Glaucoma Grand Rounds 2021

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Glaucoma and Diabetes Eye Institute
Cincinnati, Ohio

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Financial Interests

- Optovue – speakers alliance
- Reichert – speakers alliance
- Haag Streit - speakers alliance
- Ocuflow - consultant

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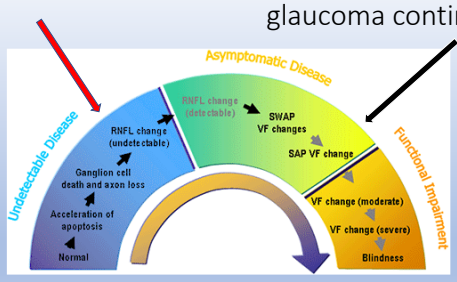
Agenda

- POAG
- Pigmentary
- NTG
- Drance Hemorrhage
- LASIK
- Steroid induced
- Narrow Angle
- Pseudoexfoliation
- Uveitic
- IOP emergency

3

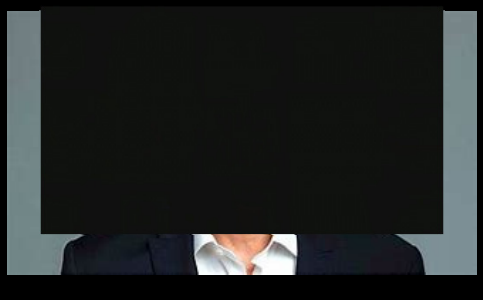
glaucoma continuum



Adapted from Weinreb et al. Am J Ophthalmology. 2004;138:458-467.

4

New (glaucoma) Rules



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Novel Classification
Where is the glaucoma coming from?

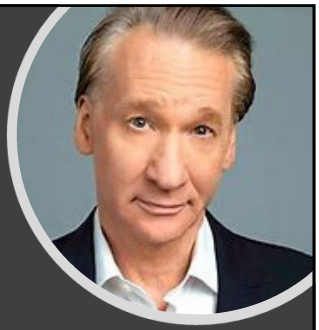
- Anterior segment glaucoma etiology
- Posterior segment glaucoma etiology
- Combined glaucoma etiology

6

When does glaucoma become glaucoma?

- Significant IOP risk?
- Repeatable field loss?
- Documentation of axonal loss?

Who cares?



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Glaucoma Progression

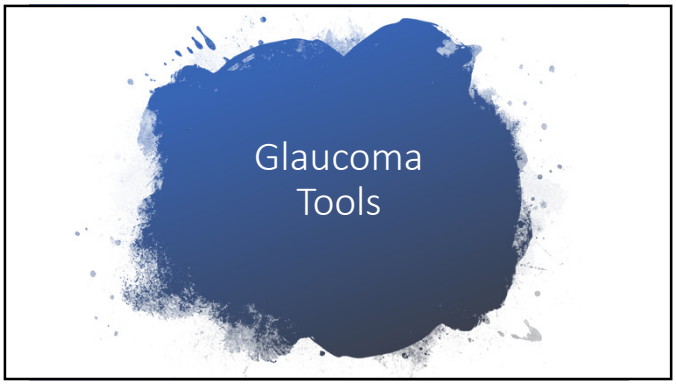
- Glaucoma is a bilateral disease
- Glaucoma progression is not symmetrical
- Glaucoma progression is not linear

8

Treat

Risk of PROGRESSION

9



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Corneal Thickness & IOP

- Calculation based on data of Ehlers et al (1975)
- Modified from Stodtmeister (1998)
- Arithmetic mean of corneal thickness in healthy subjects: 545 *µm* (Doughty and Zaman 2000)

CCT (µm)	Correction Value (mm Hg)
465	+6
485	+5
505	+3
525	+1
545	0
565	-1
585	-3
605	-4
625	-6

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James Brandt, MD
Director Glaucoma Services
UC Davis

"Assuming that CCT can be used as a correction factor for GAT is a misinterpretation of the results of OHTS… that couldn't be further from the truth. Adjusting IOP based on CCT is attempting to instill a degree of precision into a *flawed measurement*. You may actually correct in the wrong direction. The issues related to the most accurate tonometry need to include the material properties of the cornea"

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New IOP measurement techniques

- Pascal (DCT)
- CR 7 – Reichert
- Icare

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"CATS" tonometer prism

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CATS prism

- Fits on any Goldmann style tonometer
- Contoured tip
- Less error than traditional applanation
- Low cost

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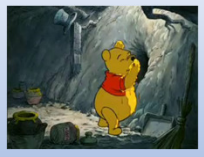
Finding the IOP floor

- Valsalva effects
- Large patients
- Repeat measurements
- Proper slit lamp technique
- Room lighting?



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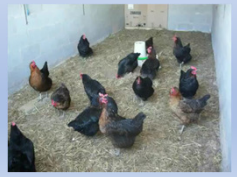
When do YOU "chicken out"?

- 21 mm Hg?
- 24 mmHg?
- 26 mmHg?
- 30 mmHg?



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What Changes First?

- Structure damage often precedes functional damage in glaucoma[1]
- RNFL loss often precedes optic disc changes[2]
- Can GCC change before RNFL?

1. Sommer A. et al. Clinically detected nerve fiber atrophy precedes the onset of glaucomatous field loss. Arch Ophthalmol 1991; 109:77-83.
2. Quigley HA, Katz J et al. Ophthalmology 1992; 99: 19-28.

