

Non-Glaucomatous Causes of Decreased Vision in Glaucoma

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ABSTRACT

Purpose: To determine the non-glaucomatous causes of decreased visual acuity in glaucoma patients presenting in the eye OPD of a tertiary care hospital.

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: Abbasi Shaheed Hospital from July 2019 to September 2020.

Methods: Patients above 18 years of age, visual acuity of less than 6/6 and diagnosed case of glaucoma were included in this study. Patients with congenital glaucoma and patients not willing to participate in the study were excluded. Detailed history was taken and ocular examination of the patient was done. Causes of decreased visual acuity were determined. Data was collected and analyzed on SPSS version 20.

Results: There were 369 glaucoma patients with a mean age of 58.2 ± 11.54 SD years. Males were 224 (60.4%), with mean duration of glaucoma as 5.4 ± 5.2 years. Primary open-angle glaucoma was seen in 209 (56.6%) and primary angle-closure glaucoma was in 96 (26%) of patients. Treatable causes were 119 (32.2%) and non-glaucomatous causes of decrease vision were 221 (59.9%). Glaucomatous optic atrophy was seen in 182 (49.3%) patients followed by cataract in 96 (26%). Patients with corneal pathologies were 38 (10.2%) and ARMD were 26 (7%).

Conclusion: The commonest cause of decreased visual acuity in glaucoma patients is irreversible glaucomatous optic atrophy. Age-related macular degeneration, corneal pathologies, and amblyopia also contribute to irreversibly decreased visual acuity in glaucoma patients. Reversible causes include cataract, refractive errors, cystoid macular edema and diabetic macular edema.

Key Words: Cataract, Glaucoma, Glaucomatous Optic Atrophy, Vision.

How to Cite this Article: Fasih U, Shahid E, Shaikh A. Non-Glaucomatous Causes of Decreased Vision in Glaucoma. *Pak J Ophthalmol.* 2021, **37 (2):** 228-233.

Doi: <http://doi.org/10.36351/pjo.v37i2.1193>

INTRODUCTION

Glaucoma is the second leading cause of blindness worldwide.¹ It affects 60 million people globally and is

responsible for 12% of global blindness.² Glaucoma is often known as "sneak thief of sight" because it generally presents without any symptoms. Visual acuity is not affected until and unless there is significant damage to the optic nerve. Several glaucoma patients present with decreased vision. Causes other than glaucoma e.g., cataract, uveitis, refractive errors, amblyopia, myopic degeneration, age-related macular degeneration, cystoid macular edema, Ischemic optic atrophy, corneal edema, opacity, diabetic and hypertensive retinopathy should also be considered for a cause of decreased visual acuity. It

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*Received: January 5, 2021
Accepted: February 10, 2021*

has been reported that decreased visual acuity among glaucoma patients might not be due to glaucoma itself.³ It could be caused by cataract, age-related macular degeneration (ARMD), vitreoretinal surgeries, retinal disorders, corneal pathologies and neuro-ophthalmological disorders.

The incidence of cataract and glaucoma increases with age and they can coexist in the elderly population. Glaucoma is more frequently associated with cataracts and there is an increased risk of developing cataracts in glaucoma patients.⁴ Uveitis can also lead to potentially blinding Glaucoma. Intraocular pressure (IOP) elevation in uveitis can be secondary to open-angle or angle-closure mechanisms or due to long-term corticosteroids use.⁵ The prevalence of glaucoma associated with uveitis varies but is estimated to be 10 to 20%. However, in severe chronic uveitis, it can be as high as 46%.⁶ A persistent rise in intra-ocular pressure can result in glaucomatous optic neuropathy, visual field loss, and a decrease in visual acuity.⁷ A study from Singapore had reported axial myopia as a potential risk factor for primary open-angle glaucoma.⁸

An important aspect of glaucoma patients is that central vision is preserved in these patients until the development of advanced glaucomatous optic atrophy. Most of the time reversible causes of decrease vision remain undiagnosed and neglected. These reversible causes need to be identified, evaluated, and managed accordingly. This will help to improve the quality of life and morbidity among glaucoma patients. The objective of this study was to determine the causes of decreased visual acuity in glaucoma patients presenting in the eye outpatient department of a tertiary care hospital.

METHODS

This was Descriptive Cross-Sectional study conducted in the Ophthalmology department of Abbasi Shaheed Hospital, Karachi. The study was conducted from July 2019 to September 2020. The approval from the Ethical Review Committee was taken. Adult patients above 18 years of age, visual acuity of less than 6/6, a diagnosed case of primary open-angle, primary angle-closure, secondary open-angle, and secondary angle-closure glaucoma, were included in this study. Patients with congenital glaucoma and patients not willing to participate in the study were excluded.

