Review of risk factors in the identification of primary open angle glaucoma

Agenda

1. Introduction
2. Prevalence
3. Risk factors
4. Building an effective risk profile
5. Practical use of guidelines
6. Implementation of a primary open angle glaucoma risk tool
7. Conclusion
Introduction

• Impact of disease on the optic nerve
• Primary open angle glaucoma (POAG)
  - Mechanism
    • Trabecular collagen meshwork becomes sclerotic with age
  - Inheritance pattern
    • Typically, familial
  - Onset
    • Typically starts in the 4th decade of life

Prevalence

World Health Organization¹
• 3rd leading cause of blindness in the world
• 2.2 billion people have vision impairment
• 1 billion people living with reduced or absent eyesight due to preventable causes
  - Refractive error
  - Cataracts
  - Glaucoma

National Eye Institute (USA)²
• Cases detected by gender, race, ethnicity
  - Women (61%)
  - Caucasians (66%)
• 1.9% of people over age of 40 are diagnosed with glaucoma

¹ “Blindness and visual impairment” who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment, October 2021; accessed April 2022
Risk factors

- Age
- Ethnic background
- Personal medical history and family history of glaucoma
- Narrow angle
- Eye injury / eye surgery
- Intraocular pressure (>20)
- Corneal thickness
- Cup-to-disc ratio (>0.2)
- Krukenberg spindles
- Iris transillumination
- Pseudo-exfoliation
- Pallor (thinning of nerve fiber layer)
- High myopia
- Scleral Crescent
- Changes over time

A tool to assess significant risk

- UnitedHealthcare Vision's peer review committee
  - Optometry / ophthalmology
  - Glaucoma risk tool pilot program
- Based on a review of the literature
  - Each risk factor for glaucoma is weighted
  - Combinations of factors increase risk
  - Establishes level of risk to substantiate the diagnosis of “glaucoma suspect”
  - Develops criteria for glaucoma work-up and testing

<table>
<thead>
<tr>
<th>Risk factors for Glaucoma</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 40-70</td>
<td>2</td>
</tr>
<tr>
<td>Ethnicity (African)</td>
<td>2</td>
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<tr>
<td>Ethnicity (Asian)</td>
<td>2</td>
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<tr>
<td>Ethnicity (Hispanic)</td>
<td>2</td>
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<tr>
<td>Family history (1 parent)</td>
<td>6</td>
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<tr>
<td>Family history (2 parents)</td>
<td>8</td>
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<tr>
<td>Family history (Parent blind from GL)</td>
<td>8</td>
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<tr>
<td>Medical history (Diabetes)</td>
<td>2</td>
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<tr>
<td>Medical history (Cardiovascular disease)</td>
<td>2</td>
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<tr>
<td>Eye injury</td>
<td>4</td>
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<tr>
<td>Eye exam (Thin cornea &lt;535)</td>
<td>4</td>
</tr>
<tr>
<td>Eye exam (Krukenberg spindles)</td>
<td>5</td>
</tr>
<tr>
<td>Eye exam (Iris transillumination)</td>
<td>5</td>
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<tr>
<td>Eye exam (Narrow angle)</td>
<td>4</td>
</tr>
<tr>
<td>Eye exam (Pseudo-exfoliation)</td>
<td>10</td>
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<tr>
<td>Eye exam (ICP above 20)</td>
<td>8</td>
</tr>
<tr>
<td>Eye exam (C/D difference &gt; than 0.2)</td>
<td>4</td>
</tr>
<tr>
<td>Eye exam (Pallor/thinning of nerve head)</td>
<td>8</td>
</tr>
</tbody>
</table>
### Age

40-70 is statistically the age group at highest risk for primary open angle glaucoma

- Certain people have genetic predisposition to develop POAG
- Suggested mechanism
  - Age-related sclerosis of the trabecular meshwork impedes outflow of the aqueous humor

### Ethnic background

Certain ethnic backgrounds have statistically higher incidence of glaucoma

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>2 points</th>
</tr>
</thead>
</table>
| **African Americans** | ![Heart Icon] | • 6-8x more common than Caucasian population¹  
• 7x more likely to go blind from glaucoma than Caucasians²  
• Prevalence rate for primary open angle glaucoma (POAG) for African American individuals is 15%³  
• Often occurs earlier than in other ethnic populations |
| **Asian** | ![Heart Icon] | • Increased risk for primary angle closure glaucoma (PACG)⁴  
• Prevalence rate for primary open angle glaucoma (POAG) for Asian individuals is 5%³ Asian population has a 51% higher risk for POAG²  
• Japanese population showed greatest risk for normal tension glaucoma⁴ |
| **Hispanic** | ![Heart Icon] | • Equal to Caucasian populations however prevalence increases with age⁵  
• Hispanic population has some of the highest rates of vision loss and blindness due to eye diseases and conditions like glaucoma⁵  
• Prevalence rate for primary open angle glaucoma (POAG) for Hispanic individuals is 18%³ |