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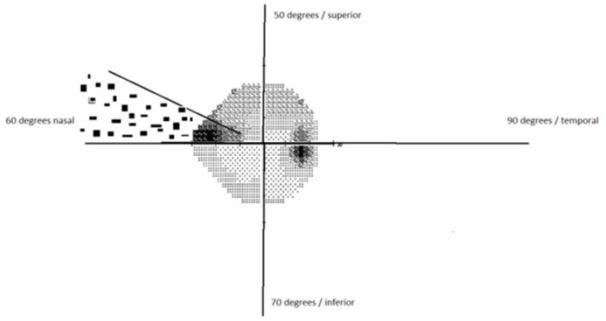
Fields

20

24-2 – the Gold Standard"



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" It's tough to make predictions, especially about the future"

Yogi Berra

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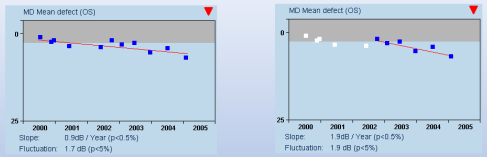
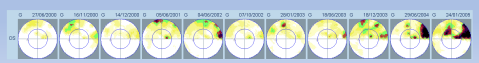
Progression rate in Glaucoma



- Look at past 6 tests for more meaningful trend
- Beware of deceptive Mean Deviation (MD) trends !
- Look at focal defects



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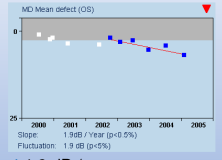
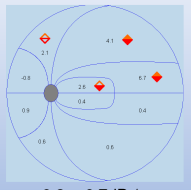
Progression rate in Glaucoma

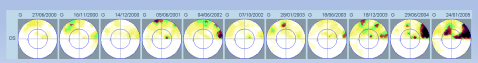
Global versus local progression rates





- 1.9 dB / year

vs. -0.8 ~ 6.7dB / year



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current standard of care

- 24 or 30-2 2x per year
- Consider 10 degree for early detection - ??
- Always use 10 degree for advanced where fixation is challenged

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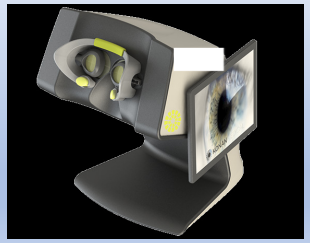
Konan "objectivefield"

Objective – measuring pupil response to stimulus

Performed OU simultaneously

7 minutes total



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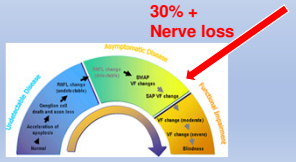
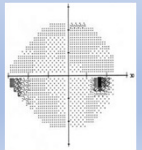
Do you have to see a defect before you treat?

Quigley HA, Addicks EM, Green WR. Optic nerve damage in human glaucoma. III. Quantitative correlation of nerve fiber loss and visual field defect in glaucoma, ischemic neuropathy, papilledema, and toxic neuropathy. Arch Ophthalmology 1982 Jan;100(1):135-46.





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Ophthalmoscopy / Photography

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the basics

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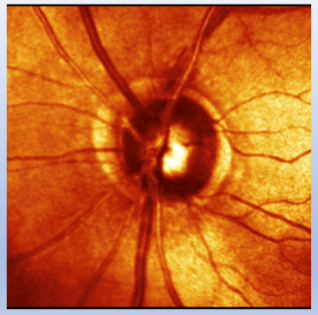

Examining
the Nerve

31

5 good "old "rules

- Margins
- Diameter (size)
- Neuroretinal rim - Wedge defects
- Peri Papillary Atrophy (PPA)
- Drance hemorrhage

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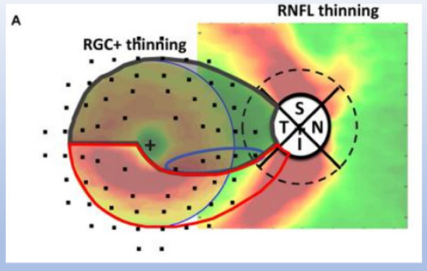
OCT

33



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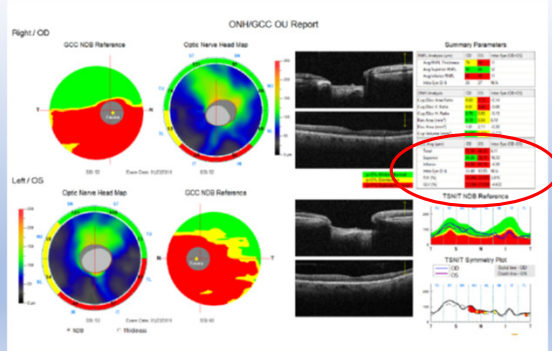

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Focal Loss Variance
Global Loss Variance

Avg Thickness	OD	OS	Inter Eye (OD-OS)
Total	90.72	84.77	5.95
Superior	89.37	82.71	6.66
Inferior	92.00	86.87	5.21
Intra Eye (S-I)	-2.71	-4.16	N/A
FLV (%)	0.479	2.007	-1.528
GLV (%)	5.000	10.500	-5.500

