

Pattern of Corneal Disorders at a Tertiary Care Centre in Amritsar, Punjab, India: A Cross-sectional Study

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ABSTRACT

Introduction: Corneal disease is the fifth leading cause of blindness in the world. The burden of corneal blindness is higher in developing countries like India, where corneal opacity contributes to 8.2% of the blind population. It is estimated that approximately 25,000 new cases of corneal blindness arise each year in India.

Aim: To determine the pattern of corneal disorders at a tertiary care centre in North India.

Materials and Methods: This was a cross-sectional descriptive study conducted at the Regional Institute of Ophthalmology in Amritsar, Punjab, a tertiary care Institute in North India based on data from patients diagnosed with corneal pathology collected between July 2022 and June 2023. A standardised proforma was filled out for each patient. Information recorded included demographic characteristics, place of residence, presenting visual acuity, duration between the onset of symptoms and presentation at the clinic and final diagnosis. The data obtained were compiled in tabulated form using Microsoft Office Excel and the results were expressed as numbers and percentages.

Results: A total of 2,535 patients (2,670 eyes) diagnosed with varying forms of corneal disorders were evaluated over a one-year period, accounting for 7.24% of the total 35,000 new patients seen. Males outnumbered females with a ratio of 2:1. The peak age of presentation was between 31 and 40 years, with a median age of 37 years. Patients engaged in agricultural activities constituted the largest group at about 49%. Pterygium (36.92%) and infectious keratitis (24.62%) were the major causes of corneal disorders among the patients. Approximately, 541 (20%) eyes presented with a visual acuity of less than 3/60. The majority of patients 1,747 (68.9%) were from rural areas.

Conclusion: More than one-third of the eyes had severe visual impairment or blindness at presentation. Pterygium, infectious keratitis, corneal degeneration and foreign bodies were the main causes of corneal pathology found in the present study. A significant number of patients presented more than two weeks after the onset of symptoms, highlighting the importance of early referral to eye care facilities.

Keywords: Blindness, Bullous keratopathy, Corneal disease, Corneal opacities, Keratitis

INTRODUCTION

Corneal disease is the fifth leading cause of blindness in the world, following cataract, refractive error, glaucoma and age-related macular degeneration [1]. According to a meta-analysis on global trends in blindness and visual impairment from 1984 to 2020, 5.5 million people worldwide are bilaterally blind, while 6.2 million are unilaterally blind due to corneal opacities [2].

The burden of corneal blindness is higher in developing countries like India. The countrywide prevalence of blindness and visual impairment in India is estimated to be 0.36% and 5.47%, respectively. Corneal opacity has been recorded as the second major cause of blindness, after cataract, contributing to 8.2% of the blind population in India [3]. It is estimated that about 25,000 new cases of corneal blindness arise each year in India. Major causes of corneal blindness include corneal ulcers, ocular trauma, trachoma, Post-surgical Bullous Keratopathy (PBK), corneal degeneration and vitamin A deficiency [4].

The causes of corneal blindness may vary in different regions depending on local climate and occupational diversity. A brief report from Punjab published in 1982 indicated that the incidence of corneal diseases was 11.96% [5]. Since then, with significant improvements in healthcare facilities and the establishment of the Regional Institute of Ophthalmology at Amritsar, this number is expected to have changed, presenting new challenges that need to be addressed. A 2017 retrospective study at a tertiary care centre in Punjab found that corneal opacity, followed by active infectious keratitis, were the most common indications for penetrating keratoplasty [6].

In the present study, the authors aim was to ascertain the proportion of patients visiting the institute who were diagnosed with severe visual impairment or blindness due to corneal diseases and to understand the aetiological pattern. This knowledge will help address gaps at the primary levels of healthcare and promote early referral to tertiary centres.

MATERIALS AND METHODS

The present was a cross-sectional descriptive study conducted at the Regional Institute of Ophthalmology in Amritsar, Punjab, a tertiary care institute in North India. Patients attending the Outpatient Department (OPD) of the Institute between July 2022 and June 2023 were informed about the study and invited to participate. Institutional Ethics Committee clearance was obtained for the conduct of the study (GMC/IEC/24/AB/187). Informed consent was obtained from all eligible patients; in the case of minors, consent was acquired from their legal guardians.

Inclusion and Exclusion criteria: Patients diagnosed with corneal pathology were included in the study, while those with diminished vision due to other ocular diseases were excluded.

Study Procedure

A standardised proforma was filled out for each patient. Information recorded included demographic characteristics, place of residence (urban/rural), presenting visual acuity, duration between the onset of symptoms and presentation at the clinic and final diagnosis. Previous records, whenever available, were also reviewed to ascertain the nature and aetiology of the corneal opacity.

