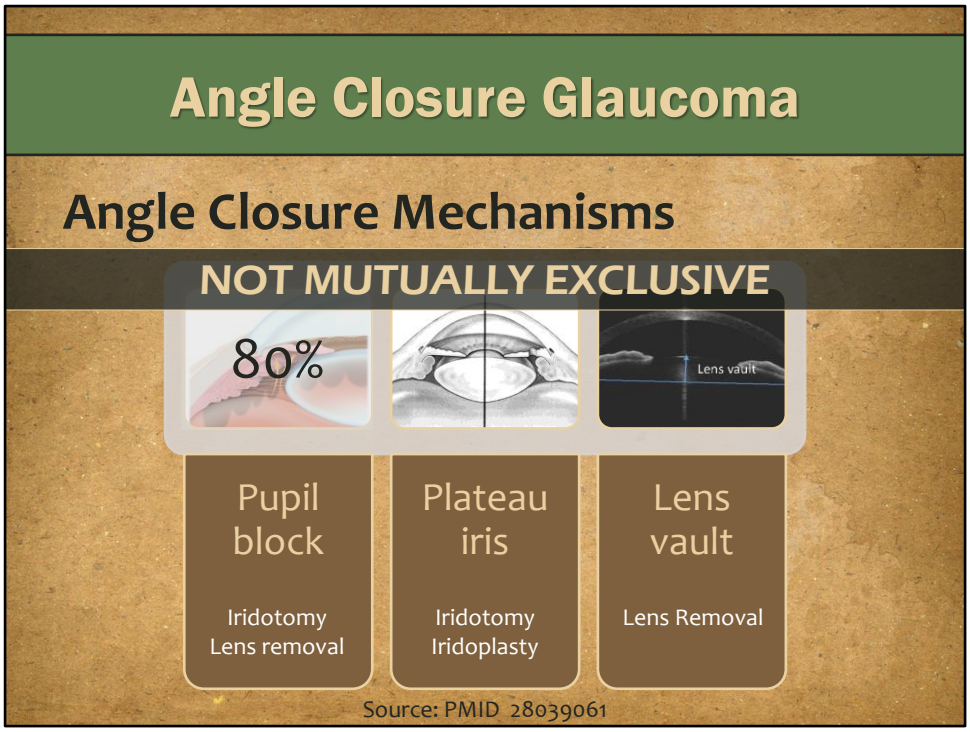
10 days S/P acute ACG OS. Vision: HM, IOP 37mmHg



AC Suspect
-- Occludable angle == TM not visible in at least 2 quads without indentation

Primary AC
-- Occludable angle + (IOP elevation and/or PAS)

AC Glaucoma
-- Occludable angle + (IOP elevation and/or PAS) + Optic neuropathy (cupping, RNFL defects, VF loss)



USE INDENTATION GONIO TO IDENTIFY CLOSURE MECHANISM

Pupil block: Resistance to AH flow at pupil >> Both LPI and lens removal effective
-- LPI effect == 2 step Shaffer grade increase (approx. 20 degree chg). Less effect if other mechanisms also present (He, 2007)

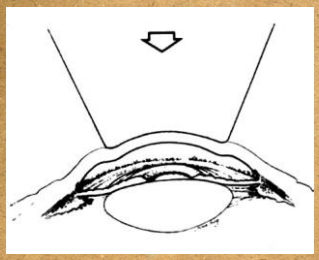
Plateau iris: Ciliary body elevates peripheral iris >> Argon laser iridoplasty thins periph iris and deepens angle
-- LPI effect == 65% of cases with plateau iris configuration resolve following LPI

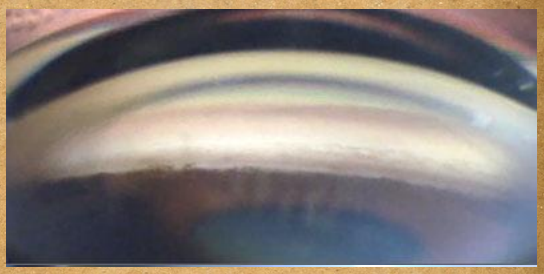
Lens vault ("Phacomorphic"): Iris resting on anteriorly positioned lens >> lens removal required to resolve the condition

NOT MUTUALLY EXCLUSIVE
Often a mixed bag – pt may have relative pupil block AND plateau iris configuration

