Glaucoma, a global challenge to vision: screening, early detection and management

By

Dr. Maduabuchi E. Okorie, O.D., M.Sc.
Department of Optometry,
Federal University of Technology, Owerri

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PRESENTATION OUTLINE

- Protocol
- Preamble
- Introduction
- What is Glaucoma?
- Classification, pathophysiology, clinical signs
- Epidemiology: Screening/Early detection
- Therapeutic & Surgical management
ABSTRACT

• Although the burden of visual impairment and blindness due the glaucoma eye disease have been increasing worldwide, the level of awareness of the general population about its solution and the utilization of eye health care services are low. This lecture attempts to provide illumination and co-opt health educators on the issue of glaucoma, its magnitude, and those at risk. It emphasizes on what need to be done for it’s control, such as screening, early detection and treatment.
INTRODUCTION

The eye is the most important of the body’s sensory organs consisting of several different tissues which, in association with the nervous system, provides us with one of the most important of God’s precious gifts to man - Sight or Vision
Structural components of the Eye
The Visual Pathway
Vision or seeing is a learned behavior that refers to the ability of an individual to associate visual sensations aroused in the nervous system with their external sources.
• A **sensation** is a change in state of consciousness by which we appreciate any alteration caused by external or internal stimuli (light, color, sound, a taste, hunger, etc.,) without associating it with any internal or external causes (Emsley, 1953)
• This implies that although new born infants experience visual sensations, *vision* is abnormal but develops to the normal state at maturity (5-6 years) with continuous stimulation and is subject to threats occasioned by inherited, developmental, and acquired diseases.
Forms of vision

✓ Light perception
✓ Field of vision
✓ Form vision
✓ Color vision
✓ Contrast sensitivity
✓ Depth perception, etc.
Processes of Vision

- Physical process
- Physiological process
- Psychological process
The physical process of vision

Light
- Reflection
- Transmission
- Refraction
- Retinal image formation
Physiological process of vision

- Light
  - Absorption
  - Transduction
  - Processing
  - Transmission to brain cause visual sensation
Retinal neurons in photo-transduction
The optic nerve is an afferent nerve that continuously sends visual information to the CNS, leading to a visual sensation.

The Optic Nerve: A part of the CNS
The psychological process of vision

- Visual Sensation
  - Processing
  - Interpretation
- Visual perception

Figure 8. Visual input goes from eye to LGN and then to primary visual cortex, or area V1, which is located in the posterior of the occipital lobe. Adapted from Polyak (1957).
According to the International Classification of Diseases (ICD)-10, there are 4 levels of visual function:

- Normal vision
- Moderate visual impairment
- Severe visual impairment
- Blindness;

based on measurement of visual acuity (form vision) and/or field of vision
Normal Vision

Distance Vision
Near Vision
Color Vision
Field of Vision
Contrast Sense

Normal Vision is Essential. About 85% of our perception, learning, cognition and activities are mediated through Vision.
The Snellen Visual Acuity (VA) Test chart

Normal Distance VA.
Field of Vision

Visual Field Test with The Goldman Perimeter
Visual Impairment/Vision loss

- **Moderate**: Presenting/Entry VA of $< 6/18$ to $6/60$, or a corresponding VF loss to $< 20$ degrees in the better eye;

- **Severe**: Presenting VA of $< 6/60$ to $3/60$, or a corresponding VF loss to $< 10$ degrees in the better eye

- **Blindness**: Presenting VA $< 3/60$ – no PL

- (WHO, 2007)
Moderate & Severe Visual Impairment (VI)
VI & Blindness - Global Causes

- Cataract
- Refractive Errors
- Glaucoma
- ARMD
- DR
- Childhood blindness
- Trachoma
- River blindness
- Others

Figure 3. Global causes of blindness due to eye diseases and uncorrected refractive errors

WHO (2007)
Data released by WHO in 2012 indicate that

✓ 285 million people are estimated to be visually impaired worldwide. Out of this No.
✓ 39 million are blind;
✓ 246 million have moderate-severe VI

The major causes of Visual Impairment was listed to include
✓ Uncorrected Refractive Error,
✓ Un-operated Cataract, and
✓ Glaucoma ()
What is the Problem with Glaucoma?

- **Glaucoma** is the most common cause of irreversible blindness worldwide (WHO, 2007; Budenz, et al, 2013), affecting about 60.5 million people as at 2010.

- This number is estimated to reach 80 million by 2020 (Murthy & Johnson, 2012)
Glaucoma (POAG) is highly prevalent among adults in SSA (3-7%), with early onset, and progresses more rapidly (Buden et al, 2013; Olawoye & Tarella, 2014; Tham et al, 2014). These factors are compounded by poor awareness and low knowledge about glaucoma even by persons affected (Kyari et al, 2013).
What We Need to do to Reverse the Global Burden of Visual Impairment

✓ Provision of eye care services,
✓ Professional commitment to prevention of VI
✓ Public awareness about solutions to VI/Public health action and Utilization of eye health care services
✓ Commitment/Support of NGOs and Corporate bodies.
WHAT IS GLAUCOMA.

• **Glaucoma** - a group of eye diseases characterized by **optic nerve damage** (optic neuropathy) and **visual field loss** which progress to irreversible loss of vision or blindness in the absence of early detection and treatment.