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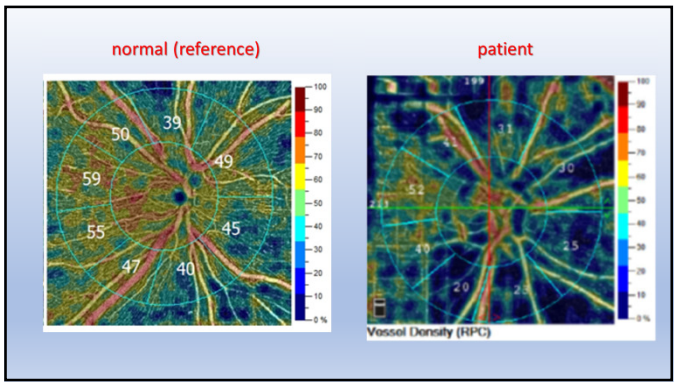
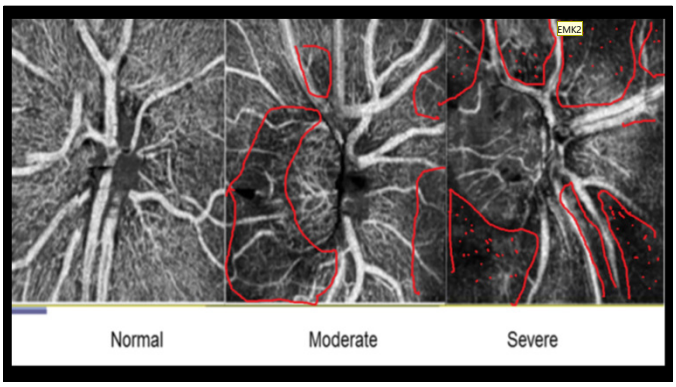
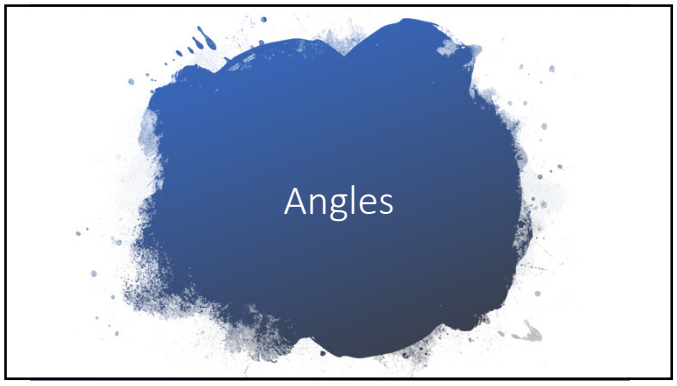

normal (reference)
patient
50
39
49
59
55
45
47
40
Vessel Density (RPC)

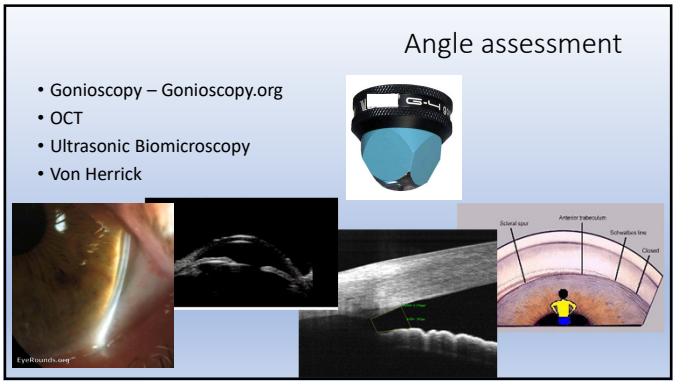
37


EMK2
Normal
Moderate
Severe

38


Angles

39


Angle assessment
• Gonioscopy – Gonioscopy.org
• OCT
• Ultrasonic Biomicroscopy
• Von Herrick

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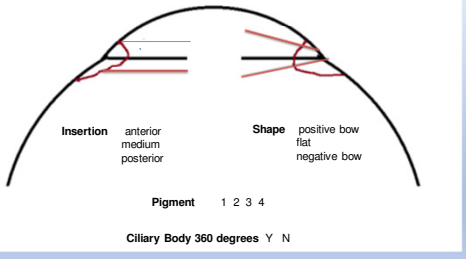
Slide 38

EMK2 Dr. Elliot M. Kirstein, 12/21/2019

easy gonio



Insertion anterior
medium
posterior

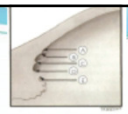
Shape positive bow
flat
negative bow

Pigment 1 2 3 4

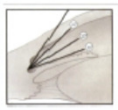
Ciliary Body 360 degrees Y N

41

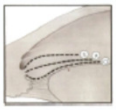
Gonioscopy



A = Above Schwalbe line, totally occluded angle.
B = Behind the Schwalbe line, peripheral iris is in contact with TM.
C = Scleral spur Iris root at the level of scleral spur
D = Deep anterior ciliary body seen.
E = extremely deep



Angle approach



Curvature of periheral iris

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VEP / ERG

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Primary Open Angle Glaucoma

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Primary Open Angle Glaucoma

- Most common
- Highly hereditary
- IOP seldom over low 30's
- No apparent angle anomaly
- First changes seen mostly structural

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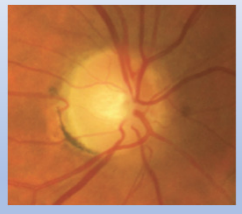
- 63 y/o Caucasian female
- Initial IOP's 28 OU
- Sister advanced with trabeculectomies



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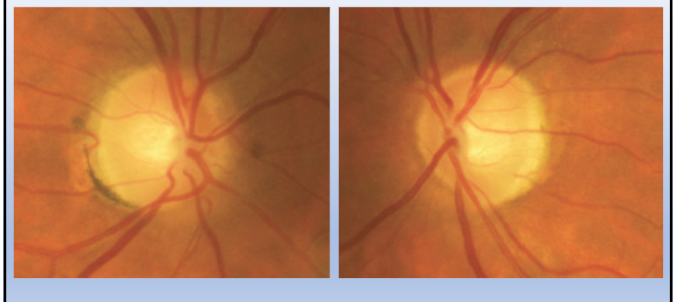