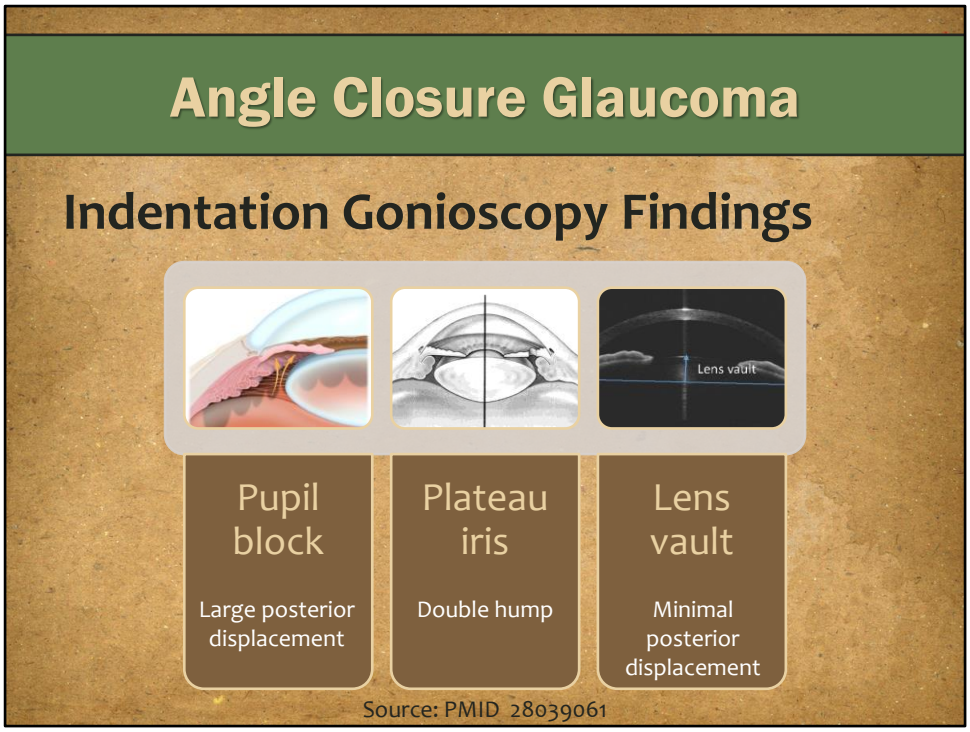
Angle Closure Glaucoma

Indentation Gonioscopy Technique





Source: PMID 26119516



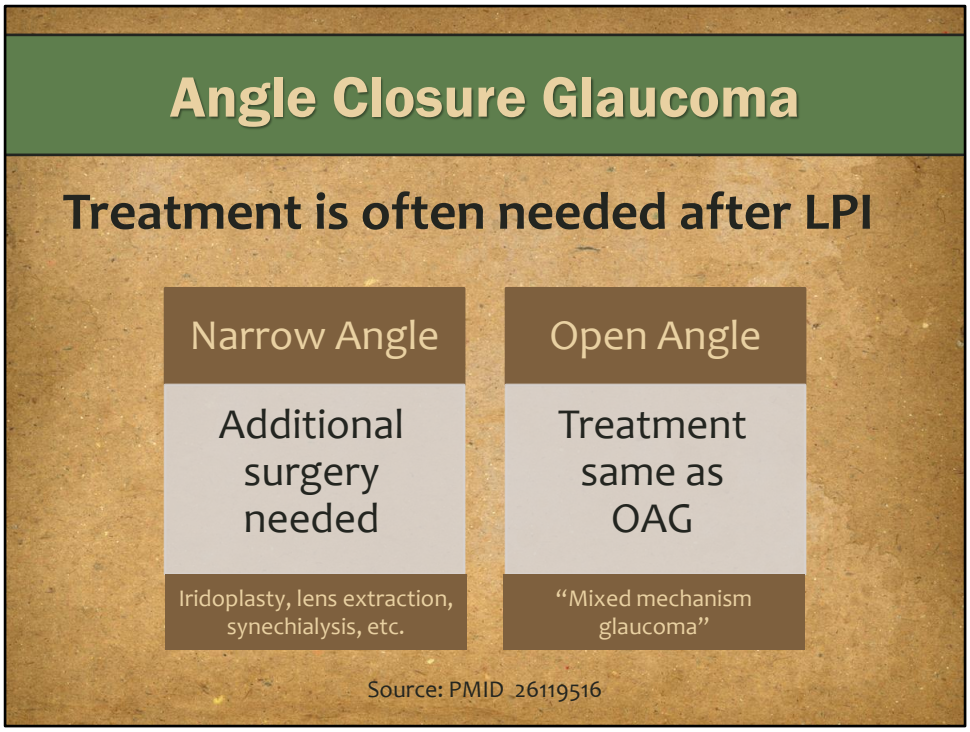
USE INDENTATION GONIO TO IDENTIFY CLOSURE MECHANISM

Pupil block: Resistance to AH flow at pupil >> Iris bombe >> Large movement on indentation gonio

Plateau iris: Ciliary body elevates peripheral iris >> narrow angle recess with flat iris >> "Double hump" on indentation

Lens vault ("Phacomorphic"): Iris resting on anteriorly positioned lens >> Convex iris >> Little/no movement on indentation

NOT MUTUALLY EXCLUSIVE
Often a mixed bag – pt may have relative pupil block AND plateau iris configuration



Studies find that at least 50% of eyes with PAC/PACG require further medical/surgical intervention post-LPI (Wright, 2015)

Among PACS, 75% of patients demonstrate an increase in chamber depth post-LPI >> 25% DO NOT!!!
-- He (2007) ::: 20% of Chinese PACS remained closed following LPI

How to evaluation/document change in angle after LPI
-- Gonio
-- Digital imaging

Angle Closure Glaucoma

LPI complications: Dysphotopsia

– 7%-10% of patients experience transient dysphotopsia

- Halos
- Lines
- Crescents
- Glare
- Ghost images
- Shadows
- Blurry vision

Source: PMID 30315902

Symptoms will resolve within 6 months in most patients

KAVITHA (2019)
-- 9.7% of subjects reported 1 or more new symptoms at 2 weeks post-LPI
-- Only 0.7% of subjects who developed 1 or more dysphotopsia at 2 weeks reported continued symptoms at 6 month

Angle Closure Glaucoma

LPI complications: Dysphotopsia

– Risk of dysphotopsia is related to lid position

Source: PMID 24531024

Where to position LPI?
-- Superior == traditional
-- Temporal == Possibly best for thin, blue irises

Lessons Learned

- Symptomatic angle-closure suspects should be managed with a sense of urgency
- Provide instructions to patients in both writing and verbally
- Document return "sooner PRN"

LESSON #2

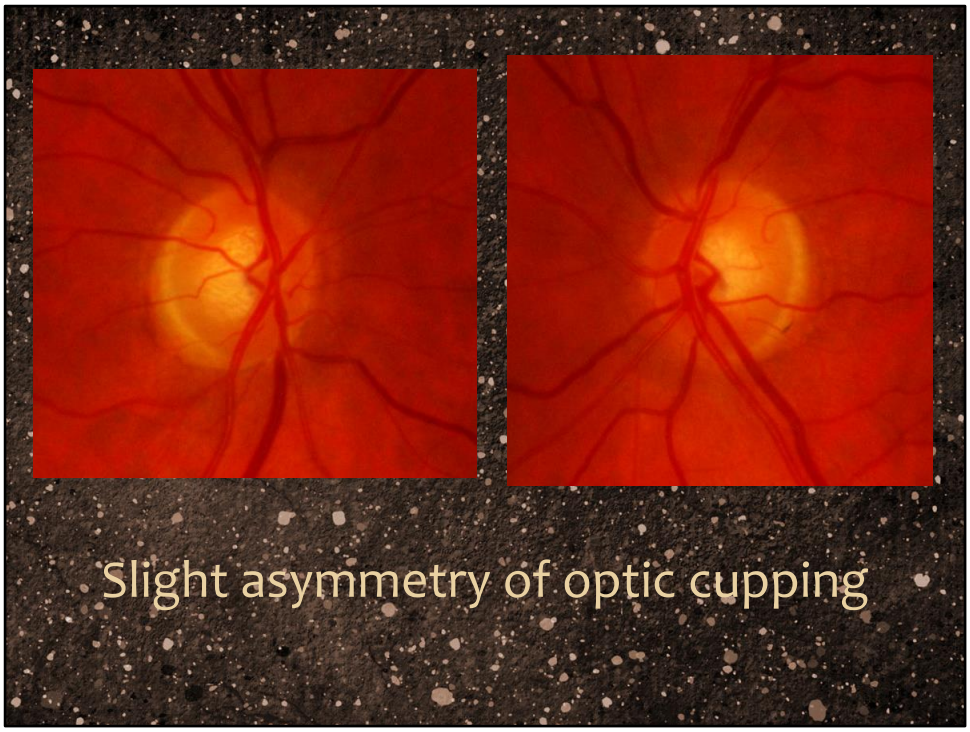
The Little Things

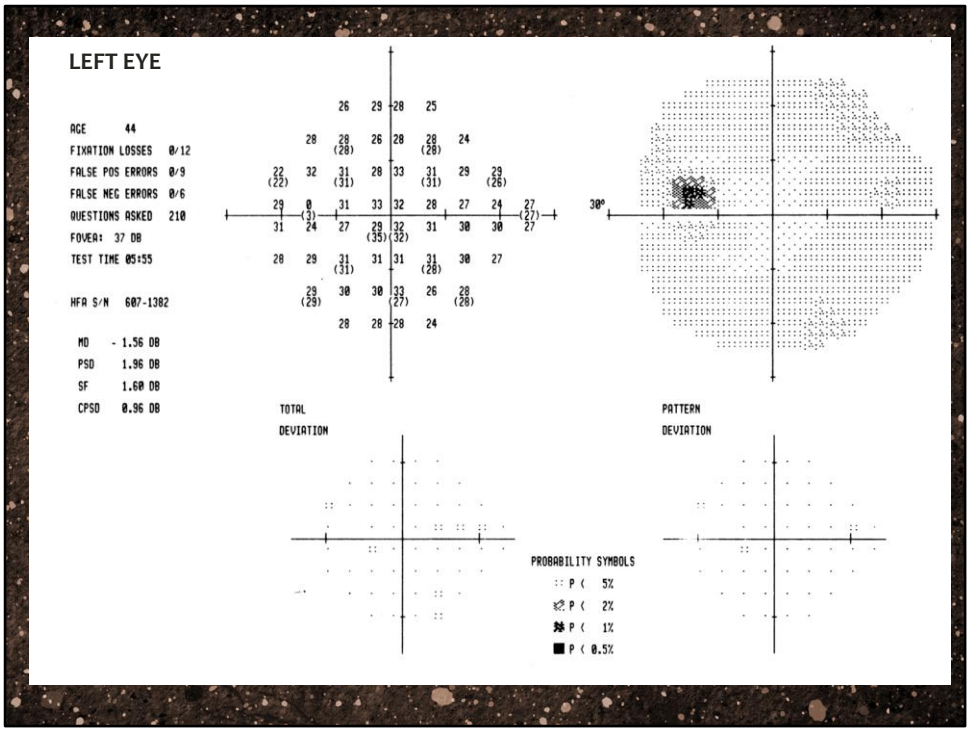
"It has long been an axiom of mine that the little things are infinitely the most important."

