Risk Factors for Progression to Advanced Glaucoma in Ghana

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Acknowledgements

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• I have no commercial interests.

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• Thank you Jennifer Staple and all of Unite for Sight!
Background

- My name is Andrew Francis

- I am a third year medical student at Boston University School of Medicine

- I traveled to Accra, Ghana with Unite for Sight for 9 weeks in 2009 to conduct clinical research into risk factors for progression of glaucoma.
Why Eye Care Is Important

- 80% of all blindness is curable or preventable
- 36 million are needlessly blind
- Decreased quality of life
- 90% of blind individuals cannot work
- The life expectancy of blind persons is one-third less than that of their sighted peers, and most die within 10 years of becoming blind
- There is a lot of need, and much to do

Source: http://www.uniteforsight.org/community-eye-health-course/module1
What Prevents Patients From Accessing Care in Ghana?

- Financial barriers
- Transportation barriers
- Education and awareness barriers
- Fear
- Long-term access
- Solution: Bring continuous quality, free, or low-cost care by local doctors to patients
Learning Objectives

- Gain a hands-on understanding about best practices in global health and be aware that good intentions are not enough!
- Work with talented ophthalmologists who are social entrepreneurs addressing complex global health issues
- Understand the opportunities and challenges facing social clinicians in developing countries
- Reduce patient barriers to care.
- Develop strong skills in cultural competency, ethics, professionalism, interpersonal communication in the health setting, and community eye health
Ghana

**Background**

- Ghana is a country in West Africa formerly known as the Gold Coast
- Ghana was the first African country to gain its independence in 1957
- The government is a constitutional presidential republic
- The official language is English, but there are 46 local dialects
- The first African nation President Obama visited in 2009
Ghana

Facts

• The country has a total area of 92,098 sq mi

• The economic status of Ghana is “not-least developing” – overall GDP is estimated at >34 billion

• The country is divided into 10 major regions

• These 10 regions are subdivided into 138 local districts

• Each district is governed at the local level by a village chief

• These local districts are the basic health care unit in Ghana
Ghana

- Ghana has a population of 23 million people

- Life expectancy at birth:
  - 57 years for males
  - 61 years for females

- Ghana has a developing medical infrastructure

- There are currently 384 health facilities in the greater Accra region

- The majority of health clinics in Ghana are privately owned, but monitored by the local government
Schedule

- June and July, 2009
  - Outreaches to village communities in the greater-Accra region

  - I assisted with examinations, dispersed medication, and collected valuable data on patients

- Research at the Emmanuel Eye Clinic in Accra, Ghana
  - Large outpatient clinic in Ghana’s capital Accra
  - 30,000 patients/year
  - Data collection was primarily a chart review of patients records
Ocular Pathology

- Ghana is a tropical country and its patients suffer from eye diseases endemic to hot climates in Africa.

- Many of these diseases present with greater severity than would be seen in the developed world.

- Basic preventative examinations could prevent a large number of these diseases from becoming severe.
Eye Diseases

- Examples of common ocular pathology in Ghana include:
  - Glaucoma
  - Trachoma
  - Xerophthalmia and nutritional corneal ulceration
  - Onchocerciasis and other parasitic diseases (under increasing control)
  - Leprosy
  - HIV/AIDS
  - Diseases of the cornea
  - Diseases of the conjunctiva, eyelids, and lacrimal apparatus,
  - Diseases of the uvea, lens, and retina
  - Diseases of the optic nerve and visual pathways
  - Eye injuries / trauma
  - Orbital diseases
  - Squints and other disorders of eye movement
Research Project

- My project was a case control study that investigated risk factor correlations for open-angle glaucoma (OAG) in Ghana.

- The aim of my study was to determine which risk factors predisposed patients to progress from a moderate form of glaucoma, with central vision still primarily intact to advanced glaucoma and subsequent blindness.

- In a previous population study published in 2001, Ghana was shown to exhibit one of the highest incidence of OAG for any country (8.5% overall)\(^1\)
Objectives

- Correlate risk factors for progression of glaucoma to an advanced state in Ghanaian patients.

- Define moderate and advanced glaucoma in case and control populations according to International Geographical and Epidemiologic Ophthalmology (ISGEO) criteria.

- Determine which risk factors are potentially modifiable to help prevent or slow disease progression.

- Apply results to the long term clinical therapy of glaucoma patients in the cities and villages of Ghana.
Research Methods

- Case-control study conducted at a large outpatient eye clinic in Accra, Ghana.

- Glaucoma patients were separated into moderate and advanced glaucoma groups.

- Moderate and advanced glaucoma was defined by ISGEO definitions, primarily severity of optic nerve damage and visual field loss.
**Advanced Glaucoma Criteria**

- (1) C/D ratio \( \geq 0.7 \) in either eye or C/D ratio asymmetry \( \geq 0.2 \) plus a confirmed glaucomatous visual field test (VFT) defect.

- (2) C/D ratio \( \geq 0.9 \) in one or both eyes or a C/D ratio asymmetry \( \geq 0.3 \).

- (3) If no fundus exam or VFT is possible due to a corneal opacity, the subject must have an afferent pupil defect, visual acuity light perception or worse, and IOP \( \geq 30 \) mmHg (97.5\textsuperscript{th} percentile).

