



TO EVALUATE THE DEMOGRAPHIC, SYSTEMIC, AND OCULAR RISK FACTORS ASSOCIATED WITH PHACOMORPHIC GLAUCOMA IN EASTERN UTTAR PRADESH

Ophthalmology

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ABSTRACT

Background: Phacomorphic glaucoma is an acute secondary angle-closure glaucoma caused by an intumescent cataractous lens, leading to rapid elevation of intraocular pressure (IOP) and potential irreversible vision loss. Despite advances in cataract surgery, it remains prevalent in developing countries due to delayed presentation and socioeconomic barriers. **Aim:** To evaluate the demographic, systemic, and ocular risk factors associated with phacomorphic glaucoma in a tertiary care setting in eastern Uttar Pradesh. **Methods:** This retrospective case-control study included 80 subjects (80 eyes), comprising 40 cases of phacomorphic glaucoma and 40 age- and sex-matched controls with senile cataract without glaucoma. Data on demographic characteristics, systemic comorbidities, and ocular parameters were collected. Biometric measurements included anterior chamber depth (ACD) and axial length. Statistical analysis was performed using t-tests and chi-square tests, with $p < 0.05$ considered significant. **Results:** The mean age of cases and controls was comparable (63.9 ± 6.8 vs. 63.5 ± 6.6 years; $p = 0.78$), with a female predominance in both groups (80%). Cases presented with significantly poorer visual acuity ($\leq$ counting fingers in 80% vs. 25%; $p < 0.001$) and markedly elevated IOP (42.6 ± 8.4 mmHg vs. 14.8 ± 3.2 mmHg; $p < 0.001$). Biometric analysis showed significantly shallower ACD (1.78 ± 0.32 mm vs. 2.65 ± 0.41 mm; $p < 0.001$) and shorter axial length (22.1 ± 0.9 mm vs. 22.8 ± 1.0 mm; $p = 0.02$) in cases. Low socioeconomic status was significantly associated with phacomorphic glaucoma (70% vs. 40%; $p = 0.01$). Systemic comorbidities did not show a significant association. **Conclusion:** Phacomorphic glaucoma is strongly associated with shallow anterior chamber depth, shorter axial length, and elevated IOP, with socioeconomic factors playing a significant contributory role. Early identification of at-risk individuals and timely cataract surgery are crucial to prevent this avoidable cause of blindness.

KEYWORDS

Phacomorphic Glaucoma, Intraocular Pressure, Anterior Chamber Depth, Axial Length, Socioeconomic Status, Cataract

INTRODUCTION

Phacomorphic glaucoma is an acute, vision-threatening form of secondary angle-closure glaucoma caused by an intumescent cataractous lens. Progressive lens swelling induces pupillary block and anterior displacement of the iris-lens diaphragm, resulting in shallowing of the anterior chamber and obstruction of aqueous outflow. Clinically, it presents with severe ocular pain, conjunctival congestion, corneal edema, dilated pupil, markedly elevated intraocular pressure (IOP), and profound visual impairment. If not treated promptly, sustained elevation of IOP can lead to irreversible optic nerve damage and permanent visual loss [1,2].

Despite advances in cataract surgery, phacomorphic glaucoma continues to be encountered frequently in developing countries such as India, where delayed presentation of cataract remains common. Socioeconomic barriers, limited access to ophthalmic care, old misconceptions and lack of awareness contribute to the persistence of advanced or mature cataracts, thereby increasing the risk of lens-induced glaucomas [1]. The burden is further amplified in resource-limited settings, where delayed surgical intervention is more prevalent. The pathogenesis of phacomorphic glaucoma is multifactorial, involving both anatomical and clinical determinants. Ocular biometric factors such as shallow anterior chamber depth, shorter axial length, and increased lens thickness contribute to anterior segment crowding and predispose to angle closure [3, 4]. Previous analytical studies have demonstrated the role of these biometric parameters in the development of phacomorphic glaucoma [5].

More recent Indian data have further reinforced the role of ocular biometry, demonstrating that eyes with phacomorphic glaucoma have significantly shorter axial length and markedly elevated IOP compared to those with uncomplicated mature cataract [6].

A key gap in the literature is the lack of analytical studies that integrate demographic, systemic, and ocular parameters within a comparative framework. A clearer understanding of these determinants is essential for early identification of at-risk individuals and timely surgical intervention. Therefore, the present study was designed to evaluate the demographic, systemic, and ocular risk factors associated with phacomorphic glaucoma using a retrospective case-control approach in patients in eastern Uttar Pradesh.