A thorough ophthalmic examination was performed, which included the recording of pinhole visual acuity for both eyes using illuminated Snellen visual acuity charts. If the visual acuity could not be determined, the following tests were used sequentially: counting fingers, hand movement and light perception. If more than one disease was present, the disease most likely to cause vision impairment or blindness was considered. Any posterior segment pathology was excluded using an ultrasound B-scan whenever necessary.

Eyes with best corrected visual acuity of less than 3/60 were regarded as blind, those with visual acuity between 6/60 and 3/60 as severely visually impaired, those with visual acuity between 6/18 and 6/60 as moderately visually impaired and those with visual acuity between 6/12 and 6/18 as mildly visually impaired, according to World Health Organisation (WHO) criteria [7].

STATISTICAL ANALYSIS

The data obtained were compiled in tabulated form. A descriptive analysis of the data was conducted using Microsoft Excel 365 (Version 2409) and the results were expressed as numbers and percentages.

RESULTS

The authors evaluated 2,535 patients (2,670 eyes) diagnosed with varying forms of corneal disorders during the study period. This accounted for 7.24% of the total 35,000 patients seen. Males constituted 1,692 (67%), while the remaining 843 (33%) were females, resulting in a male-to-female ratio of 2:1. The ages of the patients ranged from three months to 82 years, with a median age of 37 years. Patients aged under 50 years accounted for 67.06% of the total sample size, while those aged over 50 years constituted 33.25% [Table/Fig-1]. The peak age of presentation was between 31 and 40 years.

| Variables | Male, n | Female, n | Total, n (%) |
|---------------------|---------------|--------------|--------------|
| Age group | | | |
| <50 years | 1241 | 459 | 1700 (67.06) |
| >50 years | 451 | 384 | 835 (32.94) |
| Total n (%) | 1692 (66.75) | 843 (33.25) | 2535 (100) |
| Occupation | | | |
| Agricultural | 1054 | 194 | 1248 (49.23) |
| Non agricultural | 283 | 74 | 357 (14.08) |
| Office job | 97 | 68 | 165 (6.51) |
| Student | 42 | 18 | 60 (2.37) |
| Housework | 13 | 277 | 290 (11.44) |
| Retired/not working | 203 | 212 | 415 (16.37) |
| Total n (%) | 1692 (66.75%) | 843 (33.25%) | 2535 (100) |

[Table/Fig-1]: Demographic profile and occupational distribution of patients (N=2535).

Patients engaged in agricultural activity represented the largest group, constituting about 49.23% of the total cases. Other occupational distributions are shown in [Table/Fig-1]. The number of patients belonging to rural areas was 1,747 (68.9%), while those from urban areas numbered 788 (31.1%). The duration between the onset of symptoms and presentation ranged from within 24 hours to more than 20 years, with a median of 11 days.

About 1,529 (60.32%) patients presented within two weeks of the onset of symptoms, whereas 1,006 (39.68%) presented more than two weeks after symptom onset.

Pterygium (36.92%), active infectious keratitis (24.62%), corneal degenerative disorders (18.46%) and foreign body (12.31%) were the major causes of corneal disorders in the patients [Table/Fig-2]. Most cases of corneal foreign bodies occurred during daily activities, especially among artisans and some patients were unable to identify the activity that preceded the onset of symptoms. Among

corneal degeneration cases, most were classified as spheroidal degeneration (80%), followed by calcific band keratopathy (14%) and corneal dystrophies (6%).

| Aetiology | Unilateral, n | Bilateral, n | Total, n (%) |
|--------------------------------------|---------------|--------------|--------------|
| Active infectious keratitis | 621 | 3 | 624 (24.62) |
| Healed infectious keratitis (CO/AS)* | 93 | 11 | 104 (4.1) |
| Pterygium | 857 | 79 | 936 (36.92) |
| Corneal degeneration | 454 | 14 | 468 (18.46) |
| Foreign body | 291 | 21 | 312 (12.31) |
| Open-globe injury | 52 | 0 | 52 (2.05) |
| Bullous keratopathy | 23 | 3 | 26 (1.03) |
| Miscellaneous [#] | 9 | 4 | 13 (0.51) |
| Total n (%) | 2400 (94.67%) | 135 (5.33%) | 2535 (100) |

[Table/Fig-2]: Aetiological agents and corneal pathology (N=2535).

*Corneal opacity/Anterior staphylooma

[#]trachoma, vitamin A deficiency, allergic eye disease, exposure keratopathy, ocular surface disease

A total of 541 (20.26%) eyes presented with visual acuity of less than 3/60, while severe visual impairment was observed in 462 (17.3%) patients as shown in [Table/Fig-3]. Moderate visual impairment was noted in 406 (15.21%) patients. Approximately half (47%) of the eyes had only mild visual impairment or normal visual acuity.

| BCVA | Eyes (%) |
|------------|-------------|
| 6/6-6/12 | 870 (32.58) |
| <6/12-6/18 | 391 (14.64) |
| <6/18-6/60 | 406 (15.21) |
| <6/60-3/60 | 462 (17.30) |
| <3/60-NPL* | 541 (20.26) |
| Total | 2670 (100) |

[Table/Fig-3]: Presenting visual acuity in eyes of patients with corneal pathology (N=2535 patients (2670 eyes)).