- Sherlock Holmes

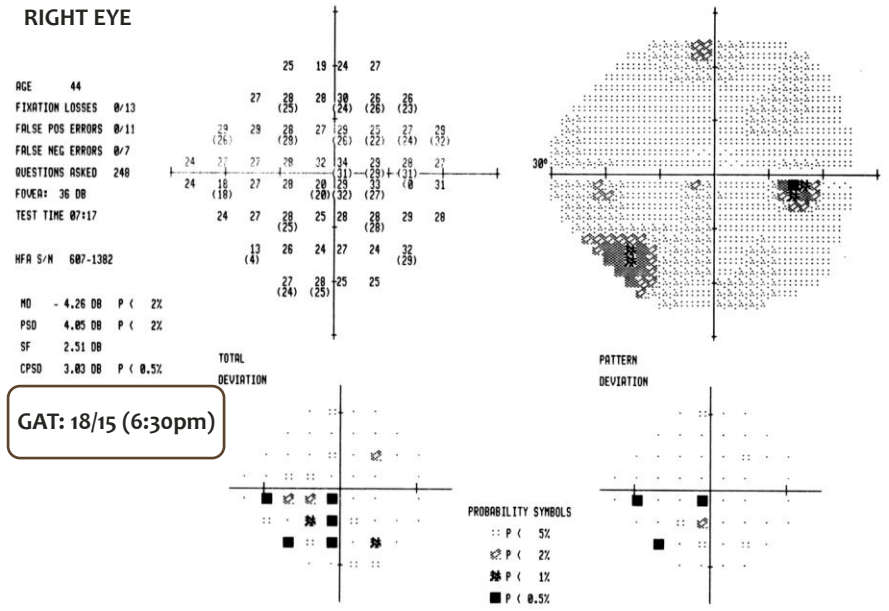
The Little Things

- 44yo WM presents for routine eye exam
- LEE: 7-8yrs ago
- PMH: migraines, smoker, no meds
- FOH: No glaucoma
- Refraction: -4.00-0.75x060 20/25 -4.75 20/20
- PERRL, (-)APD
- BP: 130/84
- GAT: 20/20 3pm
- C/D: 0.6 OD, 0.5 OS
- IMP: Borderline IOP
- Plan: Schedule VF

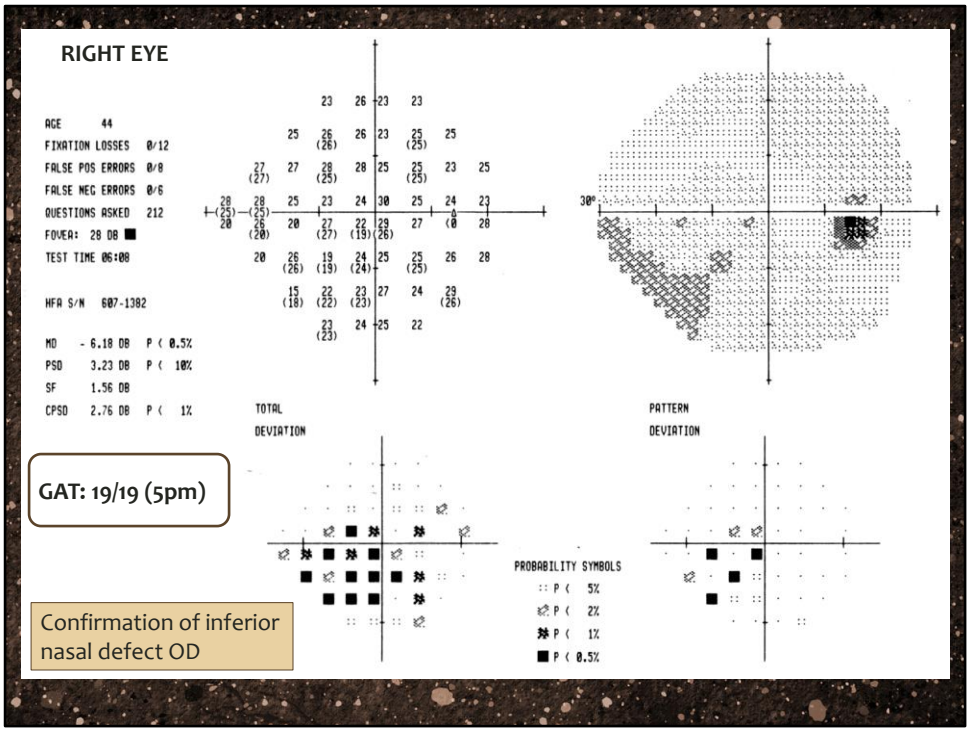

Slight asymmetry of optic cupping


LEFT EYE
AGE 44
FIXATION LOSSES 0/12
FALSE POS ERRORS 0/9
FALSE NEG ERRORS 0/6
QUESTIONS ASKED 210
FOVEA: 37 DB
TEST TIME 05:55
HFA S/N 607-1382
MD -1.56 DB
PSD 1.96 DB
SF 1.60 DB
CPSD 0.96 DB
30°
TOTAL DEVIATION
PATTERN DEVIATION
PROBABILITY SYMBOLS
P < 5%
P < 2%
P < 1%
P < 0.5%

RIGHT EYE



GAT: 18/15 (6:30pm)


RIGHT EYE
AGE 44
FIXATION LOSSES 0/12
FALSE POS ERRORS 0/8
FALSE NEG ERRORS 0/6
QUESTIONS ASKED 212
FOVEA: 28 DB
TEST TIME 06:08
HFA S/N 607-1382
MD - 6.18 DB P (0.5%
PSD 3.23 DB P (10%
SF 1.56 DB
CPSD 2.76 DB P (1%
30°
TOTAL
DEVIATION
PATTERN
DEVIATION
PROBABILITY SYMBOLS
P (5%
P (2%
P (1%
P (0.5%
GAT: 19/19 (5pm)
Confirmation of inferior nasal defect OD

What is going on here?

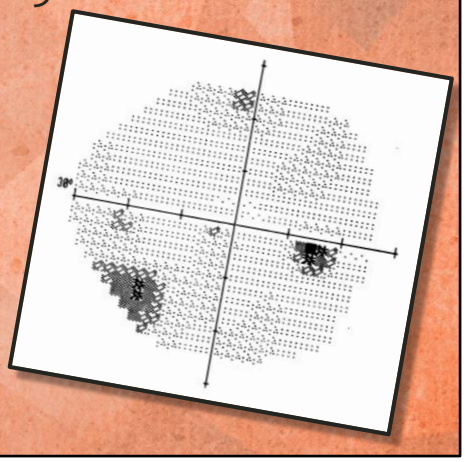
44yo WM

15-20 mmHg

Inferior nasal VF defect OD

C/D: 0.6/0.5

A. Normal tension glaucoma
B. Ischemic optic neuropathy
C. Brain tumor
D. Something else?



The Little Things

- Ophthalmology consult
  - Hx: No head/eye trauma, (+) migraine HA
  - GAT: 19/19 (3:30pm)
  - Gonio: normal OU
  - Pupils normal, Color: normal
  - DFE: normal OU, no pallor

  - **IMP**: Abnormal VF with normal IOP and ONH
  - **PLAN**: Get diurnal curve

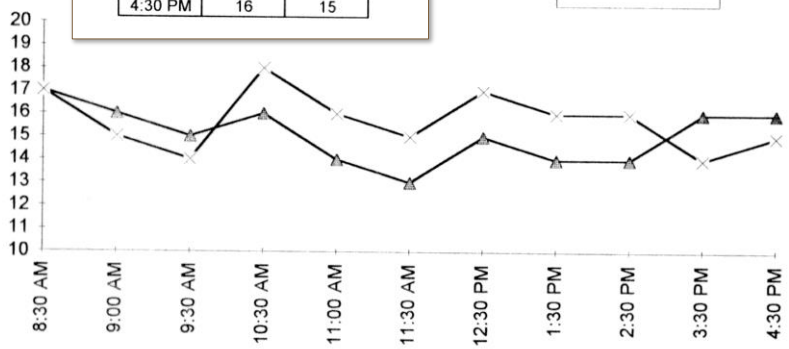
Impression was more a description than a true diagnosis -- not sufficient info to commit to an actual dx