**Moderate Glaucoma Criteria**

- (1) C/D ratio \( \geq 0.7 \) or \( \geq 0.8 \) without a confirmed glaucomatous visual field test defect.

- (2) C/D ratio \( < 0.7 \) with a confirmed glaucomatous visual field test defect.

- (3) IOP \( \geq 30 \) mmHg in either eye (\( > 97.5\textsuperscript{th} \) percentile).
All new patients received the following from one of three ophthalmologists on staff on their initial presentation to the clinic:

- Comprehensive slit-lamp examination
- Goldmann applanation tonometry reading
- Gonioscopic measurement
- Humphrey’s visual field test

Results of this initial examination were used to classify patients as moderate or advanced glaucoma patients.

Patients with significant prior glaucoma therapy were excluded.
Methods

Risk factors we matched & screened for included:

- African Ancestry
- High myopia
- Diabetes
- Hypertension
- Past history of eye injury, surgery, or other causes of 2nd glaucoma
- Past diagnosis or treatment of primary glaucoma or related glaucoma conditions
Results

- The mean age was approximately 55 years for both moderate and advanced glaucoma groups.

- More advanced patients were male (60% vs. 40.5%). No other significant statistical gender variations were found between groups.

- The advanced group had a higher mean IOP (32.0 vs. 26.4 mmHg) and higher C/D ratio (0.85 vs. 0.57).

- There was a strong (+) correlation between IOP and higher C/D ratio.

- There was a (+) correlation between age and glaucoma progression, but not significant due to similar age distribution between case and control groups.
Age Distribution

Age distribution by glaucoma category

Cumulative percentage

Glaucoma type

Advanced Glaucoma Group

Moderate Glaucoma Group

Cumulative percentage

<35
<=35 <50
<=50 <65
<=65 <80
>=80
## Data

<table>
<thead>
<tr>
<th></th>
<th>Moderate Glaucoma Subjects</th>
<th>Advanced Glaucoma Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>count</strong></td>
<td>74</td>
<td>90</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>55.55(15.03)</td>
<td>55.83(17.83)</td>
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<tr>
<td><strong>Gender (F/M)</strong></td>
<td>44/30</td>
<td>35/55</td>
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<td><strong>count</strong></td>
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<td>88</td>
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<tr>
<td><strong>IOP_OD</strong></td>
<td>26.16(9.54)</td>
<td>31.37(13.94)</td>
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<td>88</td>
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<tr>
<td><strong>IOP_OS</strong></td>
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<td>32.68(13.66)</td>
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<td>84</td>
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<td><strong>CDR_OD</strong></td>
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<td>0.85(0.17)</td>
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<tr>
<td><strong>CDR_OS</strong></td>
<td>0.58(0.14)</td>
<td>0.85(0.16)</td>
</tr>
</tbody>
</table>
Average Age, IOP, C/D Ratio

Average Age, IOP, and C/D Ratio of Comparison Groups

- **Advanced Glaucoma Group**
  - Age: 55.55 years
  - IOP (mm Hg): 32.0
  - C/D ratio (#/100): 85

- **Moderate Glaucoma Group**
  - Age: 55.83 years
  - IOP (mm Hg): 26.4
  - C/D ratio (#/100): 57

Legend:
- Red: Age (years)
- Yellow: IOP (mm Hg)
- Blue: C/D ratio (#/100)
Results

- 94.7% of patients with IOP ≥ 40 mmHg had a C/D ratio of at least 0.7.
- Glaucoma progression was 2.5x more likely with IOP ≥31 mm (OR=2.50, 95% CI (1.33 - 4.69)).
Charts – C/D Ratio vs. IOP (OD/OS)

C/D Ratio vs IOP (OD)

C/D Ratio vs IOP (OS)
Results

- Older patients (>65 yrs) progressed to advanced glaucoma more frequently (OR=1.28, 95% CI (0.92 - 1.78)), but relationship was not especially significant.

- The distribution of both moderate and advanced glaucoma groups prevented a significant correlation from being drawn.

- Despite this, there is evidence to show age was an important risk factor for progression of glaucoma in this study.
Charts – C/D Ratio vs. IOP (OD/OS)
Conclusions

- Progression to advanced glaucoma in Ghana is strongly correlated with the IOP - C/D ratio relationship.

- Glaucoma progression is not as strongly related to gender independent of additional variables.

- Earlier examinations and aggressive treatment crucial to preserving vision.

- African ancestry a significant risk factor when compared to less at-risk groups.
Discussion

- The significance of the IOP-CDR relationship probably means many ‘suspect’ glaucoma patients in villages are receiving unnecessary and expensive chronic therapy.

- Age is an important risk factor for progression, but clearly all patients >65 years old do not progress to advanced glaucoma independent of additional variables. Abnormal or borderline IOP-CDR values should be taken seriously in this group.

- Our moderate control group had significant visual impairment, but were still functional. Arresting the disease at this stage is key to long term productivity.

- Earlier examinations and aggressive treatment for ocular hypertensive's is crucial to reducing the risk of progression to advanced glaucoma in the long-term.

- Defining the severity of the patient’s condition is half the battle. IOP should be a guide supported with sound evidence from additional examinations.
Future

- This study is ongoing and prospective follow up should further define important relationships (expected 2012).

- Optic nerve imagery, including cornea pachymetry and ocular coherence tomography, were unavailable and would better define glaucoma patients.
Thank you!

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