



*Government of the Republic of Malawi
Ministry of Health*

National Guidelines for Glaucoma Eye Care

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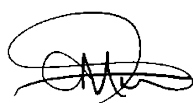
Foreword

Glaucoma is a leading cause of irreversible blindness globally. In Malawi, glaucoma accounts for 15.8% of the blindness among people aged 50 years and above. Blindness from glaucoma is preventable with early detection and timely treatment. However, glaucoma management remains a challenge to eye care providers due to its asymptomatic progression.

These guidelines inform eye care providers about the requirements for early detection of glaucoma, and the appropriate assessment and management of glaucoma patients. The guidelines also demonstrate the need for ophthalmologists to work with secondary-level eye care providers. With glaucoma being a permanently blinding condition, it is vital to ensure that all eye care providers are adequately equipped with skills and resources for the early detection and management of glaucoma.

The Ministry of Health developed the National Guidelines for Glaucoma Eye Care as a comprehensive document to be used at secondary and tertiary level. The goal is to guide the management that should be provided to patients at different stages of glaucoma at the different levels of the health care system. They also provide a guide for follow-up of glaucoma patients to assist in timely decision making that could prevent or delay permanent visual loss. The guidelines have been adapted from the Guidelines for Glaucoma Eye Care which were developed by International Council of Ophthalmology.

These guidelines are a much-needed resource for eye care workers to improve the quality of glaucoma care and will be reviewed and updated to be in line with advancing technology and scientific evidence in the field of glaucoma.



Dr Charles Mwansambo
Secretary for Health

Acknowledgements

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1. Introduction

Glaucoma is the leading cause of world blindness after cataracts and is a second leading cause of blindness in Malawi. Glaucoma refers to a group of diseases, in which optic nerve damage is the common pathology that leads to vision loss. The most common types of glaucoma are open angle and closed angle forms. Worldwide, open angle and closed angle glaucoma each account for about half of all glaucoma cases. Together, they are the major cause of irreversible vision loss globally. Patients with glaucoma are reported to have poorer quality of life, reduced levels of physical, emotional, and social well-being, and utilize more health care resources.

High intraocular pressure (IOP) is a major risk factor for loss of sight from both open and closed angle glaucoma, and the only one that is modifiable. The risk of blindness depends on the height of the intraocular pressure, severity of disease, age of onset, and other determinants of susceptibility, such as family history of glaucoma. Epidemiological studies and clinical trials have shown that optimal control of IOP reduces the risk of optic nerve damage and slows disease progression. Lowering IOP is the only intervention proven to prevent the loss of sight from glaucoma.

Glaucoma should be ruled out as part of every regular eye examination, since complaints of vision loss may not be present. Differentiating open from closed angle glaucoma is essential from a therapeutic standpoint, because each form of the disease has unique management considerations and interventions. Once the correct diagnosis of open or closed angle glaucoma has been made, appropriate steps can be taken through medications, laser, and microsurgery. This approach can prevent severe vision loss and disability from sight threatening glaucoma.

In low resource settings, managing patients with glaucoma has unique challenges. Inability to pay, treatment rejection, poor compliance, and lack of education and awareness, are all barriers to good glaucoma care. Most patients are unaware of glaucoma disease, and by the time they present, many have lost significant vision. Long distances from healthcare facilities, and insufficient medical professionals and equipment, add to the difficulty in treating glaucoma. A diagnosis of open or closed angle glaucoma requires medical and surgical interventions to prevent vision loss and to preserve quality of life. Preventing glaucoma blindness in underserved regions requires heightened attention to local educational needs, availability of expertise, and basic infrastructure requirements.

Pediatric glaucomas are a heterogeneous group of diseases that may result from an isolated congenital abnormality of the aqueous outflow pathways (primary glaucoma) or from abnormalities affecting other regions of the eye (secondary glaucoma). The primary treatment for childhood glaucoma is surgery. Primary congenital glaucoma (PCG) is usually effectively treated with angle surgery (goniotomy or trabeculotomy). Generally, medical therapy for childhood glaucoma has lower success rates and greater risks than medical therapy for adult glaucomas. However, it serves several important purposes in preoperative, postoperative, and long-term management, particularly in childhood glaucoma other than PCG.

There is strong support to integrate glaucoma care within comprehensive eye care programs and to consider rehabilitation aspects of care. Persistent efforts to support effective and accessible care for glaucoma are needed.¹

¹ Universal Eye Health: A Global Action Plan 2014-2019, WHO, 2013 www.who.int/blindness/actionplan/en/.

Open Angle Glaucoma

In open angle glaucoma, there is characteristic optic nerve damage and loss of visual function in the presence of an open angle with no identifying pathology. The disease is chronic and progressive. Although elevated IOP is often associated with the disease, elevated IOP is not necessary to make the diagnosis.

Risk factors for the disease include elevated intraocular pressure, increasing age, positive family history, racial background, myopia, thin corneas, hypertension, and diabetes. Patients with elevated IOP or other risk factors should be followed regularly for the development of glaucoma.

- Open Angle
- ± Glaucomatous Optic Nerve Damage
- ± Elevated IOP
- ± Visual Field Damage

Closed Angle Glaucoma

In closed angle glaucoma, optic nerve damage and vision loss may occur in the presence of an anatomical block of the anterior chamber angle by the iris. This may lead to elevated intraocular pressure and optic nerve damage. In acute angle closure glaucoma, the disease may be painful, needing emergency care. More often the disease is chronic, progressive, and without symptoms. Risk factors for the disease include racial background, increasing age, female gender, positive family history, and hyperopia. Patients with these risk factors should be followed regularly for the development of closed angle glaucoma.