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¹Glaucoma Awareness Month, glaucoma.org/news/glaucoma-awareness-month.php, January 2021; accessed April 2022  
²Racial and Ethnic Disparities in Primary Open-Angle Glaucoma Trials, ncbi.nlm.nih.gov/pmc/articles/PMC8132140/, May 2021; accessed April 2022  
³Glaucoma Study, Review of Optometry, ncbi.nlm.nih.gov/pmc/articles/PMC3890533/, January 2022; accessed April 2022  
⁴Are You at Risk For Glaucoma, glaucoma.org/glaucoma/are-you-at-risk-for-glaucoma.php, October 2021; accessed April 2022  
⁵Glaucoma data and statistics, glaucoma.org/glaucoma-data-and-statistics, July 2019; accessed April 2022  
Family history

First-degree blood relatives with glaucoma have a significantly increased risk of developing glaucoma.

Genetic tendency for:
- Sclerotic changes in the trabecular meshwork
- Stiffness of the lamina cribrosa

Tendency for narrow angles, larger crystalline lenses

One parent | 6 points
Two parents | 8 points

Medical history

Overall health can affect the risk for glaucoma

Diabetes
- Patients with diabetes are twice as likely to develop glaucoma
- Risk of developing glaucoma increases every year and often has no symptoms
- Tighter control of diabetes improves outcomes
- Vascular changes in optic nerve
- Disruption of trabecular meshwork

Vascular disease
- Patients with general vascular disease are at significant risk for developing glaucoma
- Patients with peripheral vascular disease are more likely to develop normal tension glaucoma
- Patients with carotid stenosis have a 1.5x greater risk for POAG

Previous eye injury

Significant injuries to the globe that cause uveitis or cataract are associated with glaucoma

- Cellular debris in trabecular meshwork
- Peripheral anterior synechiae (PAS)
- Hyphema
- Angle recession

With hyphema | 4 points
With angle recession | 8 points

Eye exam

Thin cornea (<535 µm) | 4 points
Krukenberg spindles | 5 points
Iris transillumination | 5 points

Thin cornea (<535 µm)
- Patients with thinner central corneal thickness tend to have a higher IOP than measured with applanation tonometry
- Patients with naturally thin cornea (i.e., without keratoconus or refractive surgery) may have collagen disorder than can affect the lamina cribrosa

Pigment dispersion syndrome
- Krukenberg spindles
- Pigmentary dispersion syndrome
- Iris transillumination
- Pigmentary dispersion syndrome
Eye exam

Narrow anterior chamber angles
- NAC angles should be considered at risk for occlusion with gonioscopy
- Primary angle closure risk concerns
- Mixed mechanism

Pseudo-exfoliation
- Pseudo-exfoliation syndrome vs pseudo-exfoliation glaucoma
- More common age > 60 years
- More common in women
- IOP at diagnosis
- Bilaterality

IOP above 20 mmHg
- Historically significant risk factor
- Goldmann technique is the gold standard
- Multiple readings above 20 mmHg are more diagnostic
- Single reading above 23 mmHg are more diagnostic
- Low tension or normal glaucoma may never show readings above 20 mmHg
- Other risk factors and especially careful examination of the optic nerve head are critical

C/D difference > 0.2
- Glaucoma is a disease of the optic nerve
- Changes at the optic nerve head are a significant risk factor
- There are normal variants between the nerve head that are statistically 0.2 or less
- Age is an important correlated risk factor
- Asymmetry of the nerve head in a person under 20 years old with no other risk factors are often congenital
- Pallor of the larger cup, vertical elongation or notching are more diagnostic
- The most significant risk factor is change in nerve anatomy over time
Building an effective risk profile

Score each factor based on assigned points

Cumulative point value of **10+ points** should have glaucoma work-up on a separate office visit

Testing should include:
- ✔ Threshold visual field testing
- ✔ Optical coherence tomography
- ✔ Gonioscopy
- ✔ Additional testing may include:
  - Nerve head photos
  - Corneal pachymetry

If these tests are not available in-office, the patient should be referred to another location where these tests can be performed.

Practical use of guidelines & Implementation of POAG risk tool

Practical use of guidelines
- An evidence-based tool to assist the provider on when additional testing would be appropriate for patients that may be suspicious for glaucoma
- Clinical judgement must be the deciding factor

Implementation of POAG risk tool
- This risk tool will be used by clinical reviewers to determine medical necessity for additional testing
- Variations from the tool based on clinical judgement should be well documented in the medical record
Conclusion

- Glaucoma is a sight threatening disease with generally no signs or symptoms
- The annual comprehensive eye examination is the best place for the problem to be discovered
- The diagnosis of "glaucoma suspect" based on minor risk factors and over testing, however, places undue stress and anxiety on patients and their families
- This glaucoma risk tool should be helpful to providers in making the right determination for each patient