WHAT YOU NEED TO KNOW ABOUT GLAUCOMA
IT'S TIME TO VISIT YOUR OPHTHALMOLOGIST
WHAT IS GLAUCOMA?

A characteristic, progressive, optic neuropathy associated with peripheral visual field loss:
TYPES OF GLAUCOMA

- Primary open angle glaucoma (POAG)
- Secondary open angle glaucoma
  - Exfoliation syndrome
  - Pigmentary glaucoma
  - Lens-induced glaucoma
    - Phacolytic
    - Lens particle
    - Phacoantigenic
  - Intraocular tumors
  - Schwartz syndrome
- Primary angle closure glaucoma
- Secondary angle closure glaucoma
  - Acute angle closure glaucoma
  - Subacute angle closure glaucoma
  - Chronic angle closure glaucoma
- Congenital glaucoma
EYE ANATOMY 101

- Schlemm's canal
- Trabecular meshwork
- Vitreous cavity
- Retina
- Flow of aqueous humor
- Anterior chamber
- Lens
- Cornea
- Iris
- Optic nerve

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GLAUCOMA PROGRESSION

Structural progression:

Functional progression:
**Epidemiology of POAG: Globally**

- **Globally:**
  - Affects 57.5 million people
    - Projected increase to 65.5 million people by year 2020\(^1\)
  - Leading cause of PERMANENT visual impairment\(^2\)
  - Global prevalence people aged 40-80 is 3.05%\(^3\)
    - Africa: 4.3%
    - Latin America & Caribbean: 3.65%
    - North America: 3.29%
    - Oceania: 2.63%
    - Europe: 2.51%
    - Asia: 2.31%
  - Men at greater risk than women (OR 1.30-1.36)\(^1,3\)
  - Morbidity: 5.8 million people bilaterally blind by 2020\(^4\)

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\(^1\) Kapetanakis et al, Br J Ophtalmol 2015
\(^2\) World Health Organization, Fact Sheet 282, 2014
\(^3\) Tham et al, Ophthalmology 2014
\(^4\) Quigley et al, Br J Ophtalmol 2006
EPIDEMIOLOGY OF POAG: USA

- United States
  - Prevalence people over age 40 is 1.86%\(^1\)
  - Estimated to affect 3.36 million people by year 2020\(^1\)
  - Race:
    - Blacks 3x more likely to develop than Whites\(^2\)
  - Gender:
    - Men more likely than women (OR 1.37)\(^2\)
  - Largest demographic group affected: Non-Hispanic white women\(^3\)
    - Expected to shift to Hispanic males by year 2050
  - States with highest density of POAG\(^3\):
    - Texas
    - New Mexico
    - Florida

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\(^1\) Friedman et al, Arch Ophthalmol 2004
\(^2\) Rudnicka et al, IOVS 2006
\(^3\) Vajaranant et al, Am J Ophthalmol 2012
Epidemiology of POAG: VA Population

- Within U.S. Armed Forces\(^1\):
  - Incidence is 5.3 per 1,000 person-years
  - Most are borderline glaucoma (only 13.5% coded as POAG)

- Veteran population:
  - Atlanta Veterans Affairs (VA) Hospital retrospective chart review over 2 month period\(^2\):
    - 4.1% new patients diagnosed with POAG
      - Twice as high as national average
      - More closely approximates prevalence of glaucoma in nondiabetic patients over the age of 60 (CDC weekly report)
  - Prevalence within the VA not published

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\(^1\)Hurt et al, MSMR 2014
\(^2\)Maa et al, Mil Med 2013
POAG RISK FACTORS

- Studies have shown these risk factors\textsuperscript{1-3}:
  - Elevated intraocular pressure
  - Advanced age
  - Race
  - Thin central corneal thickness
  - Family history POAG
  - Diabetes mellitus
  - Myopia
  - Cardiovascular disease

CORTICOSTEROID-INDUCED GLAUCOMA

- Open angle glaucoma caused by prolonged use of corticosteroids:
  - Topical
  - Intravitreal
  - Inhaled
  - Systemic
- Can also occur in Cushing syndrome (excessive levels of endogenous corticosteroids)
- Result of increased resistance to aqueous outflow in the trabecular meshwork
- Can occur AT ANY TIME during long-term corticosteroid administration
STEROIDS IN POAG PATIENTS

- Higher proportion of patients with POAG exhibit steroid response IOP rise
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Secondary angle closure glaucoma
- Neovascular glaucoma
- Iridocorneal endothelial syndrome
- Tumors
- Aqueous misdirection
- Epithelial downgrowth
- Trauma
- Nanophthalmos
- Drug induced
Pupillary block is most frequent cause:
ACUTE ANGLE CLOSURE PRESENTATION

Redness of eye  Dilated pupil  Cloudy cornea
ACUTE ANGLE CLOSURE TREATMENT

- Lower IOP medically first
- Perform laser peripheral iridotomy
RISK FACTORS FOR PRIMARY ANGLE CLOSURE

- Race
  - 0.1%-0.6% Whites
  - 0.1-0.2% Blacks
  - 2.1-5.0% Inuits
  - 0.4-1.4% East Asians

- Anterior chamber depth <2.5mm

- Age

- Gender (2-4x more common in women)

- Family history

- Hyperopia
SUBACUTE & CHRONIC ANGLE CLOSURE

Normal Angle Structures

- Non-pigmented trabecular meshwork
- Pigmented trabecular meshwork
- Schwalbe's line
- Scleral spur
- Ciliary body band

Eyes image
Topiramate (topamax)

- Acute bilateral angle-closure
  - Underlying mechanism: ciliochoroidal effusion
- Presents with myopia, bilateral ocular pain, HA
- Usually within 1 month of initiating topamax