- Closed Angle
- ± Elevated IOP
- ± Glaucomatous Optic Nerve Damage
- ± Visual Field Damage

Most patients with open and closed angle forms of glaucoma are unaware they have sight-threatening disease. Mass population screening is not currently recommended. However, all patients presenting for eye care should be reviewed for glaucoma risk factors and undergo clinical examination to rule out glaucoma. Patients with glaucoma should be told to alert brothers, sisters, parents, sons, and daughters that they have a higher risk of developing disease, and that they also need to be checked regularly for glaucoma. The ability to make an accurate diagnosis of glaucoma, to determine whether it is an open or closed form, and to assess disease severity and stability, are essential to glaucoma care strategies and blindness prevention.

2. Initial Clinical Assessment of Glaucoma

History

Assessment for glaucoma includes asking about complaints that may relate to glaucoma such as vision loss, pain, redness, and halos around lights. The onset, duration, location, and severity of symptoms should be noted. All patients should be asked about family members with glaucoma, and a detailed history should also be taken.

Table 1 - History Checklist

√ Chief Complaint	√ Systemic conditions
√ Patient Characteristics	• Hypertension/Hypotension
• Age	• Heart disease
• Race	• Lung disease (Asthma)
√ Family History of glaucoma	• Renal stones
√ Past Ocular History	• Raynauds disease
• Past eye disease	• Migraine
• Surgery	• Diabetes
• Trauma	• Cerebrovascular disease
√ Drug history	√ Social history
• Allergies	• Occupation
• Eye medications	• Tobacco, Alcohol, Drug use
• Systemic medications	
• Corticosteroid use	

Initial Glaucoma Assessment

Evaluation for glaucoma is recommended as part of a comprehensive eye exam. The ability to diagnose glaucoma in its open or closed angle forms, and to evaluate its severity, are critical to glaucoma care approaches and the prevention of blindness. Core examination and equipment needs to diagnose and monitor glaucoma patients are listed in Table 2.

Table 2 - Glaucoma Assessment and Equipment Needs - Recommendations

Clinical Assessment	Minimal Equipment (District Level Facility)	Equipment (Tertiary Level facility)
Visual Acuity	Near reading card or distance chart with 5 standard letters or symbols Pinhole	3- or 4-meter visual acuity lane with high contrast visual acuity chart
Refraction	Trial frame and lenses, Autorefractor, Retinoscope, Jackson cross-cylinder	
Pupils	Pen light or torch	
Anterior Segment	Slit lamp biomicroscope	Corneal pachymeter
Intraocular Pressure	Goldmann applanation tonometer Portable handheld applanation Tonometer, Tonopen, icare tonometer	
Angle Structures	Slit lamp gonioscopy Goldmann, Zeiss/Posner goniolenses	Anterior segment optical coherence tomography
Optic Nerve (dilated if angle open)	Direct ophthalmoscope Slit lamp biomicroscopy with hand held 78 or 90 diopter lens	Fundus photography Optic nerve image analyzers Optical coherence tomography
Fundus	Direct ophthalmoscope Slit lamp biomicroscopy with 78 diopter lens	Head mounted indirect ophthalmoscope with 20 or 25 diopter lens 60 and 90 diopter lenses
Visual Field	Manual perimetry or automated white on white perimetry	Frequency doubling technology Short wave automated perimetry

3. Glaucoma Assessment Checklist

Visual Acuity

Vision should be tested (undilated), unaided, and with best correction at distance and near. Central vision may be affected in advanced glaucoma.

Refractive Error

The refractive error will help to understand the risk of open angle glaucoma (myopia) or closed angle glaucoma (hyperopia). Neutralizing the error is important to assessing visual acuity and visual fields.

Pupils

Pupils should be tested for reactivity and afferent pupillary defect. An afferent defect may signal asymmetric moderate to advanced glaucoma.

Lids/Sclera/ Conjunctiva

Evidence of inflammation, redness, ocular surface disease, or local pathology may point to uncontrolled IOP due to acute or chronic angle closure, or possible glaucoma drug allergy, or other disease.

Cornea

The cornea should be examined for edema, which may be seen in acute or chronic high IOP. Note that IOP readings are underestimated in the presence of corneal edema. Corneal precipitates may indicate inflammation.

Corneal Thickness

The thickness of the cornea is measured to help interpret IOP readings. Thick corneas tend to overestimate the IOP reading, and thin corneas tend to underestimate the reading.

Intraocular Pressure

IOP should be measured in each eye before gonioscopy and before dilation. Recording the time of IOP measurement is recommended to account for diurnal variation.

Anterior Segment

The anterior segment should be examined in the un dilated state and after dilation (if the angle is open). Look for anterior chamber shallowing and peripheral depth, pseudoexfoliation, pigment dispersion, inflammation and neovascularization, or other causes of glaucoma.

