

# Glaucoma: What To Do About It

## Case Studies in Glaucoma

Deepak Gupta

No financial disclosures

### Warning

- If you get excited and motivated to manage glaucoma it may cost you \$100,000 in equipment purchases
- But, you will get an incredible ROI and you will keep enjoying working longer

### 4 main types of glaucoma



### What's your job in diagnosing glaucoma?

- Find out what kind of glaucoma your patient has
  - OAG
    - Primary
    - Or secondary component

### What's your job in diagnosing glaucoma?

- Make sure your patient does not have glaucoma at the time of visit

## What's your job in diagnosing glaucoma?

- Establish a baseline

## Optometry and Glaucoma

- Average OD Database: 2500 patients
- Glaucoma patients: 50
- Glaucoma suspect: 200
- On average, an OD should see at least one patient a day related to this condition

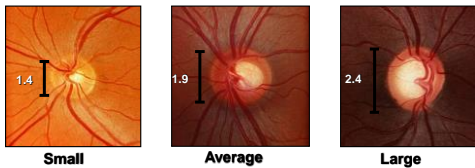
## The Optic Nerve

- Composed of 1.2 million axons
- Roughly 30 mm long

## **1<sup>st</sup> Step:**

*Assess the size of the ONH*

Size Matters! Bigger is Better



Small discs: avg vertical diameter  $\leq 1.5$  mm  
Large discs: avg vertical diameter  $> 2.2$  mm

## Optic Disc

Size discs can have small cups in glaucomatous eyes  
Large discs have large cups in healthy eyes

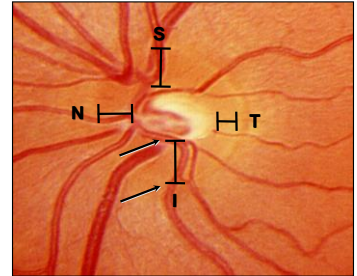
**Next Step:**

*Examine the neuroretinal rim*

**ISNT RULE**

**Rim width**  
Distance between border of disc and position of blood vessel bending

**ISNT rule**  
Inferior >  
Superior >  
Nasal >  
Temporal



Notching

At what point do you work up?

What is normal C/D ratio?

- .30
- 95% of the normal population falls between 0.2 to 0.4

Only 5% of the normal population has a C/D of .50 and greater

## Fundus Photos: Billing

- CPT code: 92250
- Can do once a year
- Average reimbursement: \$78

## Why take Fundus Photos?

- Show patient
- Establish a baseline
- Because it is the standard of care and you get paid to do it

## Old People

## Age

- Incidence of 0.25% at 20 years
- Incidence of 15% at 70-75 years

## Which races are at higher risk?

## LALES

- Population-based cross-sectional study involving 6,357 subjects 40 and older
- Designed to measure the prevalence of eye disease in Latinos

## Hispanic Population

- LALES study
- Two times greater risk for developing glaucoma than the average population
- Most at high risk where patients with vertical C/D greater than .60

## BP and OAG

- Low BP
- Treatment of Hypertension

## Those with faulty genes

## ADAGES

- African Americans have a higher incidence of glaucoma
- Glaucoma progresses faster
- More severe damage and loss of visual function

## Hypertension

- Perfusion Pressure =  
Diastolic Pressure – IOP

Normal BP = 120/80  
Normal max IOP = 20/21

## Genetic testing for glaucoma

- mutations in the genes myocilin (*MYOC*), optineurin (*OPTN*), and *TBK1* can be a primary cause of POAG. A number of genetic studies have confirmed these findings.
- Mutations in *MYOC* are associated with 3% to 4% of POAG that occurs with elevated intraocular pressure (IOP).
- Genetic testing resource: [www.genetests.org](http://www.genetests.org)

## Family History

- **“We must be more aggressive in recommending examinations for family members of OAG patients.”**
- **“First-degree relatives of identified OAG patients should be evaluated with optic disc and visual field testing.”**

Harry A Quigley, MD *Archives of Ophthalmology*, July 2006

## Chronic steroid use

- Eye drops
- Inhalers
- Pills
- Creams

## Standard Glaucoma Suspect work up protocol

- Visit 1: Dilated exam, gonio, pach, photos
- Visit 2: IOP check and OCT
- Visit 3: IOP check and VF

## Gonioscopy: The Facts

92% of glaucomas are POAG

It is standard of care for work ups

You get paid for it!!!