The calculated sample size was 369 using open Epi sample size calculator version 3 for demographic

studies. Keeping the population size 1,000,000, confidence interval of 95%, the margin of error 5%, and hypothesized frequency p (40) for cataract as the cause of decreased vision.³

Patients were registered through non-probability consecutive sampling technique from an outpatient department of Abbasi Shaheed Hospital, which is a tertiary care facility. Verbal informed consent was taken from every patient. A detailed history of the patient was taken including duration, decrease vision, treatment taken, and any systemic illness. A detailed ocular examination of the patient was done. Best-corrected visual acuity (BCVA) was assessed on Snellen's chart. Anterior segment was assessed on a slit lamp biomicroscope. Cornea was examined for corneal edema, bullae, opacity, and keratic precipitates. The anterior chamber was examined for its depth, inflammatory cells, and flare. Iris was examined for any signs of inflammation, granulomas, atrophy, anterior or posterior synechia, and neovascularization. Cataract was evaluated for its type and graded accordingly. Direct, indirect, and relative afferent pupillary defect were checked. Fundoscopy was done with a direct and indirect ophthalmoscope to evaluate the optic nerve head and nerve fiber layer for glaucomatous damage. Other than glaucomatous damage retina was examined for other pathologies including age-related macular degeneration, cystoid macular edema, clinically significant macular edema, presence of diabetic and hypertensive retinopathy. Intraocular pressure (IOP) was measured with the Goldman Applanation tonometer. Gonioscopy, perimetry and Optical Coherence Tomography were also done. Data was collected and analyzed on SPSS version 20. Means were calculated for numerical data like age, duration of glaucoma, and IOP. Frequencies were calculated for categorical variables including different types of glaucoma, laterality, reversible, irreversible, glaucomatous, and non-glaucomatous causes of decreased visual acuity.

Refractive error, cataract, cystoid macular edema were classified into reversible causes. Glaucomatous optic atrophy, age-related macular degeneration (ARMD), bullous keratopathy, amblyopia were classified into irreversible causes of decreased visual acuity as they could not be corrected by any surgical or medical intervention.

RESULTS

A total of 369 glaucoma patients were studied. The mean age was 58.2 ± 11.54 SD years. The minimum age of the patient in this study was 33 years and the maximum age was 76 years. There were 224 (60.4%) male patients. The mean duration of glaucoma was 5.4 years ± 5.2 SD. Mean IOP was 22.3 ± 11.6 SD mmHg. Primary open-angle glaucoma was seen in 209 (56.6%) and primary angle-closure glaucoma was in 96 (26%) patients. Reversible causes were seen in 119 (32.2 %) patients. Non-glaucomatous causes of decrease visual acuity were seen in 221 (59.9%) patients. Other demographic details are given in Table 1.

Table 1: Demographic features of the patients.

Variable	Frequency
Mean Age	58.2 \pm 11.54 years
Minimum age	33 years
Maximum age	76 years
Males	223 (60.4%)
Females	146 (39.6%)
Right eye	206 (55.8%)
Left eye	163 (44.2%)
Primary Open Angle Glaucoma	209 (56.6%)
Primary Closed Angle Glaucoma	96 (26%)
Secondary Open Angle Glaucoma	49 (13.3%)
Secondary Closed Angle Glaucoma	15 (4.1%)
Diabetes Mellitus	16 (4.3%)
Hypertension	20 (5.4%)
Mean Glaucoma Duration	5.4 \pm 5.2 SD years
Range of duration	1 month to 20 years
Mean IOP	22.3 \pm 11.6 SD mmHg
Range of IOP	10 to 60 mmHG
Reversible Causes	119 (32.2%)
Irreversible Causes	250 (67.8%)
Glaucomatous decreased vision	221 (59.9%)
Non-glaucomatous decreased vision	148 (40.1%)

Glaucomatous optic atrophy was the most frequent cause of decreased visual acuity seen in 182 (49.3%) patients followed by cataract in 96 (26%) patients. Patients with corneal pathologies were 38 (10.2%) and ARMD was 26 (7%). Other causes of decreased visual acuity are given in Table 2.

Figure 1 depicts the status of best-corrected visual acuity in glaucoma patients. Patients presenting with visual acuity between 6/60 and counting finger (CF) were 111 (30.1%). Patients with visual acuity between 6/18 to 6/36 were 94 (25.5%) and between 6/9 to 6/12 were 60 (16.3%). Patients with no light perception were 13 (3.5%). Patients with visual acuity of hand movement and less were 104 (28.2%). Graphical

representation of causes of decreased visual acuity at a glance is given in figure 2.

Table 2: Causes of Decreased Vision.