Glaucoma Assessment Checklist (cont'd)

□ Angle Structures

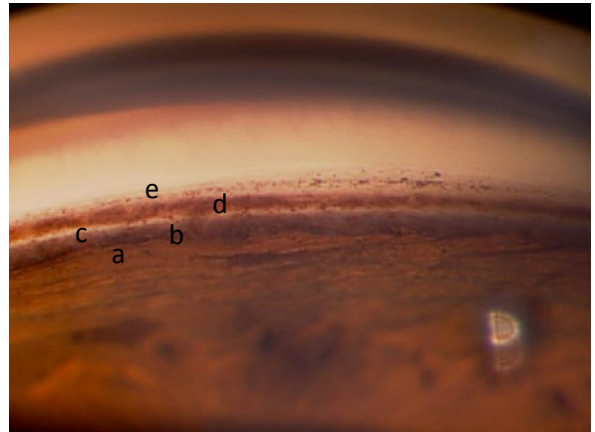
The angle should be examined for the presence of iris contact with the trabecular meshwork in a dark room setting. The location and extent, and whether it is due to appositional or synechial closure, should be determined by indentation gonioscopy. The presence of inflammation, pseudoexfoliation, neovascularization, and other pathology should be noted.

□ Iris

The iris should be examined for mobility and irregularity, the presence of anterior and posterior synechiae, and pseudoexfoliation at the pupil margin. Forward bowing, peripheral angle crowding, and iris insertion should be noted in addition to the presence of inflammation, neovascularization, and other pathology.

□ Lens

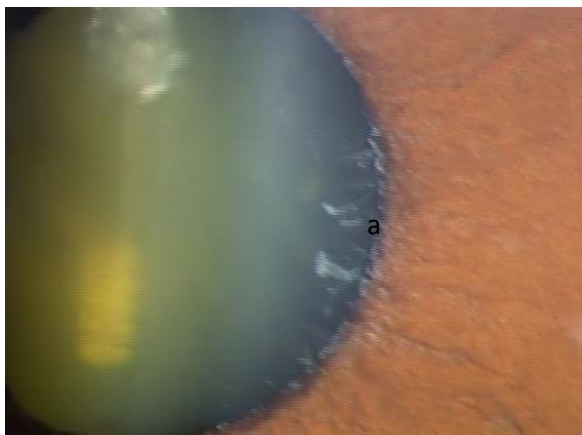
The lens should be examined for cataract, size, position, posterior synechiae, pseudoexfoliation material, and evidence of inflammation.



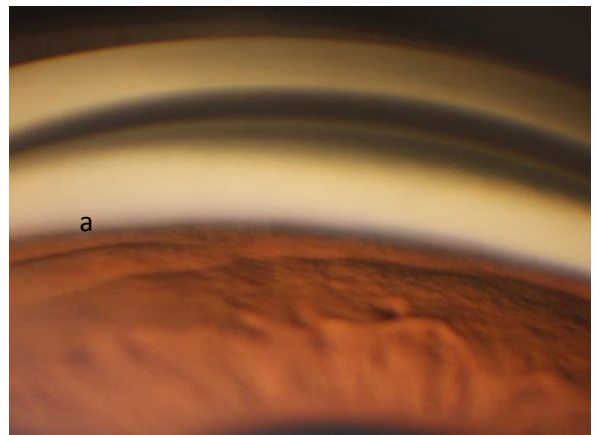
Open angle on gonioscopy
a. Peripheral Iris, b. Ciliary body, c. Scleral spur, d. Trabecular Meshwork, e. Schwalbe line



Closed angle on gonioscopy with no structures visible



a. Pseudoexfoliation deposits at the pupil



Plateau iris with peripheral iris roll

Glaucoma Assessment Checklist (cont'd)

□ Optic Nerve

The optic nerve should be evaluated for characteristic signs of glaucoma. The degree of optic nerve damage helps to guide initial treatment goals.

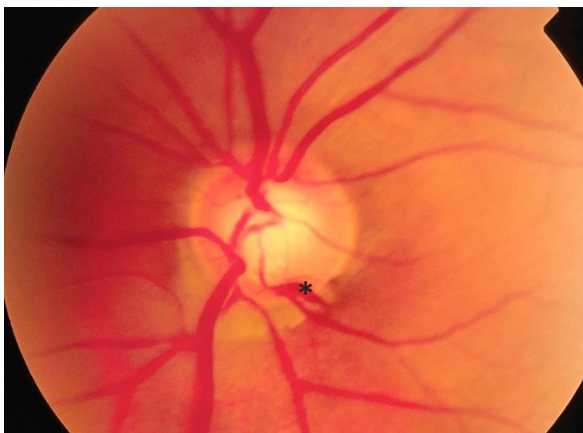
- Early optic nerve damage may include a cup ≥ 0.5 , focal retinal nerve fiber layer defects, focal rim thinning, vertical cupping, cup/disc asymmetry, focal excavation, disc hemorrhage, and departure from the ISNT rule (rim thickest inferiorly, then superiorly, nasally and temporally).
- Moderate to advanced optic nerve damage may include a large cup ≥ 0.7 , diffuse retinal nerve fiber defects, diffuse rim thinning, optic nerve excavation, acquired pit of the optic nerve, and disc hemorrhage.



