



DETERMINANTS OF MODERATE-TO-SEVERE VISUAL IMPAIRMENT AMONG CATARACT PATIENTS ATTENDING A TERTIARY CARE CENTER IN WESTERN UTTAR PRADESH

Ophthalmology

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KEYWORDS

INTRODUCTION

Cataract remains a major cause of avoidable visual impairment and blindness worldwide, particularly in low- and middle-income countries where delayed presentation, limited awareness, and unequal access to surgical services continue to contribute to advanced disease burden [1-3]. It is characterized by opacification of the crystalline lens, leading to progressive blurring of vision, glare, difficulty in night vision, and, in advanced stages, functional blindness [4, 6]. In India, cataracts continue to be one of the leading contributors to blindness and visual impairment despite sustained national blindness control initiatives [7,8]. Increasing age, socioeconomic limitations, occupational sunlight exposure, systemic comorbidities, and delayed health-seeking behavior may influence the severity of visual disability [5, 7]. Western Uttar Pradesh represents an important region for studying this pattern because tertiary care centers often receive patients with varying stages of cataract-related visual impairment. The severity of visual impairment among cataract patients may be influenced by multiple factors, including age, gender, diabetes mellitus, hypertension, tobacco use, prolonged sunlight exposure, steroid use, and cataract morphology [5,9,11-15]. Different morphological types of cataracts, such as nuclear, cortical, and posterior subcapsular cataracts, may have variable effects on visual function [5, 10, 13]. The present study was conducted to assess the determinants of moderate-to-severe visual impairment among cataract patients attending a tertiary care center in Western Uttar Pradesh.

Aim

To assess the severity of visual impairment and its associated determinants among cataract patients attending a tertiary care center in Western Uttar Pradesh.

Objectives

1. To determine the proportion of moderate-to-severe visual impairment among cataract patients.
2. To assess the association of moderate-to-severe visual impairment Sample Size Calculation and Sampling Technique

For the purpose of sample size adequacy, the minimum required sample size was calculated using the formula for estimating a single proportion:

$$n = \frac{Z^2 pq}{d^2}$$

Where,

n =minimum required sample size

$Z=1.96$ at 95% confidence level,

$p=50\%=0.50$

expected proportion of moderate-to-severe visual impairment among cataract patients,

$q=1-p=0.50$

and,

$d=2\%=0.02$

absolute precision.

Substituting the values:

$$n = \frac{(1.96)^2 \times 0.50 \times 0.50}{(0.02)^2}$$

$$n = \frac{3.8416 \times 0.25}{0.0004}$$

$$n = 2401$$

Thus, the required sample size is $n = 2401$.

Methods and Tools for Data Collection-Data were collected using a **pre-designed structured proforma** from eligible consenting patients attending the Ophthalmology OPD of a tertiary care centre in Western Uttar Pradesh. Information regarding age, gender, residence, socioeconomic status, systemic illnesses, tobacco use, sunlight exposure, steroid use, ocular trauma and family history of cataract was recorded. Visual acuity was assessed using **Snellen's chart**, and visual impairment was classified as normal, mild, moderate or severe. Detailed ophthalmic examination was performed by **slit-lamp biomicroscopy**, and cataract was diagnosed and graded using the **Lens Opacities Classification System III (LOCS III)** [13]. Cataract morphology was categorized as nuclear, cortical, posterior subcapsular or mixed type. Dilated fundus examination and intraocular pressure measurement were performed wherever required. The main outcome variable was **moderate-to-severe visual impairment**, while independent variables included sociodemographic, systemic, lifestyle-related, ocular, and cataract morphology factors. Data were entered in **Microsoft Excel** and analyzed using **Jamovi** software.

Ethical Clearance: The study was conducted after obtaining ethical clearance from the Institutional Ethics Committee of the concerned tertiary care center. Ethical Clearance Certificate No.: . Informed consent was obtained from all eligible participants before enrolling in the study.

STATISTICAL ANALYSIS-

Table 1: Proportion of Moderate-to-Severe Visual Impairment—

Visual Impairment	Frequency	Percentage
Normal	606	25.24
Mild	621	25.86
Moderate	579	24.11
Severe	595	24.78

Moderate-to-severe visual impairment was present in 1174 / 2401 = **48.90%**, 95% CI: **46.90%–50.90%**.

Table 2: Association of moderate-to-severe visual impairment with age, gender, residence, and socioeconomic status

Variable	Chi-square	df	p-value
Age group	1.022	3	0.7959
Gender	0.487	1	0.4853
Residence	0.576	1	0.4478
Socioeconomic status	0.818	2	0.6644
Diabetes mellitus	2.757	1	0.0968
Hypertension	0.238	1	0.6257
Tobacco use	0.553	1	0.4570
Sun exposure	1.013	1	0.3141
Steroid use	0.792	1	0.3735

RESULTS

A total of **2401 cataract patients** were included in the study. Among them, **606 (25.24%)** had normal vision, **621 (25.86%)** had mild visual impairment, **579 (24.11%)** had moderate visual impairment, and **595 (24.78%)** had severe visual impairment. Overall, **1174 patients (48.90%)** had moderate-to-severe visual impairment, with a **95%**

confidence interval of 46.90%–50.90%.