Causes of Decreased Vision	Frequency n (%)
Glaucomatous optic atrophy	182 (49.3%)
Cataract	96 (26%)
Corneal Pathologies	38 (10.2%)
ARMD	26 (7%)
Refractive error	12 (3.3%)
Cystoid Macular Edema	9 (2.20%)
Amblyopia	4 (1.10%)
Diabetic maculopathy	2 (0.5%)

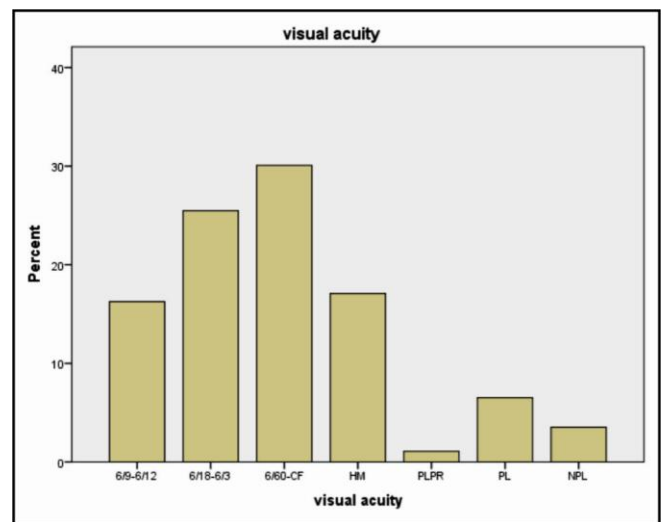


Fig. 1: Frequency of visual acuity in glaucoma patients given in percentages.

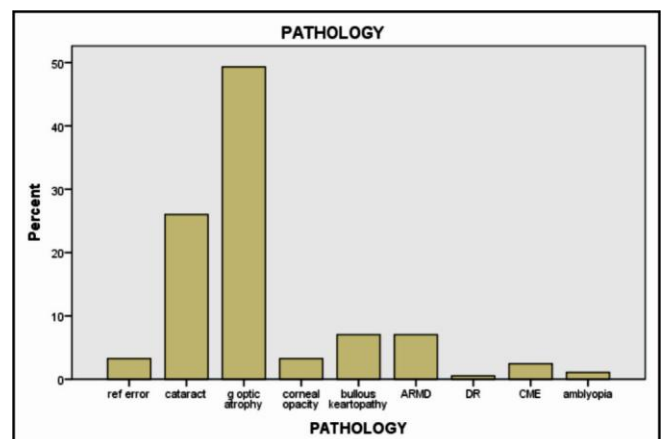


Fig. 2: Frequency of pathologies causing decrease vision in glaucoma patients.

DISCUSSION

This study was conducted to determine the common causes of decreased visual acuity in glaucoma patients. Our study included 369 patients diagnosed with different etiologies of glaucoma. The most frequent irreversible cause of decreased visual acuity in our study was glaucomatous optic atrophy, seen in 182 (49.3%) patients. More than half of the patients i.e. 67.8% in our study presented with irreversible causes and 59.9% of patients with glaucomatous causes of decreased visual acuity.

Optic nerve head is more susceptible to damage by raised intraocular pressure (IOP) due to the increased effect of shearing forces.⁹ There is greater susceptibility for glaucomatous optic nerve fiber loss in highly myopic eyes.¹⁰ Akhtar had reported 33% of glaucoma patients with advance glaucomatous damage at the initial presentation.¹¹ A study by N Ayachoua had reported visual loss with glaucomatous optic atrophy in 40% of patients.³ In Africa, up to 70% of glaucoma patients presented with advanced glaucomatous optic atrophy in better eye.¹² The frequency of glaucomatous optic atrophy was higher in our patients in comparison to other studies.^{3,11}

We included glaucoma patients with different etiologies, and the duration of the disease varied from recently diagnosed to 20 years. Initially, there is peripheral visual loss among glaucoma patients and central vision is preserved until the advanced stage of the disease. Patients usually complain of decreased vision, when central vision start to deteriorate and there is complete glaucomatous optic atrophy. Sometimes, instead of reporting these symptoms, the patients complain of blurred vision and increased requirement of light for work.¹³ Lack of awareness about the disease and poor socioeconomic conditions of the patients contribute to late presentation. This may be the possible reason that treatable and reversible causes of decreased vision in glaucoma patients remain undiagnosed, untreated and overlooked.