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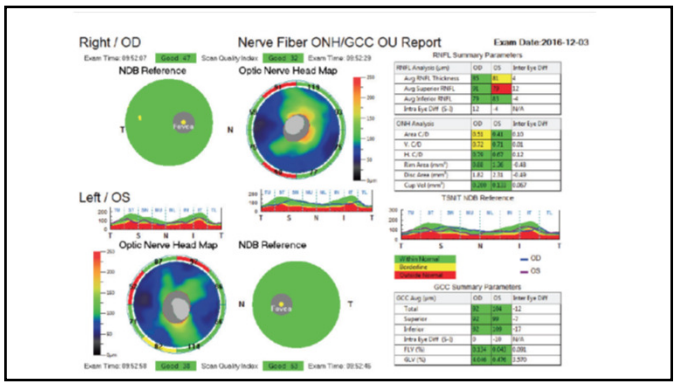

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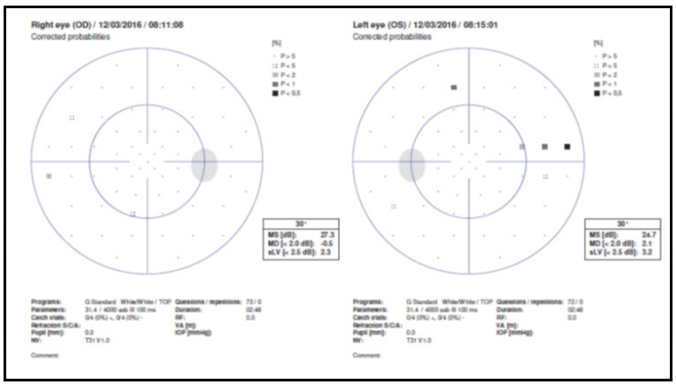

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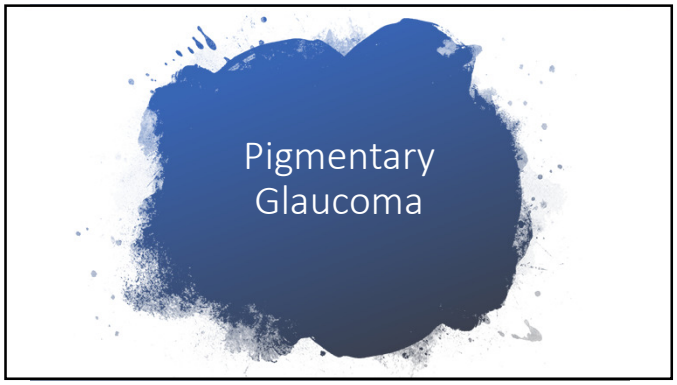

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48 y/o white male
routine exam
Monday, 2/25/2005, 2:00 pm

- Post RK 15 years, "no family Hx of glaucoma" – High plus – high Cylinder
- Gat 24 / 22
- PAK 638µm / 632µm "corrected IOP" 21 / 18
- Pigment dispersion, OU mild (no endothelial pigment, negative bowed iridies, 2+ angle pigment, slight iris trans illumination
- Excellent nerves
- No family History
- WHATS NEXT? **Work-up or wait until next year?**

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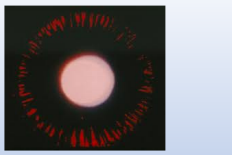

iris transillumination
angle pigment
negative iris bow
posterior iris insertion

53

Thursday, 2/28/2005
9:00 AM
Follow-up Visit

- Excellent fields
- Excellent HRT (small nerves)
- + "mother had glaucoma"
- **DCT = 37.4 / 32.8** (GAT 28 / 22)
- Rx qpm OU Travataprost / RTO 14 days
- WHAT'S NEXT?

54

Thursday, 1:00 pm
phone call
(same day)

- My right eye is "foggy" & "red"

"come on in !"

55

Thursday, 2:00 pm
Re-check

- V/A = 20/50, 20/30
- Cornea cloudy OD>OS, 2+ injection OU
- Pupils equal & reactive
- A/C 2+ cells (Pigment) OU
- Crisp new Krukenberg spindles OU
- **DCT – 50.2 / 44.8**

treatment ?

56

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Thursday, 3:30 PM

- V/A = 20/25+, 20/25+
- DCT = 19, 14

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Normal Tension Glaucoma

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NTG patient profile

- IOP not over low 20's
- Low blood pressure – profusion pressure (DPP)
- High myopia
- Race
- Migraine
- Gender

61

diastolic perfusion pressure (DPP)

DPP = diastolic BP – IOP

Barbados and Baltimore Eye Studies
Increased risk for low DPP (below 55)

This means that the highest risk is a combination of high IOP and low diastolic BP

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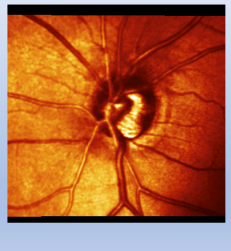
Classic NTG

- IOP OD = 20 / 21
- 69 y / o Caucasian male
- OPA = .9mm Hg OU
- No Family Hx
- Tall slender stature
- Open angles – light pigment
- CCT – 540 / 535
- Para central defects OS > OD
- Poor tolerance to beta blockers



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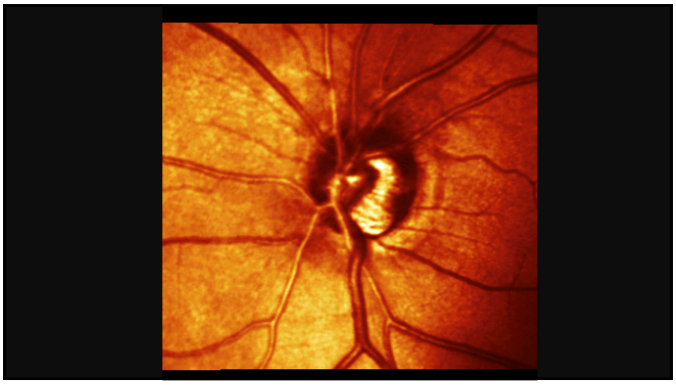

