PEARLS IN GLAUCOMA DIAGNOSIS AND MANAGEMENT

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IN THIS TALK

- Pathophysiology of glaucoma
- Consider risk factors of glaucoma
- Understand the side effects of glaucoma medications
- Diagnostic testing
GLAUCOMA

- Leading cause of irreversible blindness worldwide.

- Leading cause of blindness in African-Americans.

- Disease of the optic nerve, resulting in ganglion cell death, manifested by characteristic optic nerve head cupping on exam and visual field defects.
PEARL #1

- Educate patients of the pathogenesis of glaucoma
  - Lowering pressure decreases risk of glaucomatous damage
  - Specialized tests (Visual field, OCT, color photos) help determine if a patient is progressing
  - Importance of follow-up
Normal Angle Structures

- Non-pigmented trabecular meshwork
- Pigmented trabecular meshwork
- Schwalbe’s line
- Scleral spur
- Ciliary body band
ANGLE CLOSURE
CLOSED ANGLE GLAUCOMA
OPEN ANGLE GLAUCOMA

- **Major risk factors:**
  - Increased age
  - Family history
  - African American or Latino ethnicity
  - Elevated intraocular pressure
    - 1/3 to 1/2 of people with OAG have never had eye pressure >21 mmHg

- **Lesser Risk Factors**
  - Diabetes
  - Myopia
  - Steroid use
  - Thin central corneal thickness
Table 1. Risk Factors for Glaucoma

<table>
<thead>
<tr>
<th>Risk factors*</th>
<th>RR, OR, or prevalence</th>
</tr>
</thead>
</table>
| Family history of glaucoma\(^{31,32}\) | OR = 3.7 to 16.6 (siblings)  
     OR = 1.1 to 2.2 (child or parent) |
| Age\(^{33,34}\) | OR = 1.6 to 2.2 per decade |
| Race and ethnicity\(^{35-40}\) | RR = 3.7 to 4.3 (blacks and POAG)  
     RR = 2.8 (Chinese ethnicity and PACG)  
     OR = 3.6 (Chinese ethnicity and PACG) |

**Prevalence by race and ethnicity (POAG)\(^{35-38}\)**

<table>
<thead>
<tr>
<th>Race/Group</th>
<th>40 to 49 years</th>
<th>Older than 80 years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blacks</td>
<td>1.3% to 1.4%</td>
<td>11.3% to 23.2%</td>
<td>5.0% to 6.8%</td>
</tr>
<tr>
<td>Hispanics</td>
<td>0.5% to 1.3%</td>
<td>12.6% to 21.8%</td>
<td>2.0% to 4.7%</td>
</tr>
<tr>
<td>Whites</td>
<td>0.2% to 0.5%</td>
<td>1.9% to 11.4%</td>
<td>1.4% to 3.4%</td>
</tr>
</tbody>
</table>

| Diabetes mellitus\(^{41,42}\) | RR = 1.4 to 1.5 |
| Female sex\(^{39,40,43}\) | OR = 1.4 to 1.7 (for patients with PACG)  
     RR = 2.4 (for patients with PACG) |

\(OR = \text{odds ratio}; \ PACG = \text{primary angle-closure glaucoma}; \ POAG = \text{primary open-angle glaucoma}; \ RR = \text{relative risk}.\)
PEARL #2

Know the risk factors
  - Ask new patients questions to determine their risk
  - Patients diagnosed with glaucoma should tell their family members
  - Brothers/Sisters/Adult Children should be screened
GLAUCOMA AND SYSTEMIC DISEASE?

VASCULAR DYSFUNCTIONS

- Slim
- Low Blood Pressure
- Cold Hands
- Cold Feet
- Athletic

- Obese
- High Blood Pressure
- Dyslipidemia
- Hypocinesia
- Diabetes Mellitus
- Smoking

Population

Tendency to:

Flammer Syndrome

Disturbed Autoregulation

Ocular Hypertension

Arteriosclerosis

Tendency to:

NTG

HTG
OPEN ANGLE GLAUCOMA

- Treatment to lower intraocular pressure
  - Decrease aqueous production
    - Beta-blockers (YELLOW/LIGHT BLUE)
    - Carbonic anhydrase inhibitors (ORANGE)
    - Alpha agonists (PURPLE)
    - Combinations (BLUE/LIGHT GREEN)
OPEN ANGLE GLAUCOMA

- Increase aqueous outflow
  - Conventional outflow (trabecular meshwork → Schlemms canal)
    - Pilocarpine (GREEN)
  - Uveoscleral outflow
    - Prostaglandin analogs (TEAL)
    - Alpha agonists
    - Epinephrine
PEARL #3

Know drop bottle colors
  - Have patient bring their bottles with them
  - Let them demonstrate putting drops in
  - Caps can get switched!
Risk factors:
- Short eyes
  - Hyperopic=farsighted eyes
- Female gender
- Asian ancestry
- Advanced age
- Cataract
PEARL #4

- Know the risk factors for angle closure
  - Ask about headaches, browaches
  - Symptoms worse in dark or light?
  - Patients at risk should avoid anything that dilates the pupil - antihistamines, asthma medications, tricyclic antidepressants, adrenergics, anticholinergics
ACUTE CLOSED ANGLE GLAUCOMA

- Sudden, dramatic increase in intraocular pressure
- Pain, nausea, vomiting
- Decreased vision
CLOSED ANGLE GLAUCOMA

![Diagram showing laser treatment for closed angle glaucoma](image)