BCVA: Best-corrected visual acuity; *NPL: No perception of light

Slit-lamp photographs of eyes with various corneal pathologies that presented in the OPD during the study period is displayed in [Table/Fig-4]. These photographs were taken after obtaining appropriate consent from the visiting patients.



[Table/Fig-4]: a) Corneal foreign body; b) Pterygium; c) Corneal ulcer; d) Anterior staphylooma; e) Corneal degeneration.

DISCUSSION

Corneal disorders are a common cause of eye disease in developing countries [8]. It is estimated that one million people in India are bilaterally blind due to corneal disease, which adds to the medical burden on existing health facilities. The National Blindness and Visual Impairment Survey India 2015-2019 reported corneal opacity as the leading cause of blindness in the age group below 50 years [3].

Corneal disorders accounted for 7.24% of the total number of new patients seen in the centre during the study period. The higher number of male patients recorded in this study is consistent with the results of other studies, which indicate that men are more likely to be exposed to activities that carry the risk of corneal trauma [8-10].

Among the occupational groups, approximately half of the patients were farmers. In the current study, more than half of the patients (68.9%) were from rural areas. This finding demonstrates a strong connection between corneal diseases and the nature of one's job, particularly for farmers. This issue is compounded by a lack of awareness regarding proper eye care. Other studies have shown that the prevalence of blindness due to corneal disease is higher in

uneducated and rural populations, as well as in those from lower socio-economic strata [8,11].

Pterygium was identified as the single largest cause of corneal pathology, constituting more than one-third of the patients, followed by infectious keratitis, corneal degeneration and corneal foreign bodies. This finding aligns with the results of the Corneal Opacity Rural Epidemiological (CORE) study, although that study was a cross-sectional population-based prevalence study [12].

Infectious keratitis accounted for approximately 25% of all cases. This group of disorders can lead to blindness and carries a significant risk of severe vision loss, especially if treatment is delayed. A study in Ghana reported an infection rate of 57.3%, while studies in Nepal (80%) and Bangladesh (81.7%) showed even higher prevalence rates. This is understandable given the high incidence of corneal infections in third-world countries [13-15].

About one-fifth of the cases (18.46%) were recorded as having degenerative corneal disorders, with spheroidal degeneration being the most common type. Most eyes in this group exhibited a visual acuity of less than 6/60 and were counseled for keratoplasty where feasible.

Superficial corneal foreign bodies were observed in 312 (12.31%) patients. The majority of these cases involved artisans who sustained corneal injuries from iron particles while working with welding or cutting/drilling machines. The remaining cases were accidental, caused by sawdust or leafy materials, which aligns with findings from a previous study [5], although the overall incidence recorded in our study was higher. All foreign bodies were removed under topical anaesthesia and patients were prescribed topical antibiotics.

Open globe injuries with corneal lacerations and bullous keratopathy secondary to complicated cataract surgery were recorded in 52 (2%) and 26 (1%) patients, respectively. Contrary to the present study, their contribution to the burden of corneal disease has been reported to be much higher in some other studies [12,16-18].

More than one-third (37.56%) of the eyes presented with blindness or severe vision impairment. This reflects the cornea's essential role in vision, particularly when the disorder involves the central part of the cornea. The present study found that more than half of the patients (60.32%) presented within two weeks of symptom onset. Some of these patients had used self-medication measures before seeking professional help, which may explain the significant percentage (37.56%) of severely impaired or blind eyes at presentation. Eye disorders, especially microbial keratitis, can lead to blindness if prompt and timely intervention is not provided.

The need for trained eye care workers or ophthalmologists in rural areas is crucial to reducing the number of individuals who become blind due to corneal diseases. Alternatively, primary health care workers and doctors can be sensitised and trained to manage such cases properly and, if necessary, to refer patients quickly to secondary or tertiary care facilities.

Limitation(s)

Since the present study was conducted at a tertiary care centre, the data presented may not accurately represent the actual figures in the general population of Punjab. Many patients may have consulted at

primary levels of healthcare, private clinics, or may not have sought treatment at all and thus remained unaccounted for.