Reason for seeking a diurnal? Document abnl IOP builds support for a dx of POAG

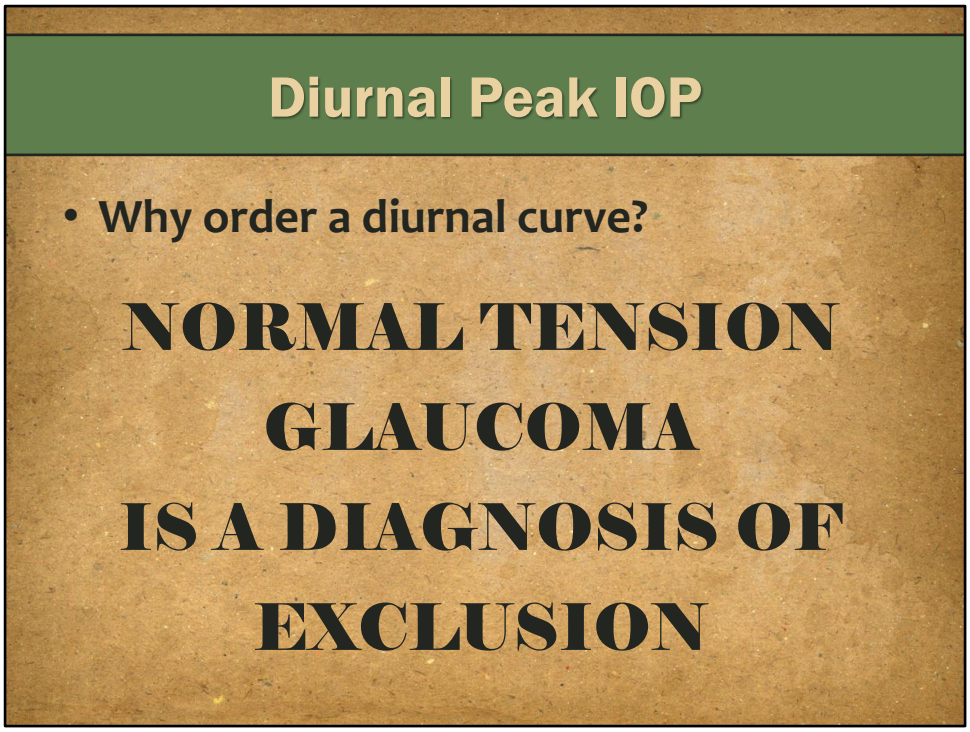
"Modified" Diurnal Curve

APPLANATION TONOMETRY READINGS

TIME	OD	OS
8:30 AM	17	17
9:00 AM	16	15
9:30 AM	15	14
10:30 AM	16	18
11:00 AM	14	16
11:30 AM	13	15
12:30 PM	15	17
1:30 PM	14	16
2:30 PM	14	16
3:30 PM	16	14
4:30 PM	16	15



PROPER WAY TO DO A TRUE DIURNAL ==
CHECK IOP EVERY 2 HOURS FOR A FULL 24 HRS



WHY DIURNAL???
-- Need to R/O other potential causes of optic neuropathy before assuming its NTG
-- Never assume a patient has NTG -- you must first consider all possible alternatives
– ESPECIALLY IN AN OTHERWISE HEALTHY 44YO MAN

WHAT WILL THE DIURNAL TELL US?
- If document IOP >21 mmHg: supports dx of POAG
- If IOP remains <21 mmHg: Need to need to consider other possibilities

Diurnal Peak IOP

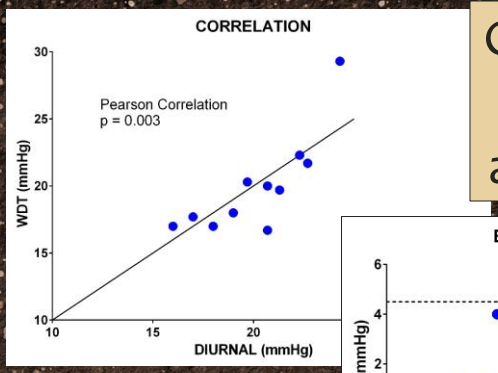
- How to monitor diurnal IOP over 24 hours
  - Sleep lab, Triggerfish
  - **NEW**: iCare HOME tonometer
- **Water Drinking Test**
  - NPO 2 hours prior to exam
  - Measure baseline IOP
  - Pt consumes 1L H_2O in <5 min
  - Check IOP every 15 min x 1 hr
  - **IOP peak approximates diurnal peak**

Source: PMID 28164419

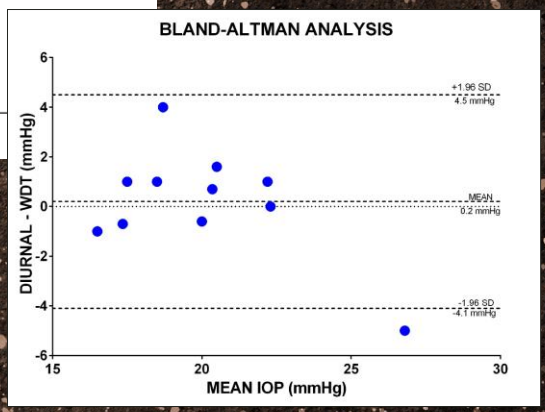
DATE OF FDA APPROVAL OF ICARE HOME == 2017

COST = APPROX $2000

CONTRAINDICATIONS:
-- KIDNEY FAILURE (DIALYSIS)
-- CHF



Good agreement between WDT and diurnal peak



Experience at the Rosenberg School of Optometry, ARVO abstract 2021

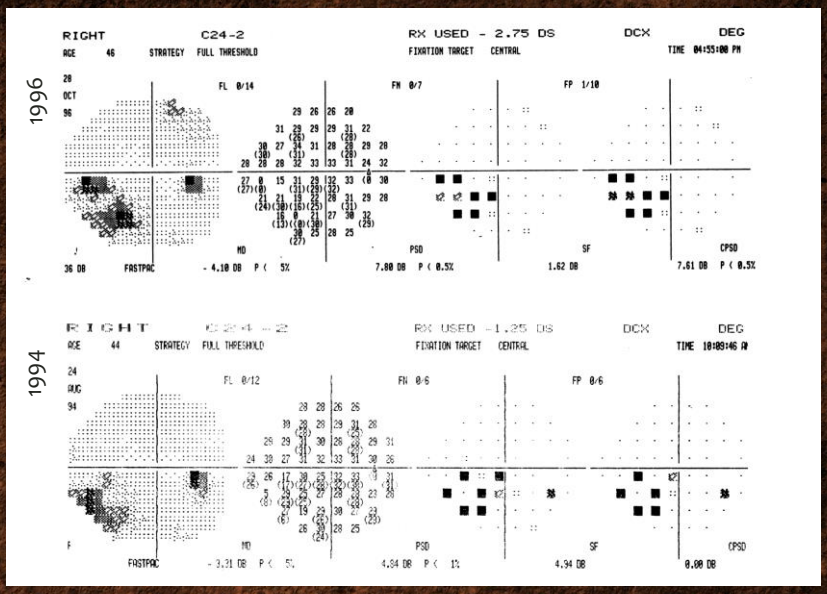
The Little Things

- **Lost to f/u x 2 years**
- Returns with c/o blurry vision

- Vcc
  -4.00-0.75x060 20/40
  -4.75 20/40
- Refraction
  -5.25-1.00x075 20/30
  -5.25-0.50x105 20/20