Good resource for gonioscopy

**[www.gonioscopy.org](http://www.gonioscopy.org)**

## Gonioscopy Billing

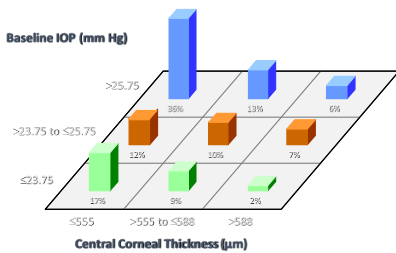
- CPT code: 92020
- Reimbursable once a year
- Average reimbursement: \$22

## Ocular Hypertension Treatment Study

- Patients with thin corneas were three times greater risk for developing glaucoma
- Influence of corneal thickness 3.5 X greater than could be accounted for by adjusting IOP
- Each 40 microns = 1.71 greater risk of progression

When is the cornea thin?

## Central Corneal Thickness and IOP



## Pachymetry: Billing

- CPT code:76514
- Reimbursable once in patient's lifetime
- Average reimbursement: \$14

## Normal IOP

- This is the least important of the risk factors for glaucoma because many patients with an IOP between 10 and 21 develop glaucoma
- However, a patient with an elevated IOP gives you reason to work him or her up

## What is normal IOP fluctuation?

- Average for normal patients is 2 to 4 mm
- Anything greater than 5.0mm is a red flag

How do we find this?

- Schedule patient appointments during different times of the day
- Serial tonometry

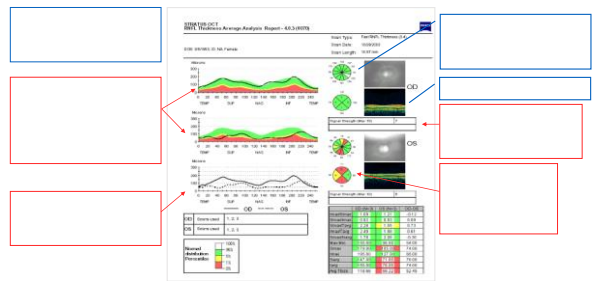
### Serial tonometry (CPT code: 92100)

- At least 3 IOP readings during different time periods of the same day
- Option 1: Patient comes in at 8am, 9am, 10am, 11am, etc
- Option 2: Patient comes in at 8am, 11am, 2pm, 5pm, etc

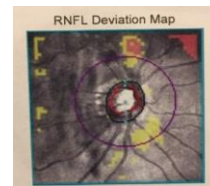
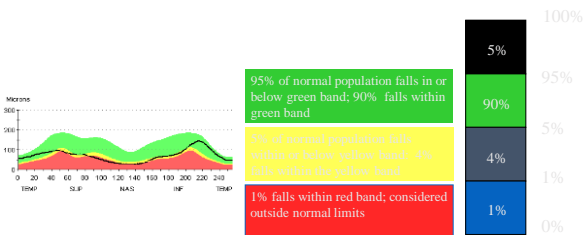
### Serial tonometry (CPT code: 92100)

- Can do once a year
- Average reimbursement: \$110

### RNFL Thickness Analysis

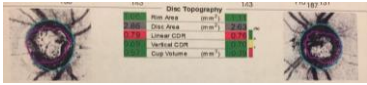


### RNFL Thickness





## How do you use them to help diagnose glaucoma?

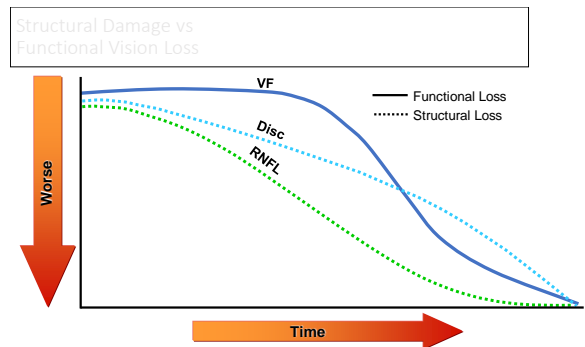


➔ No different than visual fields

➔ Look for reliable, repeatable defects

## OCT: Billing

- CPT code: 92133
- Can do once a year on stable patients
- Can do twice a year on progressive patients
- Can't do at all on advanced glaucoma
- Average reimbursement: \$45



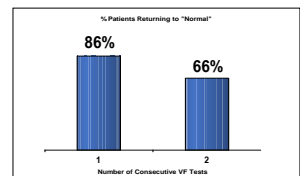
Weinreb. Presented at: The AGS Subspecialty Day Lecture: Getting Closer to Glaucomatous Optic Neuropathy; October 19, 2002; Orlando, Fla.