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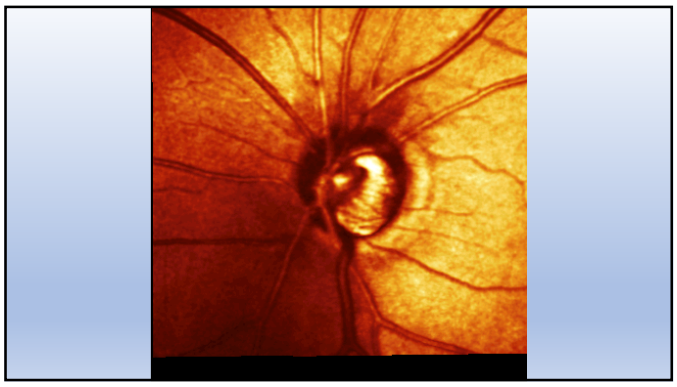

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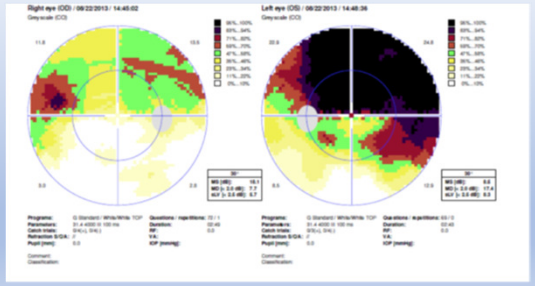
Classic NTG



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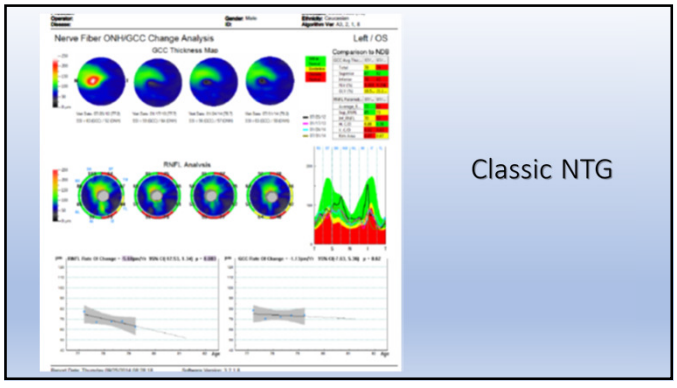

Classic NTG

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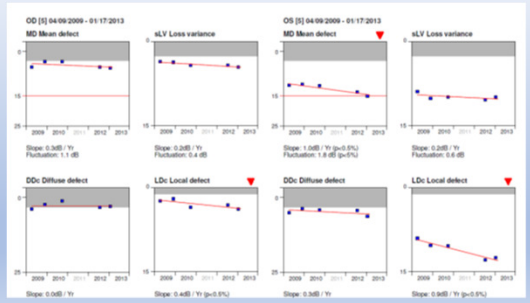
Classic NTG



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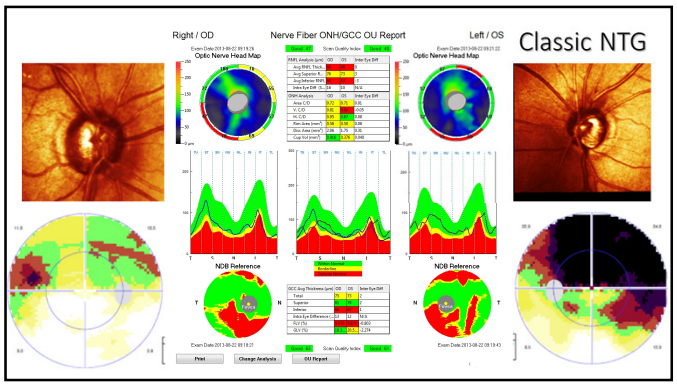

69

53 y/o Caucasian female

- "They've always told me that something way funny in the back of my eye, but the ophthalmologist said I didn't have glaucoma"
- IOP's – High teens
- 550 micron pachymetry
- BP – 135/85
- High body mass index
- No known family history of glaucoma

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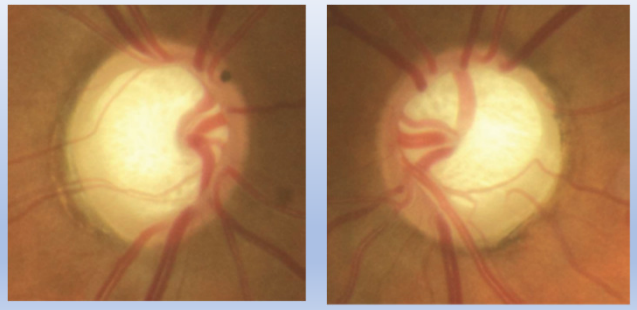
Is this NTG? ……or large nerves?



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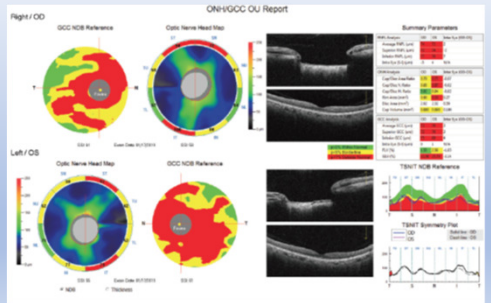
Red disease or NTG?