Retinal nerve fiber layer defect



Thinning of the inferior rim



Disc hemorrhage at 5 o'clock



Advanced glaucoma with 0.9 vertical cup

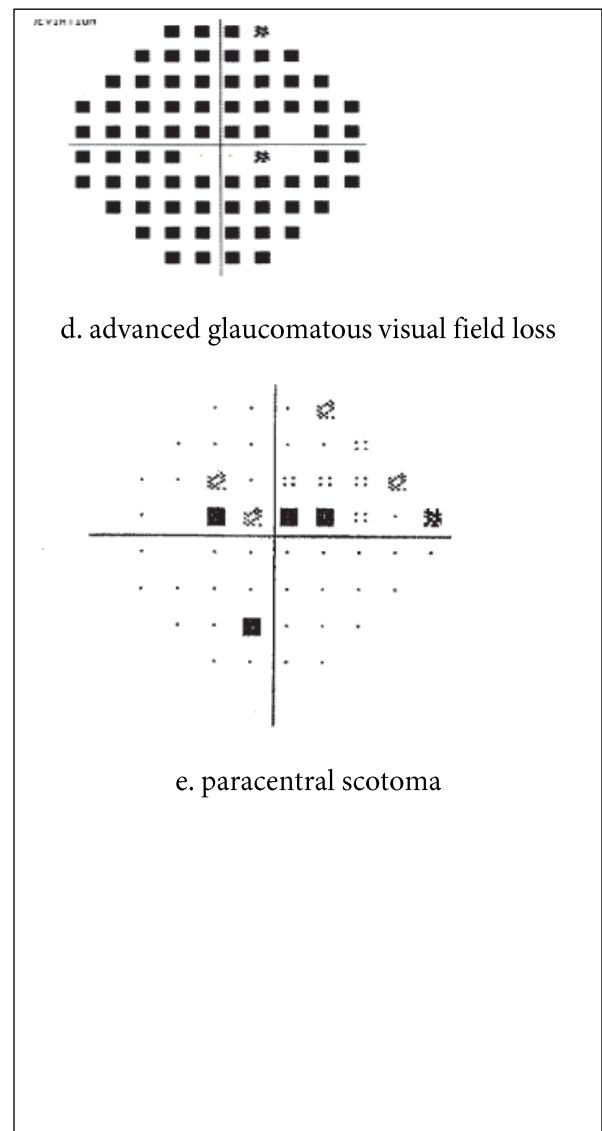
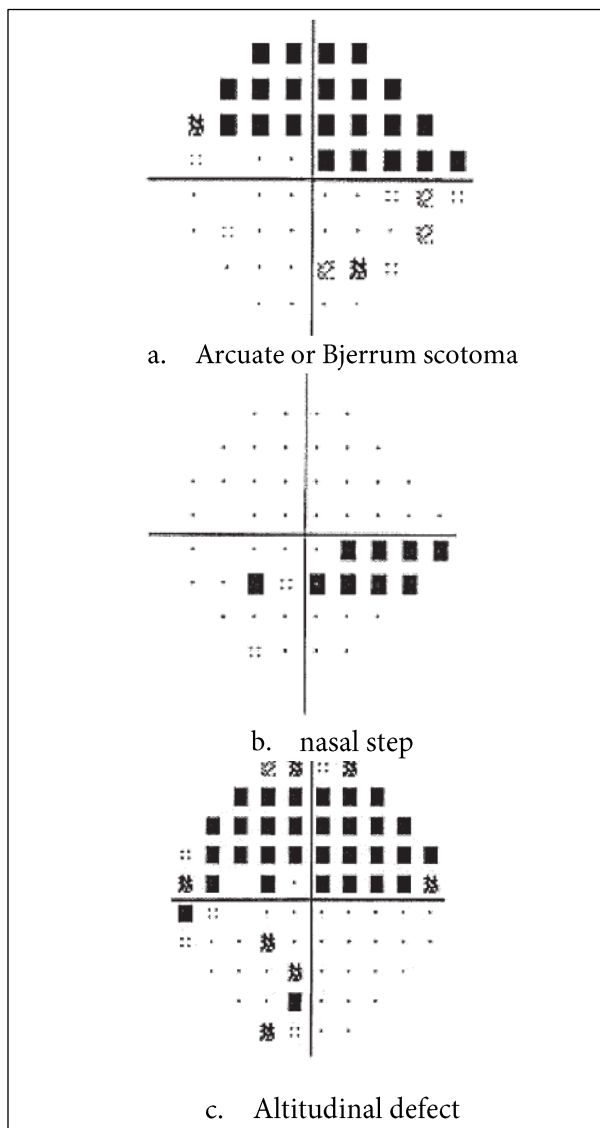
Glaucoma Assessment Checklist (cont'd)

□ Fundus

The posterior pole should be evaluated for the presence of diabetic retinopathy, macular degeneration, and other retinal disorders (Refer to our DR guidelines).

□ The Visual Field

Preserving visual function is the goal of all glaucoma management. The visual field is a measure of visual function that is not captured by the visual acuity test. Visual field testing identifies, locates, and quantifies the extent of field loss. The presence of visual field damage may indicate moderate to advanced disease. Monitoring the visual field is important to determine disease instability as seen below.



4. Approach to Open Angle Glaucoma Care

A diagnosis of open angle glaucoma requires medical and possible surgical intervention to prevent vision loss and to preserve quality of life. Once a diagnosis of open angle glaucoma is made, patient education should begin regarding the nature of the disease, the need to lower IOP, along with discussions of treatment options and need for compliance. Following counselling patients should be requested to reiterate the information that has been given to them. Patients should be informed of the need to alert first degree relatives for the need of a glaucoma examination.

The financial, physical, social, emotional, and occupational burdens of glaucoma treatment options should be carefully considered for each patient. Recommendations, risks, options, and consequences of no treatment, should be discussed with all patients in language that is understandable to the patient or caregiver. Classifying glaucoma disease as early, or moderate to advanced, can help to guide IOP treatment goals and approaches. A simplified approach to initiating care in glaucoma patients is summarized below in Table 3.