MATERIALS AND METHODS

This retrospective case-control study was conducted in the Department of Ophthalmology at Maharshi Devraha Baba Autonomous Medical College, Deoria after obtaining approval from the Institutional Ethics Committee. The study adhered to the tenets of the Declaration of Helsinki. Consent was taken from all the patients.

A total of 80 subjects (80 eyes) were included and divided into two groups: 40 cases and 40 controls. The case group comprised patients diagnosed with phacomorphic glaucoma based on clinical findings, including acute onset ocular pain, redness, diminished vision, dilated non reacting pupil, presence of an intumescent cataract, shallow anterior chamber, and elevated intraocular pressure (above 21 mmHg). The control group included age- and sex-matched patients with mature or senile cataract without any evidence of glaucoma or secondary angle closure, presenting during the same study period.

Inclusion criteria for cases were patients with a definitive clinical diagnosis of phacomorphic glaucoma and availability of complete medical records. Controls were selected from patients with cataract who did not have raised IOP or glaucomatous changes.

Exclusion criteria for both groups included a history of previous intraocular surgery, traumatic cataract, lens subluxation or dislocation, uveitis, primary angle-closure glaucoma, or any other form of secondary glaucoma.

Data was taken from hospital medical records including demographic variables (age, gender), systemic comorbidities (diabetes mellitus, hypertension), and ocular parameters. Ocular evaluation included presenting visual acuity, slit-lamp examination findings, and intraocular pressure measured using non-contact tonometry.

Biometric parameters included axial length and anterior chamber depth, measured using A-scan ultrasonography. Parameters of the fellow eye was also noted.

All cases received initial medical management for control of IOP, followed by definitive surgical management in the form of cataract extraction once the eye was stabilized.

Statistical analysis was performed using standard statistical software. Continuous variables were expressed as mean $\pm$ standard deviation (SD) and compared between groups using the independent samples t-test. Categorical variables were expressed as frequencies and percentages and analyzed using the chi-square test or Fisher's exact test as appropriate. The strength of association between potential risk factors and phacomorphic glaucoma was assessed using odds ratios (OR) with 95% confidence intervals (CI). A p-value of <0.05 was considered statistically significant.

RESULT

A total of 80 subjects (80 eyes) were included in the study, comprising 40 cases with phacomorphic glaucoma and 40 controls with mature cataract. The two groups were comparable with respect to age, with a mean age of 63.9 ± 6.8 years in cases and 63.5 ± 6.6 years in controls ($p = 0.78$). A female predominance was observed in the study population, with 32 (80%) females in each group, reflecting the demographic profile of patients presenting with advanced cataract in this setting. At presentation, visual acuity was significantly worse in the case group, with 32 (80%) eyes having visual acuity $\leq$ counting fingers close to face, compared to 10 (25%) in the control group ($p < 0.001$). A significantly higher proportion of patients in the case group belonged to low socioeconomic status (28 [70%] vs. 16 [40%], $p = 0.01$). Systemic comorbidities such as diabetes mellitus and hypertension were more frequent among cases but did not show statistical significance ($p > 0.05$) (Table 1).

Table 1: Baseline demographic and Clinical details

Parameter	Cases (n = 40)	Controls (n = 40)	p-value
Age (years, mean $\pm$ SD)	63.9 ± 6.8	63.5 ± 6.6	0.78
Gender (Female), n (%)	32 (80%)	32 (80%)	1.00
Visual acuity $\leq$ CF, n (%)	32 (80%)	10 (25%)	<0.001
Diabetes mellitus, n (%)	14 (35%)	10 (25%)	0.33
Hypertension, n (%)	16 (40%)	12 (30%)	0.34
Low socioeconomic status, n (%)	28 (70%)	16 (40%)	0.01

The mean intraocular pressure (IOP) in the case group was 42.6 ± 8.4 mmHg, which was markedly higher than that in controls (18.8 ± 3.2 mmHg, $p < 0.001$). On biometric evaluation, the anterior chamber depth (ACD) was significantly shallower in cases (1.78 ± 0.32 mm) compared to controls (2.65 ± 0.41 mm, $p < 0.001$). The axial length was also significantly shorter in the case group (22.1 ± 0.9 mm) compared to controls (22.8 ± 1.0 mm, $p = 0.02$) (Table 2).