CONCLUSION(S)

Corneal disorders constitute a significant proportion of patients requiring consultation with an ophthalmologist, especially at tertiary care centres. More than one-third of the eyes in the present study had severe visual impairment or blindness at presentation. A significant number of patients presented more than two weeks after the onset of symptoms, increasing the risk of visual impairment and blindness. Pterygium, infectious keratitis, corneal degeneration and foreign bodies were the main causes of corneal pathology found in our study. The importance of eye protection equipment should be emphasised among our population, especially for those who engage in outdoor activities. Additionally, we must stress the importance of early referral to eye care facilities within our community.

REFERENCES

- [1] Flaxman SR, Bourne RRA, Resnikoff S, Ackland P, Braithwaite T, Cicinelli MV, et al; Vision Loss Expert Group of the Global Burden of Disease Study. Global causes of blindness and distance vision impairment 1990-2020: A systematic review and meta-analysis. *Lancet Glob Health*. 2017;5(12):e1221-e1234.
- [2] Wang EY, Kong X, Wolle M, Gasquet N, Ssekasanvu J, Mariotti SP, et al. Global trends in blindness and vision impairment resulting from corneal opacity 1984-2020: A meta-analysis. *Ophthalmology*. 2023;130(8):863-71.
- [3] Vashist P, Senjam SS, Gupta V, Gupta N, Shamanna BR, Wadhwan M, et al. Blindness and visual impairment and their causes in India: Results of a nationally representative survey. *PLoS One*. 2022;17(7):e0271736.
- [4] Gupta N, Tandon R, Gupta SK, Sreenivas V, Vashist P. Burden of corneal blindness in India. *Indian J Community Med*. 2013;38(4):198-206.
- [5] Singh D, Bhullar JS. The pattern of corneal diseases in Punjab. *Indian J Ophthalmol*. 1982;30(4):333-35.
- [6] Singh S, Prasher P, Kaur M, Kakkar A, Chhabra M. Clinical indications of penetrating keratoplasty in Punjab. *Indian J Clin Exp Ophthalmol*. 2017;3(1):91-95.
- [7] Dandona L, Dandona R. Revision of visual impairment definitions in the International Statistical Classification of Diseases. *BMC Med*. 2006;4:7.
- [8] Dandona R, Dandona L. Corneal blindness in a southern Indian population: Need for health promotion strategies. *Br J Ophthalmol*. 2003;87(2):133-41.
- [9] Basak SK, Basak S, Mohanta A, Bhowmick A. Epidemiological and microbiological diagnosis of suppurative keratitis in Gangetic West Bengal, eastern India. *Indian J Ophthalmol*. 2005;53(1):17-22.
- [10] Leck AK, Thomas PA, Hagan M, Kaliamurthy J, Ackuaku E, John M, et al. Aetiology of suppurative corneal ulcers in Ghana and south India, and epidemiology of fungal keratitis. *Br J Ophthalmol*. 2002;86(11):1211-15.
- [11] Dandona R, Dandona L. Socioeconomic status and blindness. *Br J Ophthalmol*. 2001;85(12):1484-88.
- [12] Gupta N, Vashist P, Tandon R, Gupta SK, Dwivedi S, Mani K. Prevalence of corneal diseases in the rural Indian population: The Corneal Opacity Rural Epidemiological (CORE) study. *Br J Ophthalmol*. 2015;99(2):147-52.
- [13] Hagan M, Wright E, Newman M, Dolin P, Johnson G. Causes of suppurative keratitis in Ghana. *Br J Ophthalmol*. 1995;79(11):1024-28.
- [14] Upadhyay MP, Karmacharya PC, Koirala S, Tuladhar NR, Bryan LE, Smolin G, et al. Epidemiologic characteristics, predisposing factors, and etiologic diagnosis of corneal ulceration in Nepal. *Am J Ophthalmol*. 1991;111(1):92-99.
- [15] Dunlop AA, Wright ED, Howlader SA, Nazrul I, Husain R, McClellan K, et al. Suppurative corneal ulceration in Bangladesh. A study of 142 cases examining the microbiological diagnosis, clinical and epidemiological features of bacterial and fungal keratitis. *Aust N Z J Ophthalmol*. 1994;22(2):105-10.
- [16] Vijaya L, Asokan R, Panday M, Choudhari NS, Ramesh SV, Velumuri L, et al. Baseline risk factors for incidence of blindness in a South Indian population: The chennai eye disease incidence study. *Invest Ophthalmol Vis Sci*. 2014;55(9):5545-50.
- [17] Veladanda R, Sulekha S, Pallapolu L, Singh C, Desaraju V. A hospital based clinical study on corneal blindness in a tertiary eye care centre in north Telangana. *Journal of Krishna Institute of Medical Sciences University*. 2016;5(2):12-17.
- [18] Reddy TN, Anjaneyulu K, Vishnupriya S, Kanth CV, Nagarani K. Proportion of corneal blindness in blind patients attending for blind certificates in regional eye hospital, Kurnool. *J Evolution Med Dent Sci*. 2017;6(30):2407-09.

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