Table 3 - Initiating Open Angle Glaucoma Care - International Recommendations

Glaucoma Severity	Findings	Suggested IOP Reduction	Treatment Considerations
Early	Optic Nerve Damage ± Visual Field Loss	Lower IOP ≥25%	Medication <i>or</i> Laser trabeculoplasty <i>or</i> Trabeculectomy + Mitomycin C
Moderate/ Advanced	Optic Nerve Damage + Visual Field Loss	Lower IOP ≥25 – 50%	Medication <i>or</i> Laser trabeculoplasty <i>or</i> Trabeculectomy + Mitomycin C <i>or</i> Valve uergy
End-stage (Refractory glaucoma)	Blind Eye ± Pain	Lower IOP ≥25 – 50% (If painful)	Medication <i>and/or</i> Cyclophotocoagulation <i>and</i> Low vision services

Particular attention should be given to compliance with treatments and the capacity of the patient to obtain and use medication. Patients should be specifically counselled on treatment compliance. If a patient cannot afford the cost of drugs, initial laser trabeculoplasty would be favoured wherever equipment and expertise are available. Early surgery should be advocated for due to potential challenges in this setting ie unavailability of medications, loss of follow up. Patients should receive IOP lowering medication before surgery.

Table 4 - Medicines for Glaucoma Care: Recommendations

Eye Drops	Essential Medicines Secondary level Facility	Additional Medicines Tertiary level Facility
Anesthetic	Tetracaine 0.5%, Lignocaine 2% with phenylephrine	Tetracaine 0.5%, Lignocaine 2% with phenylephrine
Diagnostic	Fluorescein 1% Tropicamide 0.5%	Fluorescein 1% Tropicamide 0.5%
Anti-Fibrotic Agents		5-Fluorouracil, Mitomycin-C
Pupil Dilating		Atropine 0.1, 0.5, or 1% Homatropine or cyclopentolate
Anti-Inflammatory	Dexamethasone 0.1% Prednisolone 0.5%-1%	Dexamethasone 0.1% Prednisolone 0.5%-1%
Anti-Infectives	Gentamycin 0.3% Ciprofloxacin 0.3%	Gentamycin 0.3% Ciprofloxacin 0.3%
Intraocular Pressure Lowering (Topical)	Latanoprost 50µg/mL Timolol 0.25% or 0.5%	Prostaglandin analogs Other beta blockers Carbonic anhydrase inhibitors Alpha agonists Fixed combination drops
Intraocular Pressure Lowering (Systemic)	Oral acetazolamide	Methazolamide Glycerol Oral acetazolamide
Intracameral miotic medication (Intra-operative use)		Pilocarpine

Table 5 - Laser Trabeculoplasty for Glaucoma: Recommendations

Treatment Parameters	Argon Laser Trabeculoplasty (ALT)	Selective Laser Trabeculoplasty (SLT)
Laser Type	Argon green or blue-green / Diode Laser	Frequency doubled Q-Switched Nd: Yag Laser (532 nm)
Spot Size	50 microns (Argon) or 75 microns (diode)	400 microns
Power	300 to 1000 mW	0.5 to 2 mJ
Application Site	TM junction non-pigmented/pigmented	Trabecular meshwork (TM)
Handheld Lens	Goldmann gonioscopy lens or Ritch lens	Goldmann or SLT lens
Treated Circumference	180 – 360 degrees	180 – 360 degrees
Number of Burns	~ 50 spots per 180 degrees	~ 50 spots per 180 degrees
Number of Sitzings	1 or 2	1 or 2
Endpoint	Blanching at junction of anterior non-pigmented and pigmented TM	Bubble formation

Table 6 - Cyclophotocoagulation for Glaucoma: Recommendations

Treatment Parameters	Transscleral Nd: YAG Laser	Transscleral Diode Laser
Laser Type	Nd: YAG Laser	Diode Laser
Power	4 to 7 J	1.0 to 2.5 W
Exposure Time	0.5 to 0.7 seconds	0.5 to 4.0 seconds
Application Site	1.0 to 2.0 mm from limbus	1.0 to 2.0 mm from limbus
Handheld Probe	Transscleral contact	Transscleral contact
Treated Circumference	180 – 360 degrees	180 – 360 degrees
Number of Burns	~ 15 – 20 spots per 180 degrees	~ 12 – 20 spots per 180 degrees
Number of Sitzings	1 or 2	1 or 2

5. Ongoing Open Angle Glaucoma Care

Ongoing management of glaucoma depends on the ability to evaluate response to treatment, and to detect disease progression and instability. Follow-up examinations are similar to the initial assessment and should include history and clinical evaluation.

- ✓ **History:** Ask about changes to general health and medications, visual changes, glaucoma drug compliance, difficulty with drops, and possible side effects.
- ✓ **Clinical Assessment:** Assess for changes in visual acuity or refractive error, IOP, new anterior segment pathology, bleb for post operative patients, and changes to the angle anatomy, changes to the optic nerve, and changes to the visual field.