## What if patient has unreliable VF?

- If first is unreliable or inconsistent with previous, bring patient back for repeat VF
- Do you bill for this second test?

## VF are Highly Variable

- After one abnormal visual field test:
  - 86% of patients test within normal limits on next exam
- After two consecutive abnormal test results:
  - 66% of patient test within normal limits on next exam<sup>3</sup>



## Their conclusion:

You need three consecutive, reliable tests before making any decisions

## VF: Billing

- 92081: limited examination (e.g., tangent screen, or single stimulus level automated test)
- 92082: intermediate examination (e.g., at least 2 isopters on Goldmann, or automated suprathreshold)
- 92083: extended examination (e.g., automated threshold perimetry, Octopus program G-1, 32 or 42, Humphrey VF analyzer full threshold programs 30-2, 24-2, or 30/60-2).

## VF: Billing

- CPT code: 92083
- Can do once a year if stable
- Average reimbursement: \$59

## Glaucoma Medications

Works for roughly 90% of patients

Most ODs: Medical > Laser > Conventional Surgery

## Glaucoma Meds

- Beta Blockers
- Alpha-adrenergics (Alphagan)
- Topical CAI
- Prostaglandin - XLT
- Nitric Oxide + PG (Vyulta)
- Rho kinase Inhibitors
- Cholinergics (Pilocarpine)

Brand	Generic & Concentration	Mechanism of Action	Dosing	Typical IOP Reduction	Size	Side effects	Warnings
Lupigen (Alphagan)	Alphagan 0.5%	Increased uveoscleral outflow	QDs	27% to 33%	5mL	Hyperemia, iris pigment, CME, hyperreflexia, conjunctival injection, keratitis, eyelids, ocular pain	May obscure eye color
Troxatan Z (Xalatan)	Xalatan 0.02%	Same	QDs	25% to 33%	5mL	Same as above	Same as above
Xalatan (Prolen)	Xalatan 0.02%	Same	QDs	25% to 33%	2.5mL	Same as above	Same as above
Ziphan (Xalatan)	Xalatan 0.0215%	Same	QD	22% to 29%	0.5mL	Conjunctival hyperemia, itching, pruritus, contact, dry eye, increased ocular pigmentation, blurred vision, nasale edema, headache, cold, cough, urinary tract infection	Risk of ocular edema
Prostaglandin/ Nitric oxide prodrugs							
Vyulta (Brach - Lant)	Brach 0.024%	Increase uveoscleral and trabecular outflow	QD	34.6%	5mL	Hyperemia, eye pain, hyperreflexia	No systemic effects

## Vyzulta

- Lowered IOP by 35% to 44%, compared with only 26 to 27% with latanoprost alone
- No additional side effects compared to a PG alone; no systemic side effects

### Problem with Vyzulta

- \$\$\$\$\$\$\$
- Try vyzulta.com - pay no more than \$35 or \$40
- Insurance coverage is finally starting to get better

**Table 6. Rho-kinase Inhibitors**

Brand Name (Manufacturer)	Generic & Concentration	Mechanism of Action	Dosing	Typical IOP Reduction	Size	Side effects	Warnings
Rhopressa (Aerie)	netarsudil 0.02%	Increase trabecular outflow/decrease episcleral venous pressure and decrease aqueous production	QD	25% to 30%	2.5mL	Hyperemia, conjunctival hemorrhage, corneal verticillata	Significant red eye, no systemic effects

### Problem with Rhopressa

- \$\$\$\$
- Hyperemia
- Use discount cards
- Insurance coverage is finally starting to get better

## PG: Efficacy

- Topical Beta blockers: 20% IOP reduction
- Prostaglandins: 25-28% IOP reduction