Table 2: Ocular Parameters

Parameter	Cases (n = 40)	Controls (n = 40)	p-value
IOP (mmHg, mean $\pm$ SD)	42.6 ± 8.4	18.8 ± 3.2	<0.001
Anterior chamber depth (mm, mean $\pm$ SD)	1.78 ± 0.32	2.65 ± 0.41	<0.001
Axial length (mm, mean $\pm$ SD)	22.1 ± 0.9	22.8 ± 1.0	0.02

On univariate analysis, elevated IOP (>21 mmHg), shallow anterior chamber depth (<2.0 mm), shorter axial length (<22.5 mm), and low socioeconomic status were significantly associated with phacomorphic glaucoma ($p < 0.05$).

DISCUSSION

The present study evaluated the demographic, socioeconomic, and ocular risk factors associated with the development of phacomorphic glaucoma in a tertiary care setting. The findings show a relation between anatomical predisposition, delayed presentation, and socioeconomic determinants in the pathogenesis of this condition.

A female predominance (80%) was observed in both cases and controls. Although gender was matched and not found to be an independent risk factor, this trend reflects the higher burden of advanced cataract among women in developing countries. Similar observations have been reported in Indian studies, where gender disparities in healthcare access contribute to delayed cataract surgery among women. Angra et al. also highlighted that sociocultural barriers often result in late presentation in female patients with lens-induced glaucomas [1].

The present study demonstrated significantly worse visual acuity at presentation in the case group, with 80% of patients presenting with

vision $\leq$ counting fingers close to face. This finding is consistent with earlier studies by Jain et al., who reported poor presenting vision in phacomorphic glaucoma due to delayed presentation [2]. Likewise, Pradhan et al. observed that prolonged symptom duration was associated with advanced disease and poorer visual outcomes, emphasizing the importance of early intervention [7].

A key feature of the present study was the marked elevation of intraocular pressure (IOP) in cases compared to controls. Similar findings have been consistently reported in the literature. Lee et al. demonstrated significantly elevated IOP in phacomorphic glaucoma and identified it as a major determinant of optic nerve damage [5]. The study by Kumar and Gupta done in Jhansi also reported comparable findings, reinforcing the role of acute IOP elevation as a hallmark of the disease [6].

Biometric analysis in the present study revealed that anterior chamber depth (ACD) was significantly shallower in cases. This is in agreement with studies by Nongpiur et al. [4], which emphasized the importance of anterior segment crowding in angle-closure mechanisms. Similarly, Salmon et al. [3] reported that shallow anterior chambers are a major anatomical risk factor for angle closure in susceptible individuals. These findings collectively support the concept that reduced anterior chamber depth predisposes to pupillary block in the presence of a swollen lens.

The present study also found that axial length was significantly shorter in cases compared to controls. This observation is consistent with the findings of Lee et al [5], who reported shorter axial length as a significant risk factor for phacomorphic glaucoma. The study by Kumar and Gupta [6] further corroborated this association, demonstrating reduced axial length in affected eyes. Shorter axial length contributes to a crowded anterior segment, thereby increasing the risk of angle closure.

An important contribution of the present study is the identification of low socioeconomic status (SES) as a significant risk factor (OR: 3.5, $p = 0.01$). This finding highlights the role of social determinants in disease occurrence. Patients from lower socioeconomic areas often experience delays in accessing cataract surgery due to financial constraints, limited awareness, and reduced healthcare accessibility. Similar observations have been made in population-based studies on cataract blindness in India, which emphasize socioeconomic disparities as a key contributor to delayed treatment [1].

Systemic comorbidities such as diabetes mellitus and hypertension were more frequent in cases but did not show statistical significance. This is consistent with previous studies, including Lee et al. [5], which suggest that systemic conditions may coexist but do not play a direct causal role in the development of phacomorphic glaucoma.

Among all evaluated variables, elevated IOP and shallow anterior chamber depth demonstrated the strongest association with phacomorphic glaucoma, reinforcing their central role in disease pathogenesis.

The strengths of this study include its case-control design and the inclusion of both ocular and socioeconomic parameters, allowing for a more comprehensive assessment of risk factors. Compared to previous studies, which often focused solely on biometric variables, the present study provides a broader perspective by incorporating social determinants of health.

However, certain limitations must be acknowledged. The retrospective design introduces the possibility of selection bias, and the relatively small sample size may limit the generalizability of the findings. In addition, the absence of multivariate analysis restricts the ability to identify independent predictors after adjusting for confounding variables.

CONCLUSION

In conclusion, the present study reaffirms that phacomorphic glaucoma is strongly associated with anatomical factors such as shallow anterior chamber depth and shorter axial length, while also highlighting the significant influence of socioeconomic status on disease occurrence. Early detection and timely cataract surgery, particularly in underserved populations, are essential to prevent this avoidable cause of blindness.

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