Treatment:
- Immediate discontinuation of topamax
- Medical treatment to reduce intraocular pressure
- LPI not indicated (pupillary block is not the cause)
- Usually resolves within 24-48 hrs
TREATMENT OF GLAUCOMA

- Medical agents
- Laser
  - OAG: ALT/SLT
  - ACG: LPI
  - OAG or ACG: CPC (advanced glaucoma)
- Surgery
  - MIGS procedure (early glaucoma)
  - Trabeculectomy
  - Tube shunt
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MARIJUANA
GLAUCOMA MEDICAL MANAGEMENT: DRUG CLASSES

1. Prostaglandin analogs
2. β-adrenergic antagonists (beta blockers)
3. Carbonic Anhydrase Inhibitors (CAI’s)
4. Adrenergic agonists
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PROSTAGLANDIN ANALOGS

- Mechanism: increase aqueous outflow
  - Increased spaces between muscle fascicles within ciliary body
- Reduce IOP by 25-32%
PROSTAGLANDIN ANALOGS

- Latanoprost (Xalatan) 0.005%
- Travoprost (Travatan, Travatan Z) 0.004%
- Bimatoprost (Lumigan) 0.03%
**Prostaglandin Analogs**

- **Pros:**
  - Once daily dosing (QHS)
  - Great IOP response
  - Least amount of systemic side effects

- **Cons:**
  - Darkening of iris (permanent) and periocular skin
  - Conjunctival hyperemia
  - Hypertrichosis
  - Trichiasis

- Relatively contraindicated in uveitic patients or patients with hx macular edema
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**BETA BLOCKERS**

- **Mechanism:** Aqueous suppressant
  - Inhibit cAMP production in ciliary epithelium
  - Decrease aqueous humor secretion
- **Patients on systemic beta blockers may not see as much of effect with addition of topical beta blocker**
- **May lose effect over time (short-term escape, long-term drift, tachyphylaxis)**
- **Avoid in nursing mothers**
BETA BLOCKERS

- **Timolol maleate** (Timoptic XE, Timpotic) 0.25, 0.5%
- Timolol hemihydrate (Betimol) 0.5%
- **Levobunolol** (Betagan) 0.25, 0.5%
- Metipranolol (OptiPranolol) 0.3%
- **Betaxolol** (Betoptic) 0.25%
  - Only beta blocker that is $\beta_1$-selective
  - Safer for use in pts with pulmonary conditions
BETA BLOCKERS

- **Pros**
  + IOP lowering 20-30%
  + Original glaucoma drug

- **Cons**
  + Contraindicated in pts with reactive airway dz, low heart rate, or more than first-degree heart block
  + Lethargy, modd changes, depression
  + Light-headedness, syncope
  + Impotence, reduced libido
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CAI’S

- Mechanism: Aqueous suppressant
  - Direct antagonist activity on ciliary epithelial carbonic anhydrase
- No use in using topical CAI if pt already taking oral CAI
Dorzolamide (Trusopt) 2.0%
Brinzolamide (Azopt) 1%
CAI’S

- **Pros:**
  - 15-20% IOP reduction

- **Cons:**
  - Bitter taste
  - Ocular surface irritation (lower pH)
  - Contraindicated in eyes with decreased corneal endothelial cell function
**ORAL/IV CAI’S**

- **Acetazolamide** (Diamox) 250mg PO QID
  - Diamox Sequels 500mg PO BID
- **Methazolamide** (Neptazane) 50mg PO BID-TID

- Contraindicated in patients with sulfa allergies or renal disease (not on hemodialysis), pregnant women (teratogenic)
- Aplastic anemia, thrombocytopenia, agranulocytosis (rare)
- Hypokalemia
  - Especially in combination with other drug causing potassium loss (thiazide diuretic)
- Kidney stones
- Paresthesias of fingers/toes, loss of energy, weight loss, abdominal discomfort, diarrhea, impotence, unpleasant taste in mouth
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ADRENERGIC AGONISTS

- Mechanism: Prevents release of norepinephrine at nerve terminals
  - Aqueous suppressant
  - Decreased episcleral venous pressure
  - Improved trabecular outflow
Brimonidine tartrate (Alphagan, Alphagan P) 0.15%, 0.2%
ADRENERGIC AGONISTS

- Pros:
  - Lowers IOP 14-26%
  - May be neuroprotective

- Cons:
  - Lethargy
  - Dry mouth
  - Follicular conjunctivitis
COMBINED MEDICATIONS

- Improved efficacy
- Improved convenience
- Improved compliance
- Reduced cost
COMBINED MEDICATIONS

- Beta blocker + CAI
  - Cosopt (timpotic/trusopt) 0.5%/2%

- Beta blocker + alpha agonist
  - Combigan (timolol/brimonidine) 0.5%/0.2%

- CAI + alpha agonist
  - Simbrinza (brinzolamide/brimonidine) 1%/0.2%
BAK ALLERGY

- Patient with multiple topical drop allergies
- Consider allergy to benzalkonium chloride (BAK)
  - Most commonly used preservative
  - Alternatives include:
    - Preservative free timolol
    - Alphagan P
    - Travatan Z
    - Preservative free cosopt (dorzolamide/timolol)
REFILLING GLAUCOMA MEDICATIONS

- Outpatients
  - Please do not refill
  - Tell patient refills should be done by the eye clinic
  - Glaucoma patients should be seen q3-4 months for the rest of their lives

- Inpatients
  - Please continue all outpatient eye meds (unless medically contraindicated)
  - Glaucoma patients are elderly, many undergo multiple inpatient hospital visits
  - IOP will go up and glaucoma can worsen if drops are stopped