

# Glaucoma: An Emerging Peril

Rohit Saxena, Digvijay Singh, Praveen Vashist

Dr Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi, India

## Historical Aspect

Glaucoma was probably recognized as a disease entity in the 17<sup>th</sup> Century where the term was derived from the Greek term *glaucoma* meaning cataract or opacity of the lens implying the lack of understanding of this disease process. Today we understand that glaucoma is a group of diseases with common end point characteristics affecting the optic nerve. It is defined as an optic neuropathy characterized by specific structural findings in the optic disk (increased vertical cup disk ratio (VCDR) or VCDR asymmetry >97.5 percentile) and particular functional deficits in automated visual field testing.<sup>(1)</sup> In the past, raised intraocular pressure (IOP) was used as a defining characteristic for glaucoma; but now IOP is considered as just an important risk factor for glaucoma.

## Epidemiology

It is estimated that there are more than 60 million cases of glaucoma worldwide and it will increase to 80 million by 2020.<sup>(2)</sup> The estimated prevalence of glaucoma is 2.65% in people above 40 years of age. Globally, primary open-angle glaucoma (POAG) is more prevalent than primary angle closure glaucoma (PACG) and responsible for around three fourth of all glaucoma cases. Overall glaucoma is the second major cause of blindness after cataract and refractive errors.<sup>(3)</sup> More importantly it is the most common cause of irreversible blindness globally. It is estimated that more than 3 million people are blind due to glaucoma.<sup>(3)</sup>

In India, the estimated number of cases of glaucoma is 12 million, around one fifth of the global burden of

glaucoma. Although in the Caucasian population, around two third of cases are POAG, in the Indian population an equal proportion of open-angle and closed-angle glaucoma is seen.<sup>(2)</sup> The prevalence of POAG in rural south India among 40+ population was estimated as 1.7% in the ACES study.<sup>(4)</sup> The prevalence was comparatively higher in the urban south India – Chennai Glaucoma Study (3.5%).<sup>(5)</sup> More importantly it was observed that more than 90% cases of glaucoma were undiagnosed and identified only at the time of survey (98.6% in the Chennai Glaucoma Study and 93% in ACES). The National Blindness survey 2001 showed that glaucoma is the third major cause of blindness in India and responsible for 5.9% of blindness (VA <6/60).<sup>(6)</sup> There has been a more than threefold increase in proportion of glaucoma blindness compared to that found in the previous National survey in 1986–1989<sup>(7)</sup> It is perceived that glaucoma blindness is underestimated in these surveys as the blindness is defined on visual acuity criteria instead of visual fields which are defining criteria for glaucoma.

## Pathogenesis and Classification

To simplify the pathogenesis of the optic neuropathy, one can broadly look at two mechanisms.<sup>(8)</sup> The first is the disruption in axoplasmic flow in the optic nerve due to the raised intraocular pressure which causes compression of the nerve fibers as they exit the eyeball (mechanical theory). The second pathogenic mechanism is the reduced optic nerve head perfusion due to vascular compromise induced by the raised intraocular pressure relative to blood pressure (ischemic theory). Both of these result in death of the retinal ganglion cells and neuropathy.

Broadly glaucoma can be classified as open-angle or closed-angle glaucoma. The term angle refers to the space between the iris and cornea, where the trabecular meshwork is located. It is the prime outflow facility for the aqueous humor being produced in the eye. Open-angle glaucoma refers to the presence of adequate space at the angle such that the iris lies far away from the cornea

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#### Address for correspondence:

Dr. Rohit Saxena, Room No. 377, Dr Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, Ansari Nagar, New Delhi, India. E-mail: rohitsaxena80@yahoo.com

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and trabecular meshwork is exposed and available for the outflow of aqueous. Closed-angle glaucoma refers to narrowing of the space between the iris and cornea such that the trabecular meshwork gets hidden and isolated from the aqueous humor and its drainage is impeded. It can be further classified into acute (where a sudden closure of the angle and very high intraocular pressure compromising the optic nerve), subacute (where there are multiple intermittent self-resolving transient acute attacks leading to progressive damage of the angle and trabecular meshwork), or chronic (where the angle has closed due to permanent synechia between the iris and cornea or large areas of permanent damage to the trabecular meshwork causing a chronically raised intraocular pressure). A detailed classification includes many special forms of glaucoma and is beyond the scope of this paper.

### Clinical Features

The clinical features of glaucoma vary from an absolutely silent eye to an acutely red painful eye.<sup>(9)</sup> Open-angle glaucoma is a silent disease where the patient does not have any symptoms and the signs need to be carefully looked for, else the disease may not be diagnosed. In this case, the visual acuity is usually preserved till late and the intraocular pressure does not become very high usually remaining in the 20–30 mm Hg level. Such patients usually have nonspecific ophthalmic complaints and are mostly diagnosed incidentally during an ophthalmic evaluation. The signs include optic nerve head cupping and thinning of the neuro-retinal rim. Classic defects in the visual field develop over time and hence visual field examination forms a prominent portion of the evaluation.