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Drance Hemorrhage

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Drance Hemorrhage

- 13% POAG / 20% NTG
- 84% are missed
- 100% with 2 disc hemorrhages will have field loss
- 81% with 1 disc hemorrhage will have field loss
- 3 fold progression risk – even under treatment

Jeffrey M Liebmann, MD - New York Eye & Ear Infirmary 3.2015

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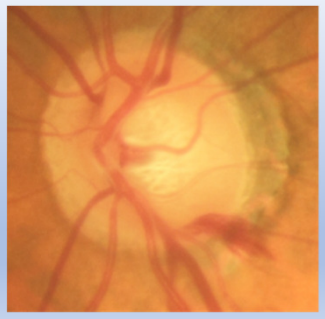
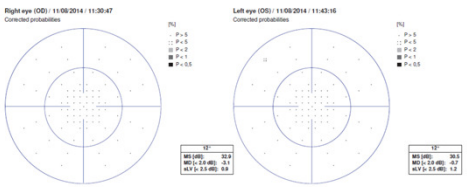
Drance Hemorrhage



- 67 y/o Caucasian female - slender
- IOP 24, 25
- BP 105/68
- Open angles
- No known family Hx
- Hx migraine

75

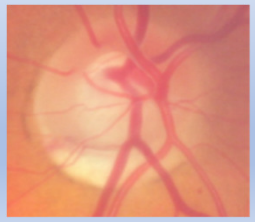
Drance Hemorrhage



76

Chronic Drance Hemorrhage

- IOP OD – 27 / 31
- 75 y/0 Caucasian female
- Strong Family Hx
- Chronic Drance hemorrhage
- .8 OPA (very low ocular pulse)
- grade 2 angles 1+ pigment
- PAK 555 / 561
- Corresponding Bjerrum defects
- Recent trabulectomy OU



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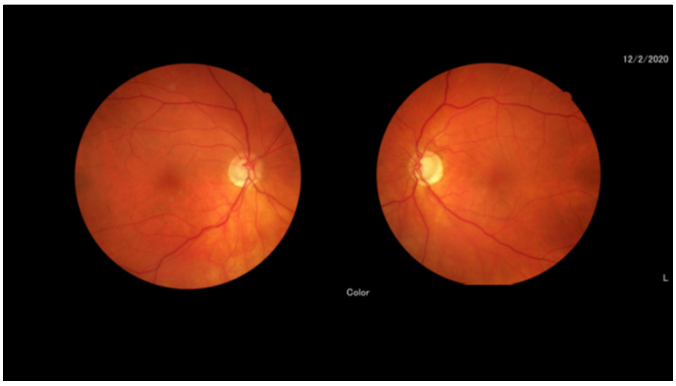

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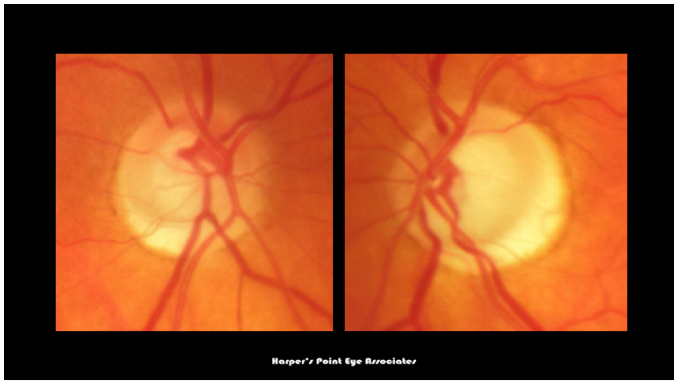

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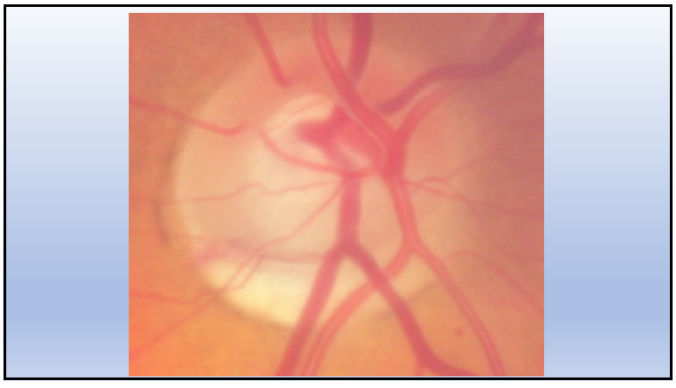

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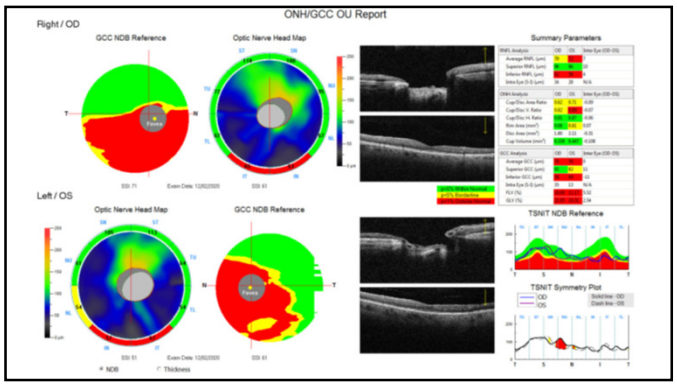

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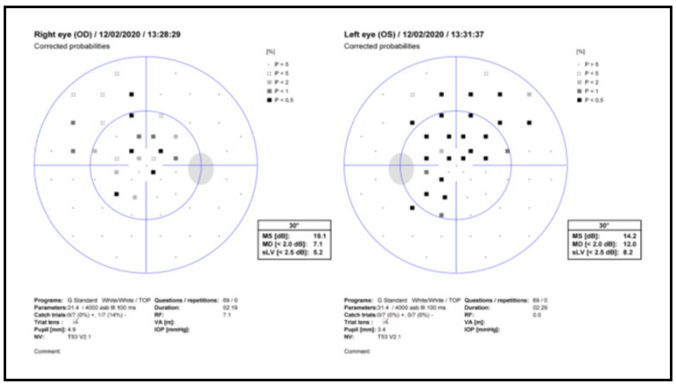

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83

LASIK

- 15,000,000 Americans
- Severe effect on applanation tonometry
- Masks elevated IOP!!!