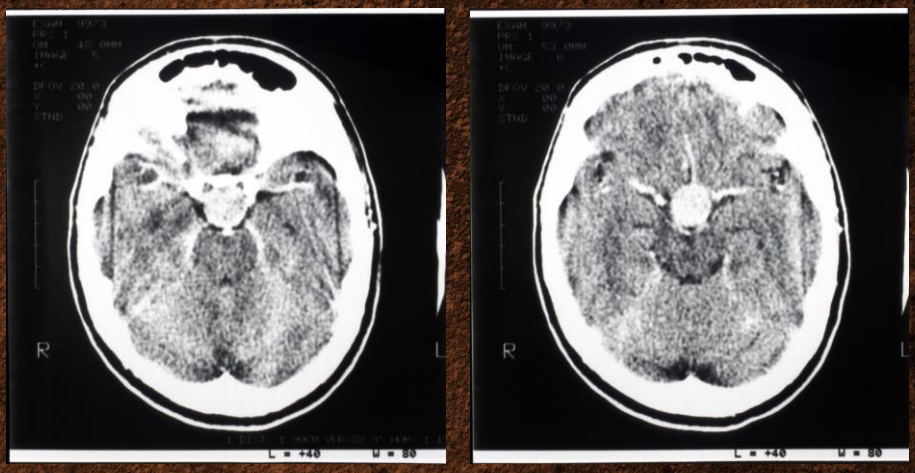
- GAT: 18/18 (3:30pm)
- PERRL, **Trace APD** OD
- C/D: 0.6/0.5

- **IMP**: Optic neuropathy OD
- **PLAN**: VF, CT scan



Has progression of the defect occurred?

CT Scan



Pituitary adenoma was found on CT scan

Normal Tension Glaucoma

- All the features of POAG with IOP < 21 mmHg
- Vascular factors (eg. perfusion pressure, CSF pressure) may play a larger role in NTG
- IOP reduction slows progression, but **≈50% of cases remain stable w/o treatment**
- **A diagnosis of exclusion**
  - *MUST* consider the possibility of non-glaucomatous causes of optic neuropathy

Source: PMID 11158794

Collaborative NTG study (2001):
-- After 2100 days (nearly 6yrs) both treatment and control groups had approx. 55% of cases that had not progressed.

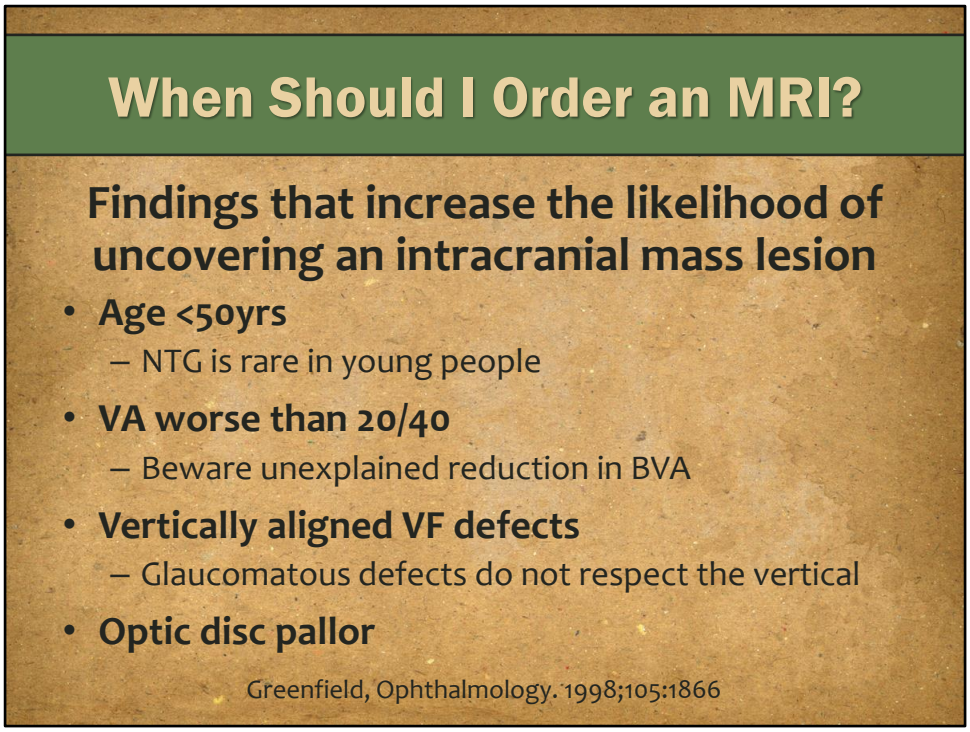
Glaucoma Masqueraders

- **Cupping**
  - Non-glaucomatous optic atrophy can exhibit glaucomatous cupping (compressive, ischemic)
- **Pallor**
  - May be subtle, variable, and deceptive
  - Many normal discs appear pale (16%)
- **OCT**
  - Different patterns of damage
  - Ganglion cell scans can detect chiasmal compression

Source: PMID 7387506; 7387507

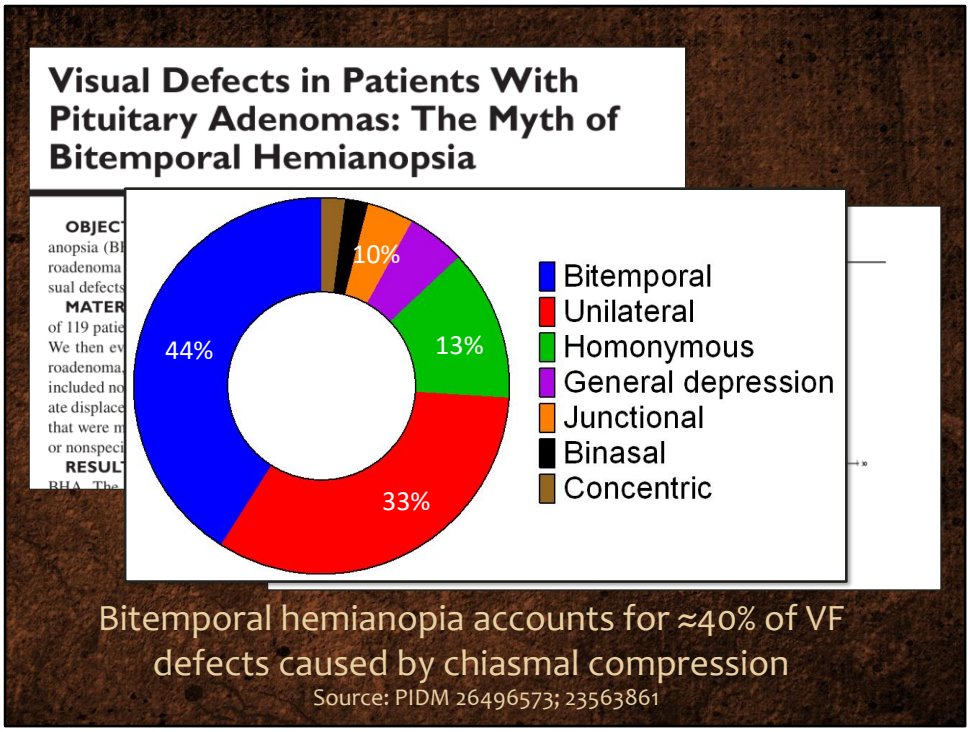
HOW TO DETECT GLC MASQUERADERS???
-- Cannot rely on cupping
-- Cannot rely on pallor
-- OCT can be of some value

1. Look for deviation from the typical pattern of damage seen in glaucoma
2. Look for binasal GCC loss as an early indicator of chiasmal compression



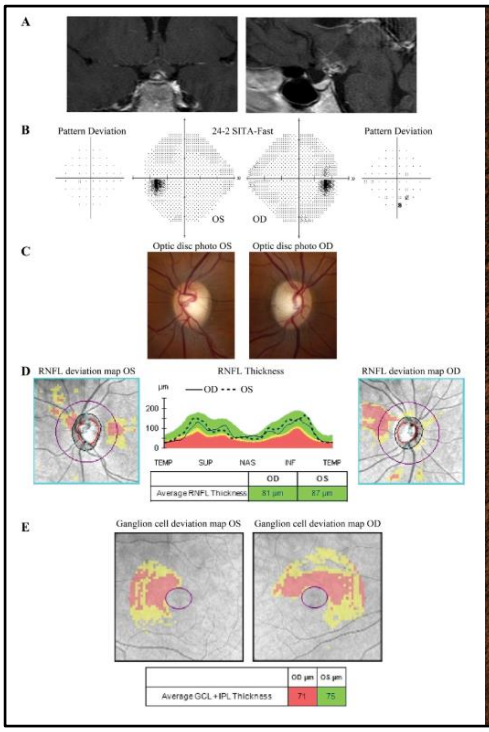
Rather than specific clinical findings to identify masqueraders, we need to step back and look at the overall clinical picture.