- **C**: Iridotomy
- **D**: Angle open to trabecular meshwork

Diagram illustrates the process of laser treatment for closed angle glaucoma, focusing on the opening of the angle to improve drainage of aqueous humor.
CLOSED ANGLE GLAUCOMA
Either extreme miosis (pilocarpine) or extreme mydriasisis (dilating drops) may break an attack of angle closure glaucoma.
<table>
<thead>
<tr>
<th>Medication class</th>
<th>Mechanism of action</th>
<th>Drug names</th>
<th>Dosing interval</th>
<th>Adverse effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha-adrenergic agonists</td>
<td>Decreases aqueous humor production</td>
<td>Apraclonidine (lopidine), brimonidine (Alphagan)</td>
<td>Two to three times daily</td>
<td>Ocular allergy, somnolence, bitter taste, dry mouth, systemic hypotension, irregular heart rate</td>
</tr>
<tr>
<td>Beta blockers</td>
<td>Decreases aqueous humor production</td>
<td>Betaxolol (Betoptic), carteolol, levobunolol</td>
<td>One to two times daily</td>
<td>Bradycardia, bronchospasm, depression, fatigue, ocular dryness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Betagan), metipranolol (Optipranolol), timolol</td>
<td>Avoid nighttime administration</td>
<td>Betaxolol is cardioselective and may have fewer respiratory effects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Timoptic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbonic anhydrase inhibitors</td>
<td>Decreases aqueous humor production</td>
<td>Brinzolamide (Azopt), dorzolamide (Trusopt)</td>
<td>Two times daily</td>
<td>Ocular irritation, sour taste</td>
</tr>
<tr>
<td>Cholinergics</td>
<td>Increases outflow through trabecular meshwork</td>
<td>Pilocarpine</td>
<td>Three to four times daily</td>
<td>Blurred vision, poor night vision, eye pain, headache</td>
</tr>
<tr>
<td>Prostaglandin analogues*</td>
<td>Increases outflow through uveoscleral pathway</td>
<td>Bimatoprost (Lumigan), latanoprost (Xalatan),</td>
<td>One time daily, typically at bedtime</td>
<td>Lengthening of eyelashes, change in iris color or periorbital skin hyperpigmentation, hyperemia, intraocular inflammation, and keratitis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tafluprost (Zioptan), travoprost (Travalan),</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>unoprostone (Rescula)</td>
<td></td>
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</tr>
</tbody>
</table>

*—Typically the first-line pharmacologic therapy.
PEARL #5

Know the ocular and systemic side effects

- Some are from preservative in medication - so changing to a different medicine in the same class can help
- Practice Punctual Occlusion
- Know the contraindications
  - Beta-blockers and heart block/COPD
  - Brimonidine and children
  - Pregnancy
QUESTIONS

- Is it safe to give Diamox?
- If so, what dose?
KEY QUESTIONS BEFORE STARTING DIAMOX

- Creatinine clearance
- Hepatic status
- Epilepsy history
- Allergy history
- Pulmonary status
KIDNEY FUNCTION AND DIAMOX DOSE

- If CrCl > 50 mL/min: full dose (250mg QID = 500mg extended-release BID).

  - If CrCl 10-50 mL/min: half dose q12hrs (250mg BID).

  - If CrCl < 10 mL/min: do not give acetazolamide.

  - If on hemodialysis: half dose q12hrs (250mg BID).

  - If on peritoneal dialysis: 125mg qday.
Contraindicated in patients with liver cirrhosis

(acetazolamide decreases ammonia clearance and increases risk for hepatic encephalopathy)

If mild liver disease: dose adjustment is not necessary

(since acetazolamide is not metabolized by the liver)
EPILEPSY HISTORY

- Serum levels of anticonvulsants (phenytoin, carbamazepine) → co-manage with a neurologist or PCP

- *If on topiramate*: Diamox may be contraindicated (topiramate inhibits carbonic anhydrase → predisposes to metabolic acidosis & kidney stones)
ALLERGY HISTORY

- Contraindicated in patients with prior serious sulfa allergy such as Stevens Johnson syndrome.

- Rarely: risk for agranulocytosis or aplastic anemia.
  - check CBC with diff at 1-2mo and also at 6mo
  - This is sudden and also irreversible.
Hypersensitivity reactions are less common in nonantibiotic sulfonamides.
• Chronic Mild-Mod COPD 
  → inducing metabolic acidosis 
  should be OK

- Caution in patients with severe or acute COPD 
  → may aggravate respiratory acidosis!
SUMMARY

- Think **CHEAP** when starting Diamox
  - Creatinine clearance
  - Hepatic status
  - Epilepsy history
  - Allergy history
  - Pulmonary status
DIAGNOSTIC TESTS

- **Structural Tests**
  - Optical Coherence Tomography (OCT)
  - Color Fundus photos

- **Functional Tests**
  - Visual Field
  - Color vision
Macula OCT maybe helpful in glaucoma

Quick test

Objective test of progression

Comorbid conditions can affect macula
GREATER PPA, SMALLER NEURORETINAL RIM AREA

VISUAL FIELD

Fovea: 35 dB

Fovea: 33 dB

GHT
Outside normal limits
VFI: 88%
MD: -5.08 dB P < 0.5%
PSD: 4.49 dB P < 0.5%

GHT
Within normal limits
VFI: 97%
MD: -3.75 dB P < 1%
PSD: 1.71 dB
Right Homonymous Hemianopia

Left eye:
MD: -8.98 dB; P<0.5%

Right eye:
MD: -13.42 dB; P<0.5%

Left eye:
MD: -16.57 dB; P<0.5%

Right eye:
MD: -12.12 dB; P<0.5%
PEARL #6

- Look at the visual fields...
  - Two eyes at a time
  - Look for symmetry
  - Defects that respect the vertical midline are suspicious for neurologic problems
OCT CAN HELP TOO
OCT ANGIOGRAPHY

- All ready being used in retina care
- Role in Glaucoma?
THANK YOU