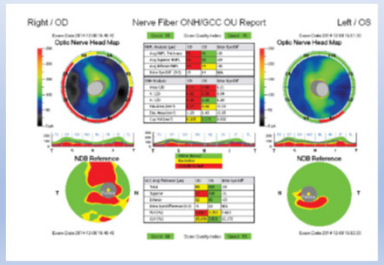
84

LASIK

- LASIK
- Age 58 / male
- OD = 20/70 OS = 20/25
- Never had IOP over 21
- Late diagnosis
- Retinal tear
- Epi Retinal Membrane with peel
- Low blood pressure
- Advanced Normal Tension Glaucoma

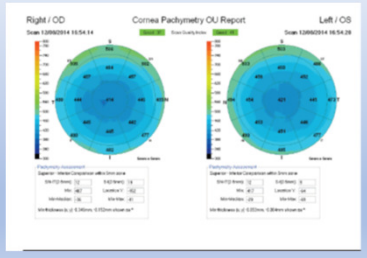
85

LASIK
OCT

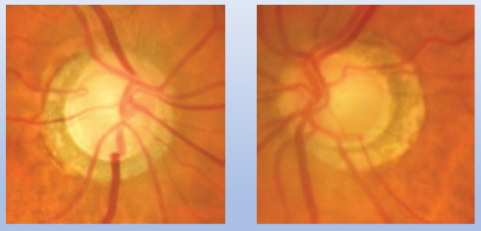


86

414 micron CCT post LASIK

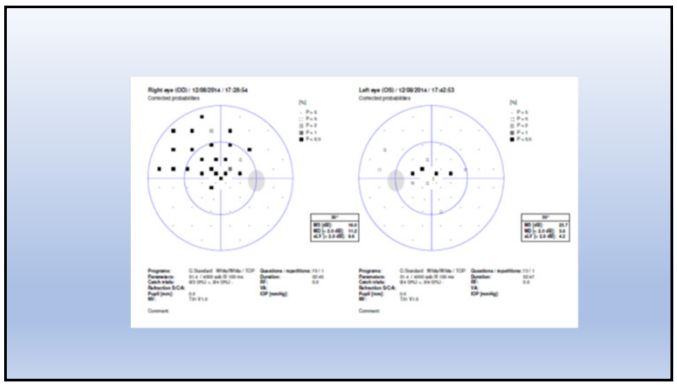


87



OD OS

88



89

Consider "CATS" tonometry
Correcting Applanation Tonometer Surface

90

Steroid Induced Glaucoma

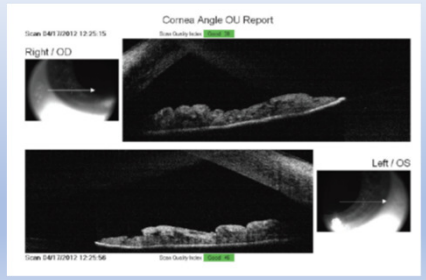
91

67-year-old Caucasian male

- Initial treatment with IOP risk at 30 mm OU (2 visits) – good nerves and fields
- No family history of glaucoma
- Takes statins and aspirin for cardiovascular risk
- Denies other medications

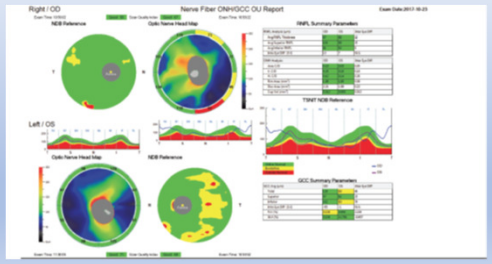
92

OCT angle



93

OCT



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IOP

- January 2016 – with latanoprost monotherapy – 19 mm OU
- April 2016 – 43 mm Hg OU
- Add Combigan BID OU and IOP – mid 20's
- June 2016 – 22 mm Hg OU
- Sept 2019 – IOP mid 40's
- Surgical consult – SLT's – similar post Tx fluctuation

95

October 2016

- Patient reports that he has had a recent steroid injection of dermatologic issues and has had several in past few years.

96

Reminder!

- Don't overlook steroid injections and OTC steroids

97

Narrow Angle Glaucoma

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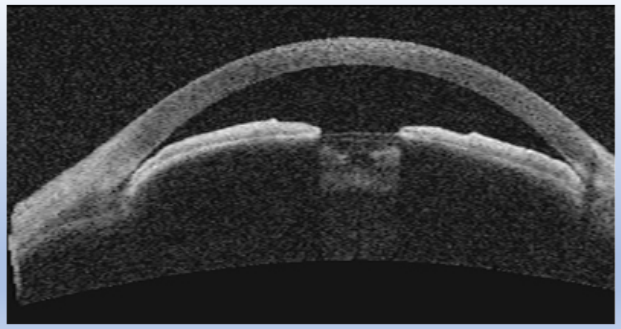

99

LPI vs. No LPI

- Err on side of caution
- Preventing potential blindness
- Prevention of angle closure
- Fairly benign
- LPI not totally benign
- Cataract acceleration
- Photophobia

100

Long Term Studies

- Recent Chinese Study - 6 out of 485 patients closed
- 1993 Chicago Study – 8 out of 129 patients closed
- India – recent study – 1 out of 48 patients closed

101

Closure with dilation

- Singapore – 3 / 471
- Rotterdam – 2 /149
- Baltimore – 0 / 38

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Stages / Classifications

- Primary angle closure suspect (“occludable”)
- Primary angle closure
- Primary angle closure glaucoma

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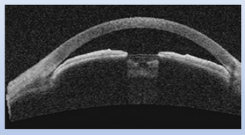
Remember