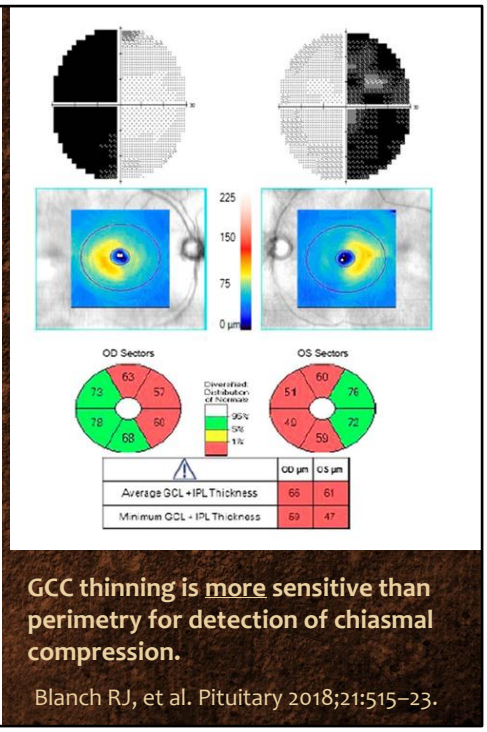
Others:
-- Headache
-- Localizing neurologic sxs
-- Unilateral VF defects



In this study out of Johns Hopkins University, a series of 119 pts with pituitary adenoma, only about 40% had bitemporal hemianopia.

The second most common category were unilateral defects, making up one-third of the total.



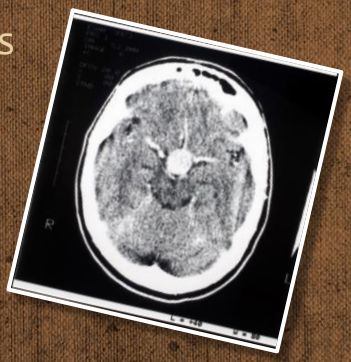


GCC thinning is <u>more</u> sensitive than perimetry for detection of chiasmal compression.

Blanch RJ, et al. Pituitary 2018;21:515–23.

Lessons Learned

- Glaucoma isn't the only condition that causes enlargement of the optic cup
- Chiasmal lesions can produce strange VF defects
- Know the indications for neuroimaging
- Use GCC to detect chiasmal lesions

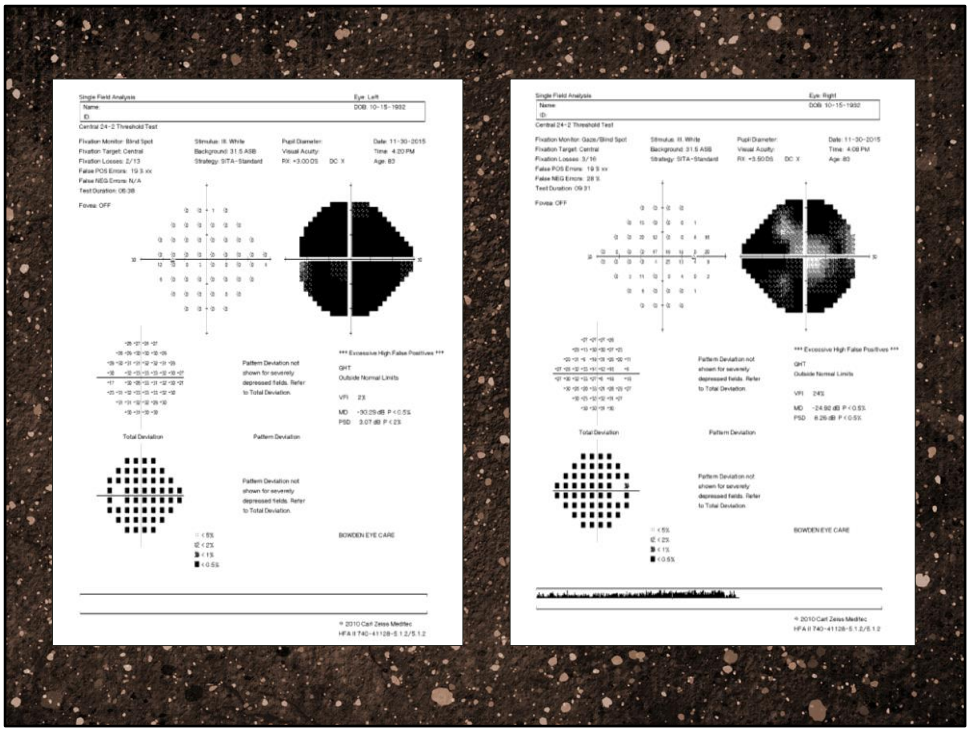


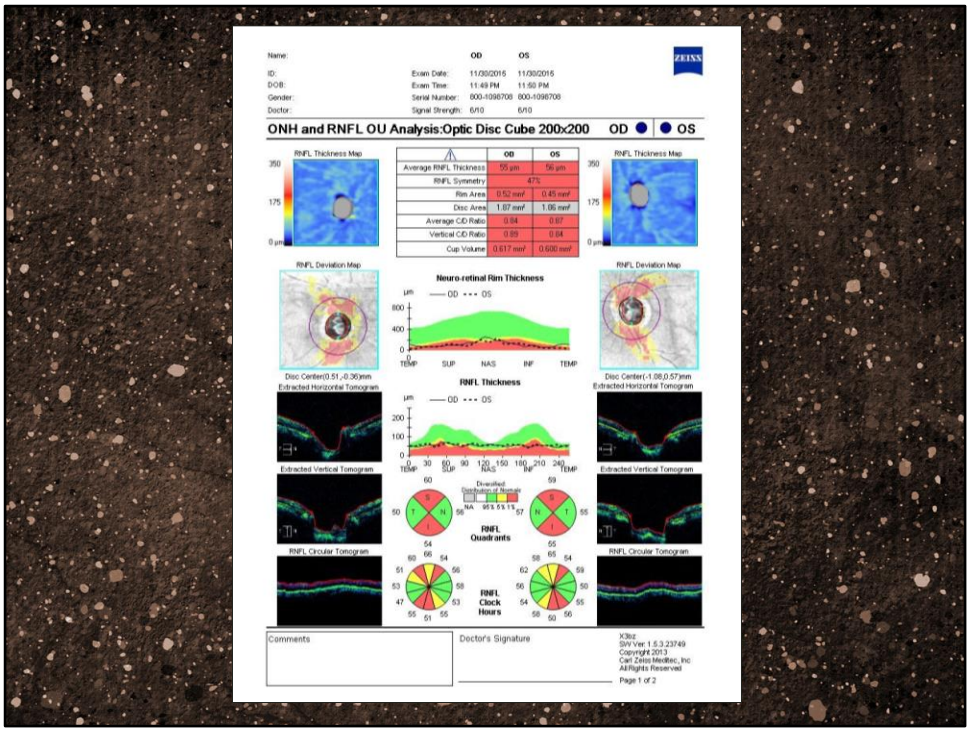
LESSON #3

Compliance Quagmire

Compliance Quagmire

- 83yo BM with severe POAG OU
- MH: NIDDM, HTN
- Poorly controlled and highly variable IOP measurements
  - OD: 12-26 mmHg; OS: 10-25 mmHg
- Baseline IOP
  - OD: 28 mmHg, OS: 26 mmHg


