

An Overview of Glaucoma Diagnosis & Management: A Literature Review

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Abstract

Introduction: Glaucoma is a leading cause of irreversible visual impairment worldwide and its diagnosis is frequently delayed. Although the pathogenesis of glaucoma is not fully understood, its incidence increases with age, the patients often have numerous comorbidities and use various medications. Thus, management and understanding of this disease. **Objective:** We aimed to review the literature reviewing the pathophysiology, clinical features, risk factors, diagnosis, and management of glaucoma. **Methodology:** Pubmed was used to select eligible articles using these terms in Mesh "Glaucoma" "Glaucoma pathophysiology" "Glaucoma trials" "Glaucoma management and diagnosis" within the title or abstract. **Conclusion:** Glaucoma is a leading cause of blindness worldwide so it requires accurate evaluation of the stages and progression of the diseases in order to detect the possible ways of management. Management of decision making demands solid history, detailed investigations, and cautious follow-up.

Keywords: Glaucoma, Pathophysiology, Management, Diagnosis.

INTRODUCTION

Glaucoma is a worldwide leading cause of irreversible visual impairment and its diagnosis is frequently delayed [1]. Glaucoma is currently defined as a characteristic progressive degeneration of the optic nerve, characterized by the loss of retinal ganglion cells, thinning of the retinal nerve fiber layer, which may also lead to specific visual field defects over time [2]. Although the pathogenesis of glaucoma is not fully understood, the incidence of glaucoma increases with age, the patients often have numerous comorbidities and use various medications [3]. Moreover, increased intraocular pressure (IOP) is the most significant risk factor in glaucoma.[4] It has been shown that the reduction of intraocular pressure is the only proven method to effectively treat the disease. This can be usually achieved by anti-glaucoma medications, laser therapy, or surgical intervention. However, the role of complementary and alternative medical management in glaucoma has received great interest from patients and ophthalmologists. [4, 5] This review is based on previously conducted studies and a general understanding of the disease, its pathophysiology, risk factors, clinical features, and management.

METHODOLOGY:

PubMed database was used for articles selection, and the following keys were used in the ("Glaucoma "[Mesh] AND

"Diagnosis "[Mesh] AND "Clinical Features"[Mesh] AND "Management"[Mesh])). In regards to the inclusion criteria, the articles were selected based on the inclusion of one of the following topics; glaucoma clinical evaluation, management, and diagnosis impressions. Exclusion criteria were all other articles that did not have one of these topics as their primary endpoint.

Review: Epidemiology:

Glaucoma is a leading cause of irreversible vision loss worldwide. In 2010, the disease was a major health issue

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causing 8% of all cases of blindness.^[6] In a 2006 study, it was predicted that cases would rise up to 76.0 million globally by 2020, and 74% of the population will have Open-angled glaucoma; while recent investigations in Iran showed a prevalence of 2 and 2.6% in women and men, respectively.^[7, 8] Glaucoma is expected to reach 37 million in Asia, which displays 47% of the globe, with East Asian countries showing the most increase.^[9] Furthermore, developing West African countries have a wide-range rising rate of cataract surgery and treatment, which has made glaucoma the leading cause of visual impairment and blindness.^[10] Unfortunately, insufficient studies have been conducted in the Middle East region and information regarding this topic is scarce. In addition, the prevalence of glaucoma is considerably higher in senior individuals, mainly people above the age of 40 compared to the younger population.^[8]

Risk factors and Pathophysiology

The exact pathogenesis of glaucoma is not well known, but the level of intraocular pressure is related directly to retinal ganglion cell death. Genetics may play a role with Mendelian inheritance as the major mode of inheritance, although it appears in the common adult-onset form.^[5, 11] Glaucoma types are defined as a ‘closed-angle’ or an ‘open-angle’ depending on the ocular lens position and iris relation to the trabecular meshwork. The open-angle type is a problem within the trabecular meshwork, as drainage is occluded or insufficient, while the closed-angle type is a problem with anatomical adherence of the iris to the cornea, in doing so they occlude both the trabecular meshwork and uveoscleral drainage. Open-angle Glaucoma is known to be progressive and irreversible accompanied by multifactorial optic neuropathy that is characterized by the open angle of the anterior chamber with typical optic nerve head changes. Open-angle glaucoma is associated with a higher incidence of blindness in severe cases.^[12] Open-angle and angle-closure glaucoma are known to be primary diseases, with the exception of traumatic type. While, secondary glaucoma (Table 1) can result from external factors such as: trauma, ophthalmic surgery, long-term medications, necrotic tumors, diabetes, or syndromic conditions such as pigment dispersion or pseudo-exfoliation syndromes, which raise the intraocular pressure.^[13]

Table 1: Secondary Glaucoma

Type	Description
Pseudoexfoliative	Peeling of the outer lens within the orbit collects in the angle and blocks the drainage route of the orbit
Neovascular	Abnormal neo-vascularisation occluding the drainage route of the orbit
Pigmentary	Leakage of pigment granules into the inner orbital fluid, blocking the drainage
Traumatic	Open-angle glaucoma, either penetrative or blunt, may cause immediate effects or develop over the years

Table 1: Secondary Glaucoma

Uveitic	Inflammation of the uvea disrupts the blood supply to the retina
Congenital	Inherited incomplete prenatal development of the drainage systems