Angle closure glaucoma can present as an acute attack which entails the presence of a red painful eye with blurred vision and a raised intraocular pressure in the range of 40–50 mm Hg. This form of glaucoma is an ophthalmic emergency since it can cause blindness in a matter of hours. Subacute angle closure glaucoma presents as transient episodes red painful vision loss and colored halos around lights, usually in the evening which resolve spontaneously on sleep. Chronic angle closure glaucoma presents primarily with vision loss and a dull eye ache owing to the persistently raised intraocular pressure. Examination reveals a shallow anterior chamber with intraocular pressure in the late 20s to 30s mm Hg range, iris atrophy, and evidence of synechia between the iris and cornea. There are usually more advanced visual field defects than open-angle glaucoma and the angle closure glaucomas are more likely to cause blindness than open-angle glaucomas.

Glaucoma is more prevalent in middle aged to elderly population and family history is a major risk factor.

It is estimated that the chances of having glaucoma are around 10 times higher in first-degree relatives of glaucoma patients. The important risk factors for glaucoma are raised IOP, high degree of refractive errors, hypotension and hypertension, use of corticosteroids, diabetes, and smoking.

### Management

The most important goal of managing a case of glaucoma is prevention of blindness. There are certain important aspects that need to be examined before treatment of glaucoma is planned. The first of these is the presence of systemic risk factors. Various systemic risk factors have been determined but the most important ones are hypertension and cardiac disease. It is therefore important to look for these and manage them. The second important aspect is the extent of damage which is determined by the degree of optic neuropathy and visual field defects. Next, the patient's age is important as the therapy will be more aggressive in younger patients than in older patients in view of life expectancy. Finally, the ability of a patient to comply with medical treatment and access to healthcare will determine the line of management.

Therapeutic options available for glaucoma include medical management or surgical management. Medical management includes the use of drugs such as alpha-agonists, beta-blockers and carbonic anhydrase inhibitors which reduce the production of aqueous humor or cholinergic agonists and prostaglandin analogues which increase the aqueous outflow. Another group of drugs include hyperosmotics such as oral glycerol or intravenous mannitol which dehydrate the vitreous to decrease intraocular pressure. Drugs for glaucoma need to be taken life-long and regular follow-up with an ophthalmologist is needed to continuously modify the therapy for maximum effect. The other aspect of medical management include lasers and the most important laser procedure includes the laser iridotomy, which is the creation of a hole in the peripheral iris to allow an alternate pathway for aqueous to flow from the posterior chamber to the anterior chamber and prevent pupillary block in cases of angle closure glaucoma. Various other laser procedures include laser iridoplasty and trabeculoplasty done primarily for open-angle glaucoma.

The mainstay of surgical management is the trabeculectomy surgery where an ostium is made in the sclera to allow direct drainage of aqueous into the subconjunctival space thereby bypassing the trabecular meshwork. Other surgical modalities include the use of drainage devices such as valves or tubes. Surgical therapy is indicated in cases where the intraocular pressure is not controlled on maximal medical therapy

or the patient is noncompliant to medical therapy or unable to tolerate medications.

### Role of Community Medicine

Community level screening and identification of glaucoma at an early stage are still a challenging task for the ophthalmologist and public health specialist. The validity of the screening tests both IOP and ophthalmoscopy has been considered low both in terms of sensitivity and specificity. It is not feasible to conduct visual field examination at community level due to high cost and long time taken in conducting the test. Screening of family members of known glaucoma cases for IOP is considered as key strategy for identification of glaucoma cases. Government of India recommends the opportunistic screening model in which all 40+ population attending the eye OPD should be screened for glaucoma.

Glaucoma is included as one of the priorities among the avoidable blinding condition in the country under Vision 2020 Right to Sight India program. Elimination of glaucoma blindness is feasible only when adequate measures will be taken at all levels of services from the primary level to advanced tertiary level. At primary level General Practitioners and PMOAs should be trained for identification of glaucoma cases by history and IOP measurement. There is a need for a massive health education campaign for glaucoma awareness in the community. At secondary level, facilities should be available for diagnosis of glaucoma using applanation tonometry and visual fields along with the surgical or medical management of glaucoma. It is important that the patients should be motivated and guided for regular

follow-up and continuation of treatment. Complicated cases should be referred to tertiary level hospitals. At tertiary level more efforts are needed in strengthening the capacity building, and research and identification of cost-effective modalities for glaucoma screening and management. There should be a good referral linkage between different levels of services.

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