## Watch out for...

- PG can cause Iritis and CME in patients with history of aphakia

Brand Name	Generic & Concentration	Mechanism of Action	Dosing	Typical IOP Reduction	Size	Side effects	Warnings
Betagan (Allergan)	bimatoprost hydrochloride 0.25%, 0.52%	Decrease aqueous production	QD-BID	20% to 30%	5mL, 10mL, 15mL	Bronchospasm, bradycardia, hypotension, decreased triglyceride and decreased HDL, increased CRP, CAC, confusional, lethargy, depression, hypoglycemia, masked hypoglycemia, maculopathy, myopia, retinal edema	Monitor for SOB, hypoglycemia, altered blood lipids, anemia, dizziness.
Bimatol (Allergan)	bimatoprost hemihydrate 0.25%, 0.5%		QD-BID	20% to 30%	5mL, 10mL, 15mL		
Betoptic-Z (Pheoch)	bimatoprost hydrochloride 0.25%	Decrease aqueous production; beta 1 selective blocker	BID	15% to 20%	5mL, 10mL, 15mL	Fever, pulmonary side effects, otherwise same as bimatol. Less effective than bimatol.	
Latisol (Bausch + Lomb)	timolol maleate ophthalmic solution 0.5%		QD	20% to 30%	5mL		
Optipronolol (Bausch + Lomb)	metipronolol 0.2%	Decrease aqueous production	BID	20% to 30%	5mL, 10mL	Bronchospasm, bradycardia, hypotension, decreased HDL, increased CRP, CAC, confusional, lethargy, depression, hypoglycemia, masked hypoglycemia, maculopathy, myopia, retinal edema	
Timoptic (Allergan)	timolol maleate 0.25%, 0.52%		QD-BID	20% to 30%	2.5mL, 5mL, 10mL, 15mL		
Timoptic in Solution (Bausch + Lomb)	timolol maleate 0.25%, 0.52%	Decrease aqueous production	QD	20% to 30%	5mL	Fever, pulmonary side effects, otherwise same as bimatol. Less effective than bimatol.	
Timoptic XL (Allergan)	timolol maleate gel-forming solution		QD	20% to 30%	5mL		

### Contraindications to Beta-Blockers



- Congestive Heart Failure
- COPD
- Asthma
- Emphysema
- Athletes: Does not allow for heart rate to exceed 135 BPM

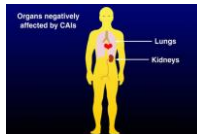
### Beta Blockers: Advantage

- Easy to follow schedule
- Generic beta blockers are relatively inexpensive
- Can generally get 1.5 to 2.0 mm hg additional IOP lowering when added to PG

Brand Name (Manufacturer)	Generic & Concentration	Mechanism of Action	Dosing	Typical IOP Reduction	Size	Side effects	Warnings
Azopt (Novartis)	brinzolamide 1%	Decrease aqueous production	BID	15% to 20%	10mL, 15mL	Slight risk of paraesthesia, metallic taste, nausea, malaise, depression, loss of libido, hypokalemia, aplastic anemia, metabolic acidosis, kidney stones, sulfonamide sensitivity.	Avoid in sulfonamide allergies, sickle cell and renal disease. Side effects more common with the oral agents.
Diamox (Teva) tablets	acetazolamide		BID-QID	15% to 20%	125mg, 250mg		
Neptazana (Fera, Perrigo) tablets	methazolamide		BID-TID	15% to 20%	25mg, 50mg		
Trusopt (Merck)	dorzolamide 2%		BID-TID	15% to 20%	10mL		

### Carbonic anhydrase inhibitors

- Dosing
- Contraindications
  - Sulfa allergies
  - Sickle Cell disease
  - Hypokalemia
  - Renal disease
  - Liver disease



### CAIs

- 15-20% IOP lowering
- Mostly used as 2<sup>nd</sup> line
- Mostly used BID
- Acetazolamide available in injectable form

Brand Name (Manufacturer)	Generic & Concentration	Mechanism of Action	Dosing	Typical IOP Reduction	Size	Side effects	Warnings
Alphagan P (Allergan)	brimonidine tartrate w/Purite preservative 0.1%, 0.15%	Decrease aqueous production and increase venous outflow	BID-TID	up to 26%	5mL, 10mL, 15mL	Dry mouth, hypotension, bradycardia, follicular conjunctivitis, ocular irritation, pruritis, dermatitis, conjunctival blebbing, eyelid retraction, mydriasis, drug allergy (opidine > Alphagan P).	Monitor for shortness of breath, dizziness, ocular redness and itching, fatigue.
Iopidine (Novartis)	apraclonidine 0.5%	Decreases aqueous production	BID-TID	up to 25%	5mL, 10mL		

## Brimonidine

- Side Effects: dry mouth, fatigue, drowsiness, and headaches
- Side Effects: Avoided in children because of possible CNS involvement