Clinical Features

Generally, in an outpatient setting, diagnosis of this disease is based on a thorough medical history taking in the majority of the cases.^[14] A Comprehensive and focused family history also enhances glaucoma diagnosis as there is a complex inheritance evident in major adult-onset forms. Moreover, some genetic tests afford useful information for early detection of most at-risk individuals before irreversible vision loss happens.^[11] Some studies show that around half of all primary open-angle glaucoma patients have a positive family history, and their first-degree relatives might have an approximately 9-fold increased risk in developing glaucoma.^[15]

Glaucoma patients may present to the clinician with an eye pain (can be severe) or redness, multicolored halos, constant headache. The physician must ask for any previous ocular disease (including cataracts), chronic diseases like diabetes (for diabetic retinopathy), uveitis, and any vascular occlusions. These may present a vital contribution to the clinician to recognize glaucoma prior to any manifestation of glaucomatous changes. Moreover, past medical history can help in ruling out some of the differential diagnoses such as surgical or systemic vasculopathies.^[4, 16] Drug history also highlights secondary causes of glaucoma such as steroids activity on the trabecular meshwork cells.^[17]

Management

Once the clinician suspects glaucoma, multiple tests can be done in order to rule out other causes of visual impairment. However, the most used clinical modality is fundus photography, which identifies early signs of progressive loss of retinal ganglion cells that causes glaucomatous optic neuropathy.^[18] Another important modality in diagnosis is tonometry which is preferred as the criterion standard to measure the internal ocular pressure. However, it highly depends on pachymetry and other biomechanical properties. Moreover, other non-invasive modalities such as scanning laser ophthalmoscopy and optical coherence tomography offer high accuracy which helps in clinical diagnosis and decision making based on disease progression.^[19] In managing glaucoma, it should be kept in mind that it can be a life-long treatment, and generally may include both surgical and medical managements. Glaucoma patients usually present with high intraocular pressure (more than 22 mmHg) with one of the clinical features. Thus, the cornerstone of management in most cases is to lower the increased intraocular pressure by 22.5%.^[5] Unfortunately, visual damages that have occurred due to the disease are irreversible. Initially, the clinician shall aim his management

towards preventing any further damage and thus lowering the permanent visual loss in these patients.^[5]

Management begins with medical treatment but could progress to interventional surgery (Table 2).^[5] Various drug classes can be used to monitor and reduce the increased intraocular pressure. Physicians usually confirm the presence of glaucoma before giving anti-glaucoma medications. Usually, the medical regimens in glaucoma achieve the expected effects with minimized adverse effects. In closed-angle glaucoma, treatment depends on the glaucoma stage and accurately identifying the progressive changes, as it requires immediate management. In this type of glaucoma, it is preferred to treat it surgically by means of peripheral laser iridotomy to alleviate pupillary block.^[13]

Table 2: Medical treatment and its mechanism of action in monitoring high intraocular pressures in patients with Open-angle Glaucoma

Classification	Action
Alpha2-adrenergic agonists	Reduces aqueous humor and increases uveoscleral outflow
BBeta-blockers	Reduces the production of aqueous humor
Prostaglandin analogs	Improves trabecular and uveoscleral outflow
Hyperosmotic agents mainly intravenous Mannitol application (Carbonic anhydrase inhibitors)	Aqueous humor reduction. Osmotic water removal from the globe.
Trabeculoplasty	Stimulates the outflow of aqueous humor through the Schlemm canal.
Cyclophotocoagulation	Reduces the production of aqueous humor
Cyclophotocoagulation	Reduces the production of aqueous humor
Minimally invasive non-filtering procedure	Decreasing the outflow resistance of the trabecular meshwork that lies in the Schlemm canal with implanting a stent throughout the procedure e.g. deep sclerotomy
Minimally invasive filtering procedure	Create additional pathways to aid the flow of aqueous humor just below the conjunctiva. e.g. trabeculectomy

Glaucoma patients usually are not devoted to be on their long therapeutic regimens. However, it is essential to be committed when using long-term medications while treating glaucoma. This depends on the patients' personal behavior during the courses of treatment and at follow up. Medication adherence can be affected by external habitual factors such as disease awareness, educational level, age, dosage, insurance, drug costs, and many other factors. The clinician shall try to tailor the therapy accordingly and can monitor patients' drug compliance as well.^[9]

Currently, glaucoma can be neither cured nor prevented, but the progression of the disease can be controlled by preventing any further vision loss. A specific plan and multidisciplinary approach is needed and can be achieved through medical and/or tropical treatment such as laser therapy, or glaucoma incisional surgeries. Follow-up for long term should be performed annually after the course of management as postoperative complications may occur. These complications include: ocular decompression retinopathy, serous choroidal or retinal detachment, hemorrhage, maculopathy, or endophthalmitis.^[20-25] Patients must be observed and monitored carefully to halt the increased risks for glaucomatous damage development especially in comorbid patients.^[4, 15]

CONCLUSION

In conclusion, since glaucoma is a leading cause of blindness worldwide, it requires an accurate evaluation of the patient and the progression of the disease. Management decision demands solid history taking, detailed investigations, and low clinical suspicion. Follow-up for the long term is pivotal in these patients either managed medically or surgically. In patients who underwent surgical management, well monitoring can reduce the risk of recurrence and reveal any undetected post-surgical complications. These follow-ups are of utmost importance especially in patients with multiple comorbidities.

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