In our study, cataract was the cause of decreased visual acuity in 96 (26%) patients. In a study by N Ayachoua, 17% of cases of decreased vision were due to cataract.³ In another report it was 50.4%.¹⁴ Cataract is a common cause of decreased visual equity in the elderly and it is a common reversible cause of decreased visual acuity in glaucoma patients.¹⁵ Uveitis, pseudo exfoliation, acute angle-closure glaucoma, trabeculectomy, laser treatment, and steroids in any

form can accelerate cataract formation.¹⁶ Even though the central vision is improved by cataract surgery, the damaged areas of the visual field due to glaucoma cannot be reversed. Any surgical intervention in advance glaucoma increases the risk of damage to remaining nerve fibers called snuff out.¹⁶

Age-related macular degeneration (ARMD) was seen in 26 (7%) patients. Literature shows that primary open-angle glaucoma patients have a significantly higher prevalence of retinal comorbidities as compared to other types of glaucoma.¹⁷ Periodic ocular examination in glaucoma patients must be carried out for the detection of such diseases as early ARMD. N Ayachoua reported acquired retinal disorders in 10% of patients in their study.³

Decreased visual acuity due to corneal pathologies was seen in 38 (10.2%) patients, among them bullous keratopathy caused decreased visual acuity in 26 (7%) patients in our study. Another study reported corneal pathologies in 4.5% of patients.³ A persistent rise in IOP causes failure of the barrier function of the endothelium and the development of bullous keratopathy. It then leads to a significant decrease in visual acuity.

Refractive errors were seen in 12 (3.3%) patients in our study out of which 8 (2.1%) patients were myopic and 4 (1.2%) were hypermetropic. The association between refractive error and glaucoma had been investigated and reported in other studies as well.¹⁸ A study from Singapore had reported population-attributable risk of POAG associated with myopia in 14.6% and for moderate or high myopia in 5.5% of cases.¹⁹ Kargi et al had reported, moderate to high myopia correlated with a high risk of primary open-angle glaucoma (POAG), low-tension glaucoma, and ocular hypertension.²⁰ Associations in our patients with refractive errors cannot be calculated because of small sample size.

Amblyopia was seen in 4 (1.10%) patients in our study. We had included adult patients above 18 years of age. Kargi et al had reported poor visual acuity in 47% of childhood glaucoma.²⁰ Amblyopia and glaucomatous optic damage were reported to be the most frequent cause of decreased vision in their study. We observed that 16.3% patients had visual acuity of 6/9-6/12, 25.5% patients had 6/18-6/36, 30.1% patients had 6/60, and counting finger, and 17.1% patients presented with hand movements. No Perception of light was seen in 3.5% of our patients.

Meher had reported 45.2% of patients with best-corrected visual acuity between 6/6-6/18, 35.45% patients with 6/18-6/60 and 2.01% patients between 6/60- 3/60.²¹ In our study 228 (61.8%) patients had visual acuity of 6/60 or less and 49.3% of them were with advanced glaucomatous optic atrophy. One of the hospital-based studies by Akhtar¹¹ had reported 40.6% of their patients had Visual Acuity of 3/60 in one eye at the time of presentation.

Primary open-angle glaucoma was the most frequent type of glaucoma, seen in 209 (56.6%) patients in our study. This was followed by Primary Angle-closure glaucoma (PACG) in 96 (26%) of patients. Meher had reported POAG in 41.6%, PACG in 30.7%, and secondary glaucoma in 22.8% of his patients attending glaucoma clinic.²¹

Irreversible causes of decrease visual acuity were found among 250 (67.8%) patients while reversible causes were found among 119 (32.3%) patients in our study. Irreversible causes are significantly high and alarming. In one of the studies, 30% of people were already blind from glaucoma in both eyes at presentation.²² Cataract is on top of the list among reversible causes followed by refractive errors in our study. If we treat these reversible causes timely, it will significantly improve the morbidity of glaucoma patients.

Population awareness and screening programs regarding glaucoma should be implemented by government and non-government organizations to reduce the burden of glaucoma in our population. The general population should be encouraged for regular eye examinations. Early diagnosis, timely management of the disease itself and associated reversible factors of decrease vision will definitely improve the quality of life of glaucoma patients. Only then we will be able to combat the silent thief of vision.

The limitation of this study was its cross-sectional study design. Further studies are needed to see the effect of managing non-glaucomatous factors on visual acuity and to see the impact on the quality of life of glaucoma patients after treating reversible causes.

CONCLUSION

The commonest cause of decreased visual acuity in glaucoma patients is irreversible glaucomatous optic atrophy. Age-related macular degeneration, corneal pathologies, and amblyopia also contribute to

irreversibly decreased visual acuity in glaucoma patients. Reversible causes include cataract, refractive errors, cystoid macular edema and diabetic macular edema.

Ethical Approval

The study was approved by the Institutional review board/ Ethical review board. (021/19)

Conflict of Interest

Authors declared no conflict of interest

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Authors' Designation and Contribution

Uzma Fasih; Associate Professor: *Concepts, Design, Literature search, Data acquisition, Manuscript preparation, Manuscript editing, Manuscript review.*

Erum Shahid; Assistant Professor: *Concepts, Design, Literature search, Data analysis, Statistical analysis, Manuscript editing, Manuscript review.*

Arshad Shaikh; Professor: *Concepts, Design, Literature search, Manuscript review.*