Single Field Analysis
Eye: Left
DOB: 10-15-1992
Central 24-2 Threshold Test
Fixation Monitor: Blind Spot
Fixation Target: Central
Fixation Losses: 2/13
False POS Errors: 19 3 xx
False NEG Errors: N/A
Test Duration: 05:38
Stimulus: III, White
Background: 31.5 ASB
Strategy: SITA-Standard
Pupil Diameter:
Visual Acuity:
Rx: +3.00 DS
DC: X
Date: 11-30-2015
Time: 4:20 PM
Age: 83
Fovea: OFF
*** Excessive High False Positives ***
GHT
Outside Normal Limits
VFI 23
MD +30.29 dB P<0.5%
PSD 3.07 dB P<2%
Total Deviation
Pattern Deviation
Pattern Deviation not shown for severely depressed fields. Refer to Total Deviation.
BOWDEN EYE CARE
© 2010 Carl Zeiss Meditec
HFA II 740-41128-S 1.2/S 1.2
Single Field Analysis
Eye: Right
DOB: 10-15-1992
Central 24-2 Threshold Test
Fixation Monitor: Gaze/Blind Spot
Fixation Target: Central
Fixation Losses: 3/16
False POS Errors: 19 3 xx
False NEG Errors: 28 3
Test Duration: 09:31
Stimulus: III, White
Background: 31.5 ASB
Strategy: SITA-Standard
Pupil Diameter:
Visual Acuity:
Rx: +3.50 DS
DC: X
Date: 11-30-2015
Time: 4:08 PM
Age: 83
Fovea: OFF
*** Excessive High False Positives ***
GHT
Outside Normal Limits
VFI 24%
MD -24.92 dB P<0.5%
PSD 8.29 dB P<0.5%
Total Deviation
Pattern Deviation
Pattern Deviation not shown for severely depressed fields. Refer to Total Deviation.
BOWDEN EYE CARE
© 2010 Carl Zeiss Meditec
HFA II 740-41128-S 1.2/S 1.2


Name:
OD
OS
ID:
Exam Date:
11/30/2015
11/30/2015
DOB:
Exam Time:
11:49 PM
11:50 PM
Gender:
Serial Number:
800-1096706
800-1096706
Doctor:
Signal Strength:
6/10
6/10
ONH and RNFL OU Analysis:Optic Disc Cube 200x200
OD
OS
RNFL Thickness Map
RNFL Deviation Map
Average RNFL Thickness
55 µm
56 µm
RNFL Symmetry
47%
Rim Area
0.52 mm²
0.45 mm²
Disc Area
1.87 mm²
1.86 mm²
Average C/D Ratio
0.84
0.87
Vertical C/D Ratio
0.89
0.84
Cup Volume
0.617 mm³
0.600 mm³
Neuro-retinal Rim Thickness
RNFL Thickness
Disc Center(0.51,-0.36)mm
Disc Center(-1.08,0.57)mm
Extracted Horizontal Tomogram
Extracted Vertical Tomogram
RNFL Circular Tomogram
RNFL Quadrants
RNFL Clock Hours
Comments
Doctor's Signature
Page 1 of 2

Compliance Quagmire

- Pt not cooperative with attempts at obtaining consultation with glaucoma specialist
  - Refuses any surgical interventions
- Communication with family members
  - Pt is widower
  - Grown daughter looks after patient, and brings him to appointments
  - She states that he is too stubborn to listen to her advice

Compliance Quagmire

- Adjustments to medication regimen to improve IOP control and compliance
  - PGA
  - Cosopt (Timolol + Dorzolamide)
  - Brimonidine
  - Diamox Sequels (500 mg PO q12hr)
- Patient would never admit to non-compliance and would become hostile at the suggestion he was not using his medication

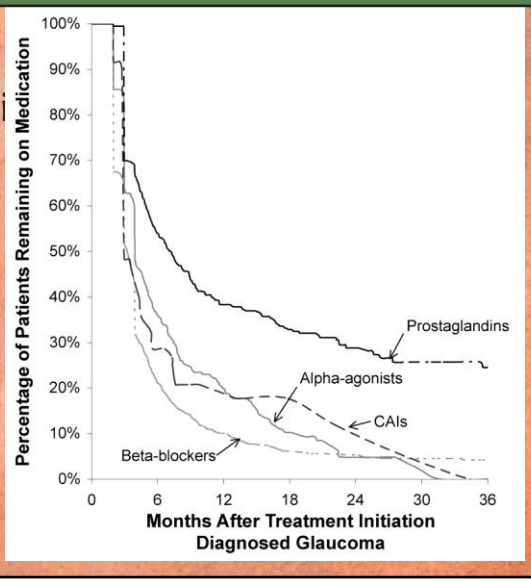
Compliance Quagmire

- Patient counseling
  - IOP numbers
  - VF review
  - Blindness imminent
  - Tips to remember drops (eg. alarms)
- Pt was followed closely for about 1.5 year, and was then lost to follow-up

Compliance Quagmire

What percentage of taking their medicati 6 months?

1. 20% to <40%
2. 40% to <60%
3. 60% to <80%
4. >80%



Am J Ophthalmol 2005;140:598-606

Glaucoma Compliance

- **Improving compliance**
  - Cost barriers
    - Generics, GoodRx.com
  - Communication barriers
    - Dr-Pt relationship, Bottle review, Forms
  - Patient barriers
    - Dose schedule, Cell-phone alarms, Surgery (SLT)

PMID: 27134639, 17572498

The **single most effective** way to improve compliance is to educate patients that treatment is designed to prevent blindness

"This treatment will not improve your vision. The treatment is designed to prevent you from going blind"

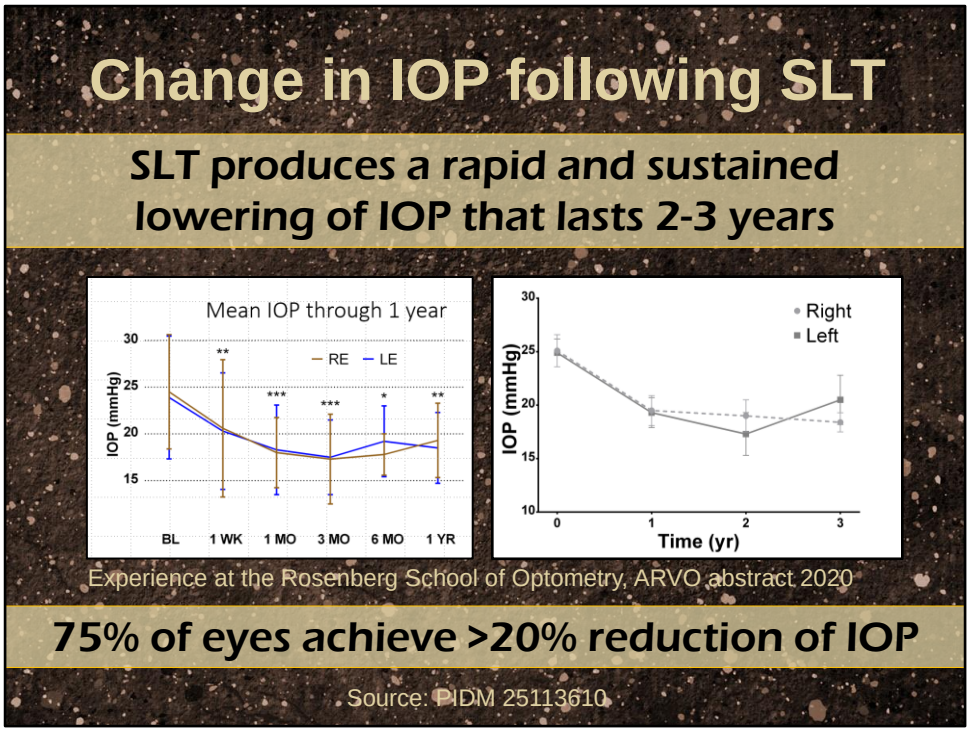
Reinforce this message at every visit!