• It’s main risk factor is **increased intra-ocular pressure** (IOP).
The Human Retina as seen with the Ophthalmoscope
Schema of optic disc shapes in glaucoma

<table>
<thead>
<tr>
<th>Normal Optic Disc</th>
<th>Focal Rim Thinning “Notching”</th>
<th>Regional or Diffuse Rim Thinning</th>
<th>Excavation</th>
<th>Nerve Fiber Layer Defect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Appearance</td>
<td><img src="image1" alt="Image" /></td>
<td><img src="image2" alt="Image" /></td>
<td><img src="image3" alt="Image" /></td>
<td><img src="image4" alt="Image" /></td>
</tr>
<tr>
<td>Cross-sectional View</td>
<td><img src="image5" alt="Image" /></td>
<td><img src="image6" alt="Image" /></td>
<td><img src="image7" alt="Image" /></td>
<td><img src="image8" alt="Image" /></td>
</tr>
<tr>
<td>Number (%) of Progressive Changes</td>
<td>15/92 (16%)</td>
<td>50/92 (54%)</td>
<td>82/92 (89%)</td>
<td>2/92 (2%)</td>
</tr>
</tbody>
</table>

Source: J Glaucoma © 2013 Lippincott Williams & Wilkins
The Retina in Normal & glaucomatous eyes

Normal optic nerve head

Glaucmatous cupping
What Vision is like in Glaucoma
VISION IN GLAUCOMA
What Vision is like in Glaucoma

Normal Vision

Early Glaucoma

Advanced Glaucoma

Extreme Glaucoma

(Photo by CHONA M. DUROGA)
What Causes Glaucoma?

The cause is unknown in Primary gl, but the following factors contribute.

✓ Elevated Intraocular Pressure (IOP)

✓ Decreased Optic Nerve Perfusion

✓ Alteration in optic nerve microcirculation

✓ Glutamate toxicity & Oxidative damage.
• **Intraocular Pressure**: the pressure exerted on the coats of the eye by its internal fluid contents, depends on the dynamic balance between rate of aqueous humor flow in and out of the anterior chamber.

• **Normal**: 15 +/- 3 mmHg

• **Glaucoma**: IOP >22, up to 60 mmHg.
Anatomy: Aqueous Humor Production & Drainage
Different Types of Glaucoma

- Primary Open Angle glaucoma (POAG)
- Primary Angle Closure glaucoma (PACG)
- Normal Tension glaucoma (NTG)
- Ocular hypertension
- Secondary glaucoma
- Congenital/infantile/childhood
- Subtypes: drug-induced, traumatic, uveitic, lens-induced, angle closure suspect, acute/chronic glaucoma, etc.
Figure 3 Acute angle closure glaucoma secondary to choroidal hemorrhage. 

Note: © Springer and Ophthalmologe. 2005;102(11):1090–1096, Akutes Winkelblock-
Epidemiology: Who is at Risk?

PACG
- Family hx of gl
- Mongoloid origin
- Female gender
- Smaller eyes
- Hypermetropia
- Older age

Risk factors for POAG
- Elevated IOP
- Age 45 +5
- African ancestry
- Family Hx of glaucoma
- Myopia, thin cornea
What are the warning signs?
Early Detection

✅ **Screening:** a process of identifying apparently healthy people in a defined population who may be at increased risk of a disease or condition, & who can benefit by further investigation, information or TX (Wormald & Lindfield, 2012).
FUTO OPTOMETRY CLINICIANS READY FOR SCREENING
OPHTHALMOSCOPY DURING SCREENING
CASE REPORT

A 9 yr. old female with advanced glaucomatous optic neuropathy & severe VI

TAKING CASE HISTORY DURING SCREENING
Screening Tests

- **Tonometry**: measure IOP

- **Ophthalmoscopy**: Assess vertical cup/disk ratio

- **Contrast sensitivity test**: measure vision under varying contrast

- **Oblique flashlight test**: estimate anterior chamber
Ocular Response Analyzer
OCULUS EASYFIELD Visual field Analyzer
Management of glaucoma

➢ Depends on the nature and severity.

➢ In each case generally,

➢ Glaucoma Can Not Be Cured, But Can Be Controlled
Glaucoma medications

➢ Topical Eye Drops, e.g., prostaglandin analogs reduce elevated IOP by facilitating aqueous humor outflow.
Glaucoma medications

- Topical eye drops, e.g., beta blockers reduce IOP by suppressing aq humor secretion

Betaxolol
Timolol
Levobunolol
Glaucoma medications

- Topical Eye drops, e.g., Alpha Agonists reduce IOP by suppressing Aq humor production.
Glaucoma medications

Carbonic anhydrase inhibitors
e.g., brinzolamide
(aqueous surppressants)
Neuro-protection in Glaucoma

- Calcium channel blockers
- Memantine
- Melatonin analogs
- CO-ENZYME Q\textsubscript{10}
- Anti-oxidants
- Alpha-Lipoic Acid.
Some natural supplements can be helpful in glaucoma.
LASER & SURGICAL PROCEDURES

• E.g., Argon Laser Trabeculoplasty

• Surgical trabeculectomy

• Etc.,
Conclusion/ recommendations

• Glaucoma is an eye disease with a devastating impact on the most important of our health related sensory abilities - vision or eyesight.

• Early detection is the key. Several simple, safe and reliable screening tests such as ophthalmoscopy, tonometry, and contrast sensitivity tests are available in optometric and ophthalmologic units for its early detection.

• Medications, surgical intervention, keeping to doctor’s appointments, and being well informed about the disease, all have proved to be effective and helpful in controlling the progressive damage due to glaucoma.
REFERENCES


RECOMMENDATIONS

Be part of something beautiful

THANK YOU
EPILOGUE
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