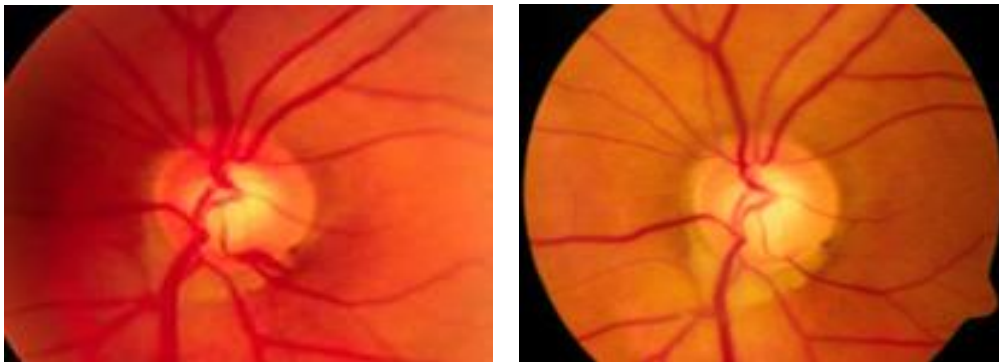
Indicators of Unstable Open Angle Glaucoma Failure to reach target IOP of 30% IOP reduction from a carefully determined baseline IOP

Elevated Intraocular Pressure

- May be due to poor compliance, drug intolerance, or worsening glaucoma.

Progressive Optic Nerve Changes

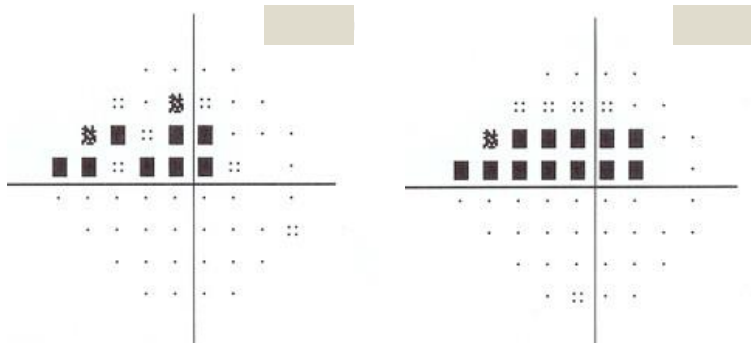
- Expanding nerve fiber layer defect, enlarging cup, new disc hemorrhage, and rim thinning.



Progressive inferior rim loss

Progressive visual field changes

- Expanding visual field defect in size and depth, confirmed by repeat testing.
(patients should have a baseline visual field assessment, then every 6 months to 12 months)



Progressive superior field loss

Ongoing Open Angle Glaucoma Care

A rise in IOP, progressive optic nerve damage, or progressive visual field loss, signal the need for additional medical or surgical intervention to prevent sight loss. A simplified approach to monitor and follow patients with glaucoma is summarized below.

Table 7 - Ongoing Open Angle Glaucoma Care - Recommendations

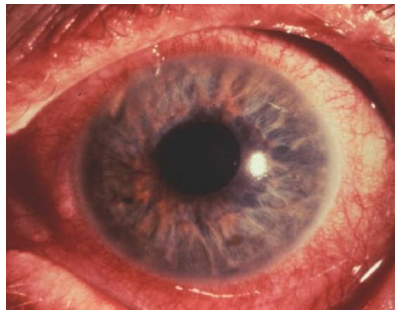
Classification	Exam Findings	Treatment	Follow-up
Stable Glaucoma	No Change to IOP and Optic Nerve and Visual Field	Continue	4-6 months
Unstable Glaucoma	Increased IOP and/or Increased Optic Nerve Damage and/or Increased Visual Field Damage	Additional IOP lowering needed by $\geq 25\%$ (Refer to Table 3)	1 – 4 months (depending on disease severity, risk factors and resources)

More frequent follow-up is suggested in the presence of advanced disease, multiple risk factors, or progression within a short period. Compliance with treatment and the capacity of the patient to obtain and use medication should be considered. Surgical options may be favored earlier, wherever equipment and expertise are available. If resources to manage glaucoma are insufficient, referral is indicated.

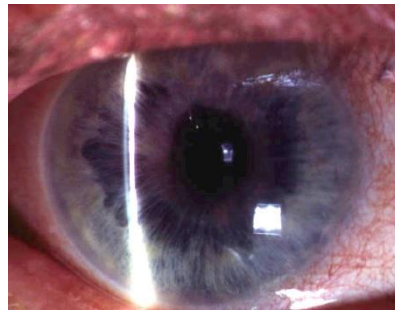
6. Approach to Closed Angle Glaucoma Care

A diagnosis of closed angle glaucoma requires medical and surgical intervention to prevent vision loss. Closed angle glaucoma management requires referral to an ophthalmologist. When acute, it is an emergency that requires urgent treatment.

Once a diagnosis of closed angle glaucoma is made, patients should be educated regarding the nature of the disease and required treatment to help prevent vision loss. The cause of angle closure will determine the clinical care pathway, and as pupil block is the most common cause, laser iridotomy is recommended as the first line treatment for all patients. A simplified approach to initiating care in closed angle glaucoma patients is summarized below.



Acute angle closure with red eye and forward iris bowing



Slit lamp beam shows very shallow anterior chamber depth

Table 8 - Initiating Closed Angle Care - Recommendations

Diagnosis	Clinical Findings	Essential Treatment	Surgical Options
Acute or Chronic Closed Angle (Pupil Block)	Iris-trabecular contact Iris bowing	Constrict pupil and lower IOP Laser iridotomy (desirable) or Surgical iridectomy (laser to fellow eye)	Lens extraction/IOL ± Trabeculectomy ± Mitomycin C
Closed Angle (Plateau Iris)	Iris-trabecular contact Flat Iris	Constrict pupil and lower IOP Laser iridotomy (desirable) or Surgical iridectomy (laser to fellow eye) and Laser iridoplasty	Lens extraction/IOL ± Trabeculectomy ± Mitomycin C

In addition to pupil block, progressive and irreversible angle closure may be due to plateau iris and other causes. The chamber angle should be carefully reviewed after laser iridotomy to look for other mechanisms of a closed angle needing treatment. At a secondary level, give IOP lowering medication and refer patient to an ophthalmologist.