- Watch for spike with dilation
- Always perform gonioscopy
- UBM and OCT helpful
- Watch for plateau
- Err on side of caution



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Pseudoexfoliation Glaucoma

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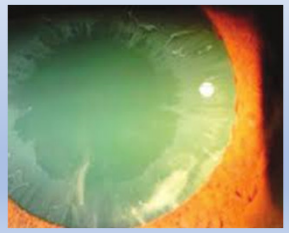
Pseudoexfoliation Glaucoma



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pseudoexfoliation glaucoma

- Systemic disorder caused by progressive accumulation of extracellular material over various tissues.
- Weakness of the zonules cause of complication during cataract surgery.
- Angle changes common.
- Pigment and flecks of pseudoexfoliative material in angle "Sampaolesi's line"
- Mostly bilateral and asymmetric
- Historically associated with Scandinavian background
- Prevalence tend to increase with latitude in the Northern hemisphere

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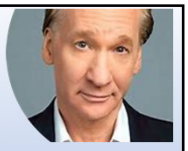


pseudoexfoliation glaucoma – big rule…..

DILATE! Or you WILL MISS IT!

108

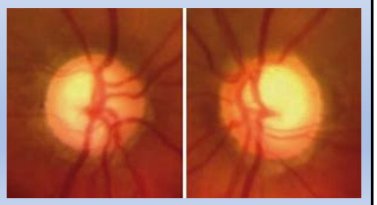
The "latitude effect" and pseudoexfoliation glaucoma

- Historically associated with Scandinavian background
- Prevalence tend to increase with latitude in the Northern hemisphere
- Independent of regional genetic background – (L Pasquale, MD)

109

56-year-old Asian female Pseudoexfoliation

- 20/25- OU low myopia
- No family history of glaucoma
- IOP 23, 28
- Pachymetry – 555 OU
- Normal fields (30-2)



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Uveitic Glaucoma

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Inflammatory glaucoma

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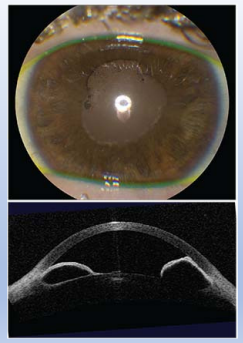
• Uveitic Glaucoma

- Common complication of uveitis affecting some 20% of patients
- Inflammatory debris obstructs trabecular meshwork
- Secondary angle-closure glaucoma can result – iris bombé
- In the long-term, inflammation can also cause scar tissue that further obstructs outflow
- Usually treated with corticosteroids
- Watch for High IOP with iritis!
- Always suspect herpetic component and consider herpetic prophylaxis



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Fuchs' Heterochromic Iridocyclitis

- Rare, chronic form of iridocyclitis characterized by iris heterochromia, low-grade anterior chamber reaction with small stellate keratic precipitates, posterior subcapsular cataract and secondary open-angle glaucoma.
- Usually unilateral, affecting the hypochromic eye, and affects men and women equally in the third to fourth decade.
- Open angle without synechiae
- Does not respond to corticosteroid therapy, and corticosteroids may worsen the IOP elevation.
- Treatment is initiated with medical therapy.
- Frequently fails to be controlled medically and often requires filtration.

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Glaucomatocyclitic crisis or Posner-Schlossman syndrome

- Recurrent attacks of mild anterior uveitis with marked elevations of IOP
- Affects young to middle-aged adults, who present with blurred vision and eye pain.
- Resolves spontaneously within a few weeks.
- IOP is usually markedly elevated (in the 40- to 60-mmHg range)
- Returns to normal between attacks.
- Chronic secondary glaucoma may develop.
- Gonioscopy may reveal keratic precipitates on the trabecular meshwork, suggesting trabeculitis as the etiology of the elevated IOP. Another theory suggests that increased levels of aqueous prostaglandins may increase aqueous production.
- Treatment consists of corticosteroids and antiglaucoma medications during episodes.

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60 mm Hg OU

- 38 y/o female – African – American
- Grade 4 angles
- .4 c/d OU
- 1+ chamber reaction
- Schlemms canal injected

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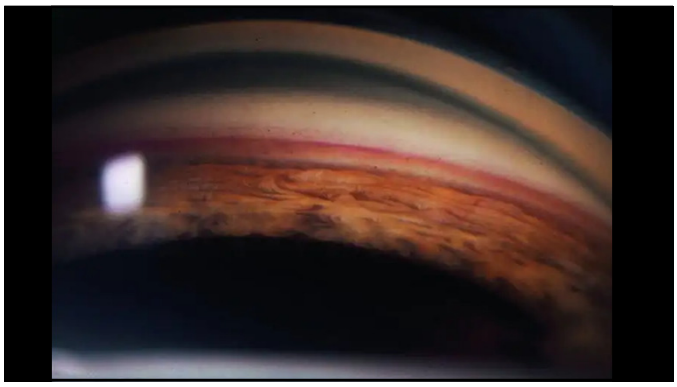

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Juvenile rheumatoid arthritis (JRA)

- Most known cause of childhood uveitis
- Frequent cause of uveitic glaucoma
- Glaucoma is reported to occur in up to 44 percent of patients
- Often require surgical intervention

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IOP Emergency!

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tools

120

IOP Emergency
IOP 35+, 45+, 50+

- Angle Closure
- Acute steroid response
- Pigmentary storm
- Uveitic Spike

- Combigan q 30 minutes
- Prostaglandin 1X
- Diamox 500 MG then 250 BID
- Dilation and q4h pred 1% with uveitic
- Pilocarpine 1% q 30 minutes with closure
- Probable surgical referral

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Thank You !

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Harper's Point Eye Associates
Glaucoma and Diabetes Eye Institute
Cincinnati, Ohio

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