## Brimonidine

👉 FDA approved for TID dosing

👉 Most prescribe as BID dosing

👉 Can get additional 2.5 mg Hg IOP lowering when added to PG

Brand Name (Mfg.)	Generic
<i>Available in US</i>	
Combigan (Allergan)	timolol 0.5%, brimonidine 0.2%
Cosopt/Cosopt PF (Akorn)	timolol 0.5%, dorzolamide 2%
Rociatan (Aerie) <i>FDA approval anticipated late 2018/early 2019</i>	netarsudil 0.02%, latanoprost 0.005%
Simbrinza (Alcon)	brimonidine 1%, brinzolamide 0.2%
<i>Available outside US</i>	
Xalcom (Pfizer)	latanoprost, timolol
Ganfort (Allergan)	bimatoprost, timolol
DuoTrav (Novartis)	travoprost, timolol
Azarga (Novartis)	brinzolamide, timolol

Combination Products:  
Did You Know ...

## Chief advantage of combinations

Improved compliance

- **All glaucoma medications have a non-response rate of roughly 10% so there is a 20% chance that one of the components of any combination drug is not doing anything**

## What happens if Glaucoma is left alone

- A patient having an IOP of 21 to 24 mm of Hg, will gradually progress to blindness from early glaucomatous changes within of period of average 13-15 years.
- A patient with an IOP of the range 25 to 28 mm of Hg will take an average of 7-8 years.
- A patient with an IOP of more than 30 mm of Hg progressive to blindness in a period of average 3 years.

## What I did next...

- Personally left voice mail for her and sent email
- Sent certified letter to her, but it was refused
- Sent letter discharging her from the practice ☹

## Discharging her

- Told her she will no longer be a patient in my office after 30 days.
- In that 30 days, she can seek any emergency appointments if needed
- Gave her a list of other providers in the area
- Told her she needs to follow up on his glaucoma so she does not go BLIND.

## How to Scare Your Patients...

- Show them the loss of vision on a VF printout
- Talk to them about surgery
- Give them a brochure of legally blind
- Turn lights off in the room

## Current Model for Therapy

- Based upon principle of detecting damage
- Set Target IOP and follow patient for progression

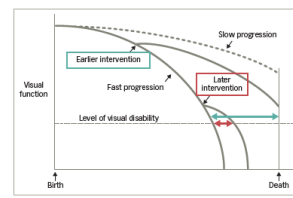
## Current Model for Therapy

- **Limitations**
  - Early changes asymptomatic
  - Changes are irreversible and represent significant damage to optic nerve
  - With our current model, we are always playing catch up

Pt agrees to take drops

- You start treating earlier
- You are more aggressive at lowering IOP
- She still has significant visual function when she dies

Figure 1: Effect of time of intervention on the rate of glaucoma progression



Talk to Your Patients

- Involve patients in their care
- 10 minutes of your time can make a huge difference

How many people get worse with glaucoma?

100%

For most patients with glaucoma . . .

Who do I treat 100% of times

- Anyone with an IOP of 28 or greater

The question is not IF they will get worse

The question is WHEN they will get worse

## Who do I treat 100% of times

- Anyone with C/D .80 or above

## Who do I treat 100% of times

- Anyone who wants to be treated to decrease their risk of converting from glaucoma suspect to glaucoma

## Prevention of glaucoma

- Eating green leafy vegetables (spinach, kale) and bright colored vegetables have been shown to a mild effect on delaying or preventing glaucoma
- These work much better than vitamins with the same antioxidants

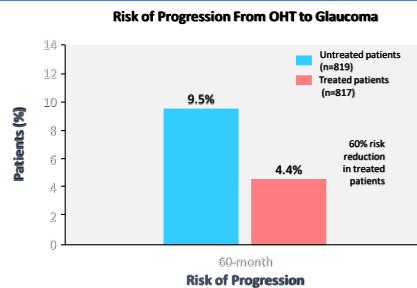
## Prevention of glaucoma

- Avoid head down positions
- Avoid sleeping on your stomach
- Add 1-2 pillows and sleep on your back

## Prevention of glaucoma

- What about lowering IOP through medical therapy (aka can we prophylactically treat glaucoma?)

## Benefit of Treating OHT



OHT = ocular hypertension.  
Kass MA et al. Arch Ophthalmol. 2002;120:701-713.