Table 9 - Laser Iridotomy and Iridoplasty for Glaucoma: Recommendations

Treatment Parameters	Laser Iridotomy	Laser Iridoplasty
Laser Type	Q-Switched Nd: Yag	Argon green or blue-green
Spot Size	Iridotomy site: 11 or 1 O'clock	200 – 500 microns
Power	2mJ to 8mJ	200 – 400 mW
Application Site	Peripheral iris	Peripheral iris
Handheld Lens	Laser iridotomy lens	Goldmann gonioscopy lens or Ritch lens
Treated Circumference	–	180 – 360 degrees
Number of Burns	–	20 – 40 spots per 180 degrees
Number of Sitzings	1	1 or 2
Endpoint	Full thickness iris opening	Contraction burn

7. Ongoing Closed Angle Glaucoma Care

Ongoing management of angle closure glaucoma relies on the ability to evaluate response to treatment and to detect disease progression and instability. Follow-up examinations are similar to the initial assessment and should include history and clinical evaluation.

- ✓ **History:** Ask about changes to general health and medications, visual changes, glaucoma drug compliance, difficult with drops, and possible side effects.

Clinical Assessment: Assess for changes in visual acuity or refractive error, assess IOP, with careful attention to the angle and changes to angle closure status, changes to the optic nerve, and the visual field, check patency of iridotomy.

Indicators of Unstable Closed Angle Glaucoma

Persistent Angle Closure

- Synechiae formation, failed iridotomy

Elevated Intraocular Pressure

- Inadequate aqueous drainage

Progressive Optic Nerve Changes

- Expanding nerve fiber layer defect, enlarging cup, new disc hemorrhage, rim thinning

Progressive Visual Field Changes

- Expanding visual field defect in size and depth, confirmed by repeat testing

Ongoing Closed Angle Glaucoma Care

Persistent angle closure with a rise in IOP, progressive optic nerve damage, or progressive visual field loss, all signal the need for additional medical or surgical intervention to prevent sight loss. A simplified approach to monitor and follow patients with glaucoma is summarized below.

Table 10 - Ongoing Closed Angle Glaucoma Care - Recommendations

Classification	Exam Findings	Treatment	Follow-up
Stable Glaucoma	No Change to Angle, IOP, Optic Nerve, and Visual Field	Continue	~ 4-6 months (depending on disease severity, risk factors, and resources)
Unstable Glaucoma	Persistent Angle Closure and Increased IOP ± Increased Optic Nerve Damage ± Increased Visual Field Damage	Additional IOP lowering needed by ≥ 25% (Refer to Table 11)	1 – 4 months (depending on disease severity, risk factors, and resources)

More frequent follow-up is suggested in the presence of advanced disease, multiple risk factors, or progression within a short period. In low resource settings, compliance with treatment and the capacity of the patient to obtain and use medication should be considered. Surgical options may be favored earlier, wherever equipment and expertise are available. If resources to manage glaucoma are insufficient, referral is indicated.

Unstable Closed Angle Glaucoma

Once closed angle glaucoma is deemed unstable, classifying the disease as early, or moderate to advanced, helps to guide IOP treatment goals and approaches. The treatment options for a closed angle differ from open angle care, and are summarized below.

Table 11 - Unstable Closed Angle Glaucoma - Recommendations

Glaucoma Severity	Findings	Suggested IOP Reduction	Treatment Considerations
Early	Persistent Angle Closure + Optic Nerve Damage ± Visual Field Loss	Lower IOP ≥25%	Medication Lens extraction/IOL
Moderate / Advanced	Persistent Angle Closure + Optic Nerve Damage + Visual Field Loss	Lower IOP ≥25 – 50%	Medication <i>and/or</i> Trabeculectomy or tube (with or without goniosynechiolysis, cataract removal, and IOL) <i>and/or</i> Cyclophotocoagulation (<i>or</i> cryotherapy) Rehabilitation Services
End-stage (Refractory glaucoma)	Blind Eye ± Pain	Lower IOP ≥25 – 50% (If painful)	Medication <i>and/or</i> Cyclophotocoagulation (<i>or</i> cryotherapy) Rehabilitation Services

Intraocular pressure goals should be adjusted according to individual risk factors. Surgical options may be favored in most instances. End-stage disease treatment is similar to that of open angle glaucoma.

8. Management of glaucoma in special situations

Neovascular glaucoma

- Retinal ischaemia drives neovascularization of iris and drainage angle which eventually leads to Peripheral anterior synachiea formation which cause complete angle closure.
- About a third of cases are due to ischaemic CRVO and diabetes
- **Treatment of neovascularization**
 - Panretinal photocoagulation to decrease retinal ischaemic drive.
 - Consider intravitreal anti-VEGF therapy (e.g Bevacizumab)
- **Reduction of IOP and inflammation**
 - Medical
 - Cycloplegic (e.g. atropine 1% bd) + frequent topical steroids (e.g. prednisolone acetate 1% qid) + ocular hypotensive agents asfor POAG
 - Surgical
 - Tube-shunt procedures (eg Ahmed valve)
 - Consider trabeculectomy
 - Cyclodestruction (e.g. cyclodiode) if poor visual prognosis.
- **Pain control**
 - Cycloplegia (e.g. atropine 1% bd)
 - Artificial tears
 - If the eye is blind and painful, consider retrobulbar injection of absolute alcohol (96%) or chlorpromazine (25mg), or evisceration/enucleation.