Glaucoma Compliance

Selective Laser Trabeculoplasty

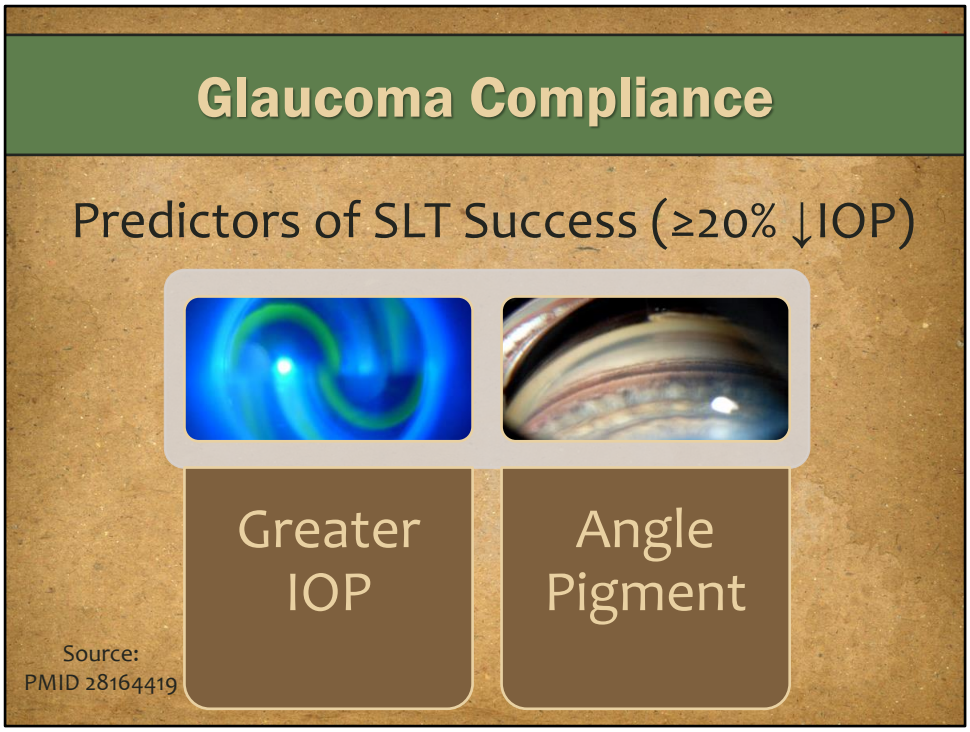
- Application of a low energy YAG laser (532nm) to the TM
  - Lowers IOP by ≥20% in 60%-95% of eyes at 1yr
  - Effect wanes after 1-3yrs, but good repeatability
- **Indications**: Any open-angle glaucoma or OHT
- **Contraindications**: Uveitis, poor view of TM

LIGHT study contraindications to SLT:
-- Inability to sit at slit lamp,
-- h/o uveitis,
-- poor view of TM



SLT lowers IOP by ≥20% in 60%-95% of eyes at 1yr

WONG (2015): about 75% of eyes experience >20% reduction in IOP



Greater pigment >> Greater energy absorption >> Greater inflamm and higher risk of IOP spike

It was believed that inflamm was a mediator of SLT effect, but that is probably not true
-- SALT study finds steroid/NSAID after SLT does not decrease IOP effect

Retrospective review of 997 eyes undergoing SLT
-- Greater IOP and angle pigment before SLT correlated positively with SLT success.
-- Age, total SLT power, severity of glaucoma, and prior treatments were not associated with SLT success or failure.

Glaucoma Compliance

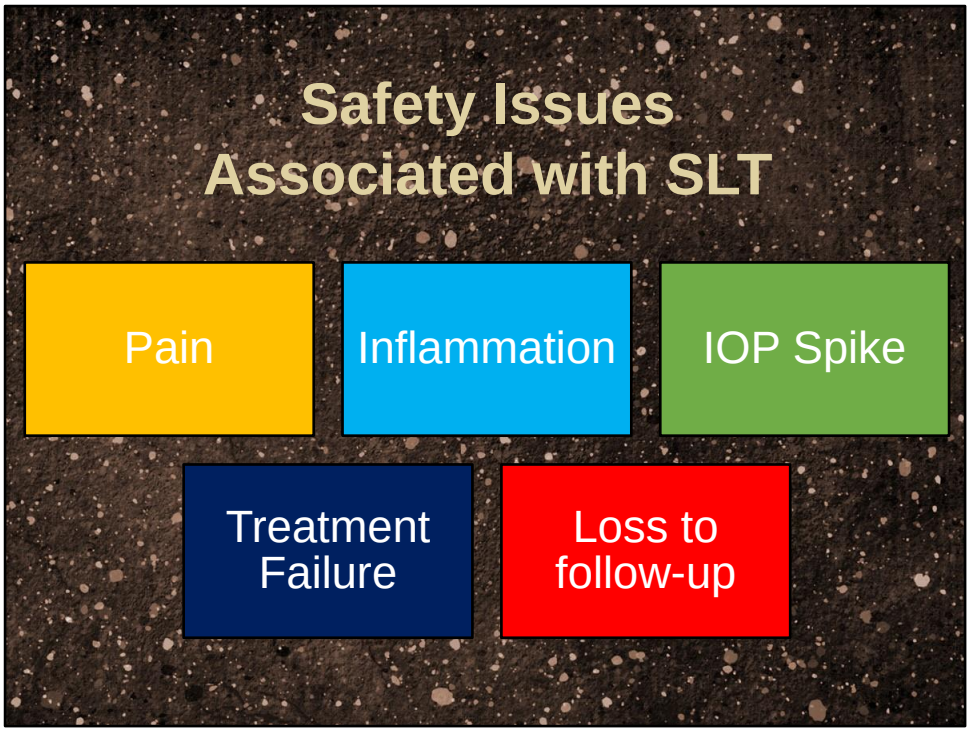
LiGHT Study: SLT as First-Line Treatment

- In 75% of patients SLT gave drop-free disease control with **less glaucoma progression** at lower cost than drops (Gazzard, 2019)
- Repeat SLT can maintain IOP at or below target with at least an equivalent duration of effect to initial treatment (Garg, 2020)
  - **Early retreatment** of poor-responders

PMID: 30862377, 32005561

The LIGHT study demonstrated that repeat laser trabeculoplasty, even after just a few months, is a reasonable option

SLT can help patients with ocular hypertension and early glaucoma to avoid the next step 75% of the time



PAIN/INFLAMM: SALT trial (2019) = 12 weeks after SLT, the IOP reduction was significantly greater in eyes that had been treated with steroid or NSAID drops (P = .02 and P = .002, respectively) than in the saline
group.

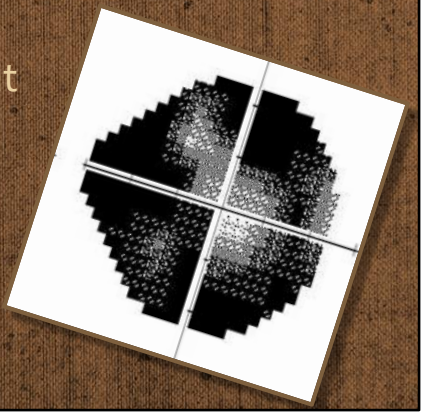
TX FAILURE: In our experience, 30% of patients do not achieve target IOP after initial SLT, and require second SLT or topical tx

Some studies have found TX FAILURE to be more common if pt has previously been treated with PGA – other studies have not found this. That is not our experience

LOSS TO F/U – COMMON PROBLEM!!!

Lessons Learned

- Avoid frustration and hostility with poorly compliant patients
- Good communication is key to maximizing patient cooperation
- Consider SLT in all open-angle glaucoma patients




Thank You!