On association analysis, none of the studied determinants showed a statistically significant association with moderate-to-severe visual impairment. Age group ($\chi^2 = 1.022$, $df = 3$, $p = 0.7959$), gender ($\chi^2 = 0.487$, $df = 1$, $p = 0.4853$), residence ($\chi^2 = 0.576$, $df = 1$, $p = 0.4478$), and socioeconomic status ($\chi^2 = 0.818$, $df = 2$, $p = 0.6644$) were not significantly associated with the outcome. Similarly, systemic and lifestyle-related factors including diabetes mellitus ($\chi^2 = 2.757$, $df = 1$, $p = 0.0968$), hypertension ($\chi^2 = 0.238$, $df = 1$, $p = 0.6257$), tobacco use ($\chi^2 = 0.553$, $df = 1$, $p = 0.4570$), sun exposure ($\chi^2 = 1.013$, $df = 1$, $p = 0.3141$), and steroid use ($\chi^2 = 0.792$, $df = 1$, $p = 0.3735$) also did not show statistically significant associations with moderate-to-severe visual impairment.

Thus, nearly half of the cataract patients presented with moderate-to-severe visual impairment; however, no statistically significant association was observed between moderate-to-severe visual impairment and the assessed sociodemographic, systemic, or lifestyle-related determinants.

DISCUSSION

In the present study, **48.90%** of cataract patients had moderate-to-severe visual impairment, indicating that nearly half of the patients presented with clinically important visual limitation. This finding reinforces cataract as an important cause of avoidable visual impairment in hospital-attending patients. WHO and Indian studies have highlighted similar public health importance, reporting cataracts as a major contributor to blindness and visual impairment. However, the proportion observed in the present study is expected to be higher than community-based estimates because this study included only diagnosed cataract patients attending a tertiary care centre. In the present study, sociodemographic variables such as **age group, gender, residence, and socioeconomic status** were not significantly associated with moderate-to-severe visual impairment. This differs from population-based findings reported by Vashist *et al.* and Singh *et al.*, where increasing age, illiteracy, and lower socioeconomic status were identified as important factors associated with blindness or cataract. This difference may be due to variation in study design and outcome assessment; those studies evaluated cataract or blindness in the general population, whereas the present study assessed severity of visual impairment among patients already diagnosed with cataract. Systemic and lifestyle-related variables, including **diabetes mellitus, hypertension, tobacco use, sun exposure, and steroid use**, also did not show statistically significant association with moderate-to-severe visual impairment. Diabetes mellitus showed the lowest p-value among these variables but remained statistically non-significant. Earlier literature associates diabetes, ultraviolet exposure, smoking, and drug-related factors with cataract development or specific cataract morphology, contrasting with these findings. Thus, the present study suggests that although these factors may contribute to cataract occurrence, they may not necessarily determine the severity of visual impairment among patients once cataract has already developed.

CONCLUSION

The present hospital-based cross-sectional study found that **nearly half of the cataract patients had moderate-to-severe visual impairment**, with an observed proportion of **48.90%**. This indicates a substantial burden of clinically significant visual impairment among cataract patients attending the tertiary care centre.

No statistically significant association was observed between moderate-to-severe visual impairment and the assessed determinants, including **age group, gender, residence, socioeconomic status, diabetes mellitus, hypertension, tobacco use, sun exposure, and steroid use**. These findings suggest that, in this study population, the severity of visual impairment among cataract patients was not independently explained by the selected sociodemographic, systemic, or lifestyle-related factors.

Therefore, early detection, timely referral, and prompt surgical evaluation remain essential to reduce cataract-related visual impairment, irrespective of patients' sociodemographic or clinical background.

Limitations

The present study was **hospital-based** and included only cataract patients attending a tertiary care centre; therefore, the findings may not

be fully generalizable to the community or to patients who do not seek hospital-based eye care. Since the study was **cross-sectional** in design, causal relationships between the assessed determinants and moderate-to-severe visual impairment could not be established.

The analysis was limited to selected sociodemographic, systemic, and lifestyle-related variables such as age, gender, residence, socioeconomic status, diabetes mellitus, hypertension, tobacco use, sun exposure, and steroid use. Other important factors such as duration of symptoms, cataract maturity, literacy status, awareness regarding cataract surgery, delay in health seeking, distance from health facility, financial constraints, and access to surgical services were not assessed in detail.

Finally, none of the studied variables showed a statistically significant association with moderate-to-severe visual impairment, suggesting that unmeasured clinical, behavioural, or health-system-related factors may have influenced the severity of visual impairment among cataract patients at presentation.

Suggestions

Early screening and timely referral of cataract patients should be strengthened at the **primary and secondary health-care levels** so that patients can be evaluated and operated on before progressing to moderate-to-severe visual impairment. Since nearly half of the patients in the present study had moderate-to-severe visual impairment, routine opportunistic screening in OPD, community eye camps, and active referral linkage with tertiary eye-care services should be encouraged.

Health education activities should focus on increasing awareness about **early symptoms of cataract, availability and safety of cataract surgery, and the importance of early consultation**. Although age, gender, residence, socioeconomic status, diabetes mellitus, hypertension, tobacco use, sun exposure, and steroid use were not significantly associated with moderate-to-severe visual impairment in this study, elderly individuals and patients with systemic illnesses should still be prioritized for regular eye examination because they remain clinically important risk groups.

Future studies should include additional factors such as **duration of symptoms, cataract maturity, literacy status, awareness level, distance from health facility, financial barriers, delay in health-seeking, and access to surgical services**. Community-based and multicentric studies are also recommended to generate more generalizable evidence regarding determinants of cataract-related visual impairment.

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