Normal Tension Glaucoma

- It is regarded as a subcategory of POAG, although clinical cases often have a distinct phenotype.
- Associated with central migraines, low blood pressure and Raynaud's phenomenon.
- Usually asymptomatic
- IOP <21mmHg
- The treatment is the same as POAG (refer to table 3)
 - Prostaglanin analogues are more preferred than beta blockers as the later are postulated to reduce optic head perfusion at night

Lens Induced Glaucoma

- The glaucoma may result from abnormalities of lens position, lens size, release of lens protein (mature cataract, surgery, trauma) and the subsequent inflammatory response.
- Early cataract extraction is the definitive treatment

Inflammatory glaucoma

- Glaucoma in the context of intraocular inflammation is a common clinical problem which can be acute or chronic.
- In the acute phase, control treatment of underlying cause may be sufficient, however anti glaucoma medications may be considered
- Avoid using prostaglandin analogue for they may exacerbate the inflammation
- If chronic, treat as chronic POAG/ PACG (refer to table 3) depending on the angle status

- Trabeculectomy is likely to have poorer results than for POAG but improves if augmented with antifibrotic tube or tube procedure).

Cataract in a glaucoma patient

Both cataract and glaucoma are conditions that are more prevalent with age. It is not surprising that many patients with glaucoma eventually develop cataracts either naturally or as a result of glaucoma therapy. It should also be noted that cataract surgery alone may lower IOP in eyes with open angles. Combined procedures are generally less effective than trabeculectomy alone in controlling IOP.

Cataract surgery may be combined with trabeculectomy in the following situations:

- cataract requiring extraction in a glaucoma patient who has advanced cupping and visual field loss to minimize postoperative pressure spike
- cataract requiring extraction in a glaucoma patient who requires medications to control IOP but who tolerates medical therapy poorly or has inadequately controlled IOP
- cataract requiring extraction in a glaucoma patient who requires multiple medications to control IOP

Trabeculectomy with cataract surgery is performed through the superior trabeculectomy incision. Also, cataract extraction may be combined with implantation of a tube shunt.

For the patient whose IOP is controlled medically, cataract surgery alone may be the appropriate choice. Standard trabeculectomy can be performed later when dictated by independent indications.

9. Indicators to Assess Glaucoma Care Programs

- a. Prevalence of glaucoma-related blindness and visual impairment.
- b. Proportion of blindness and visual impairment due to glaucoma.
- c. Last eye examination for glaucoma among known persons with glaucoma (males/females).
 - 0 – 12 months ago
 - >12 months ago
- d. Number of patients who received laser trabeculoplasty, iridotomy, trabeculectomy, or tube surgery during last year.
- e. Define ratios such as:
- f. Number of patients who received laser or trabeculectomy per million general population per year (equivalent to cataract surgical rate [CSR]).
- g. Number of patients who received laser, trabeculectomy, or tube treatments per number of patients with glaucoma in a given area (hospital catchment area, health district, region, country).
 - Numerator: number of laser, trabeculectomy, or tube treatments during the last year
 - Denominator: number of patients with glaucoma (population x prevalence of glaucoma)
- h. Number of patients who received laser, trabeculectomy, or tube treatments per number of persons with vision-threatening glaucoma in a given area (hospital catchment area, health district, region, country).
 - Numerator: number of laser, trabeculectomy, or tube treatments during the last year
 - Denominator: number of patients with vision-threatening glaucoma (population x prevalence of glaucoma)
- i. Number of glaucoma patients ≥ 40 years

10. Equipment for glaucoma management

CORE/ESSENTIALS FOR SCREENING, INITIAL ASSESSMENT, AND FOLLOW-UP

Slit Lamp biomicroscope

Goldmann Applanation tonometer

Spare tonometer heads

Visual field machine

3 Mirror Goldmann Gonio Lens

4 mirror Zeiss or Sussman (D)

Pachymetry machine

TonoPen

Caliper

Direct ophthalmoscope

A-scan ultrasound

Iridotomy Laser Lens

ALT/SLT Laser Lens

GLAUCOMA SURGERY INSTRUMENTS

Complete Trabeculectomy Set

Non-toothed forceps eg. Moorfields

Hoskins conjunctival forceps

Fine toothed forceps

Fine needle holder

Vannas scissors

Spring scissors

Paracetesis blade

Speculum

Diathermy

Kelly punch

Sponges for 5FU or MMC

Ahmed valve implants

Donor sclera/Tutoplast

11. Human resources for the detection and treatment of glaucoma

Opportunistic screening of ophthalmic patients for glaucoma is advocated for in routine ophthalmic practice. In this regard, it is recommended that a fundoscopy and an intra ocular pressure measurement should be performed on every ophthalmic patient regardless of their presenting complaint. In addition, it is recommended that all first-degree relatives of glaucoma patients should be screened of the disease.

In line with these screening recommendations, there is a need for continuing personal development programmes aimed at maintaining the glaucoma-detection skills of ophthalmic clinical officers (OCOs) and optometrists at both secondary level and tertiary level of health care.

With regard to treatment, there is a need for general ophthalmologists trained in glaucoma management which includes medical treatment , laser surgery and micro invasive surgery. In addition, there is a need for ophthalmologists with subspecialty skills in glaucoma needed to manage complex cases of glaucoma.



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