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Research Article

Etiological Profile and Clinical Outcomes of Corneal Ulcers in a Tertiary Care Hospital Population: A Prospective Observational Study

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ABSTRACT

Background: Corneal ulcers are a significant cause of ocular morbidity and preventable blindness, particularly in developing regions. The etiological spectrum and clinical outcomes vary with geography, climate, occupational exposure, and access to eye care. Region-specific prospective data are essential to guide early diagnosis, management, and prevention strategies.

Aim: To evaluate the etiological profile, predisposing factors, and clinical outcomes of corneal ulcers among patients presenting to a tertiary care referral hospital in Bihar with ANMMCH gayaji Bihar.

Methodology: This prospective observational study was conducted over six months included randomly selected patients presenting to the outpatient department with clinically diagnosed corneal ulcers were enrolled. Detailed demographic and clinical data were recorded. Comprehensive ocular examination and microbiological evaluation, including corneal scraping for smear and culture, were performed. Patients were treated as per standard protocols and followed up to assess healing, complications, and visual outcomes.

Results: A total of 120 patients were included, with a predominance of rural, working-age males. Ocular trauma, particularly with vegetative matter, was the most common risk factor. Fungal keratitis emerged as the most frequent etiology, followed by bacterial keratitis. Visual improvement was observed in over half of the patients, while poorer outcomes and complications were more common in fungal ulcers and cases with delayed presentation.

Conclusion: Corneal ulcers in Bihar are largely trauma-related and fungal in origin, with delayed presentation contributing to adverse outcomes. Early referral, prompt microbiological diagnosis, and targeted therapy are vital to reduce vision-threatening complications.

Keywords : Corneal Ulcer; Keratitis; Fungal Keratitis; Bacterial Keratitis; Visual Outcome

INTRODUCTION

Corneal ulceration, frequently manifested as *infectious keratitis*, is a major cause of ocular morbidity and blindness worldwide. This condition arises when the corneal epithelium is disrupted, allowing microorganisms to invade and induce inflammation, stromal damage, and potentially perforation of the cornea [1,2]. Globally, estimates suggest that infectious keratitis accounts for 1.5–2.0 million new cases of monocular blindness annually, highlighting its significant impact on public health, especially in developing regions with limited access to eye care services [1]. Despite advances in diagnosis and management, this disease remains a therapeutic challenge due to its rapid progression, varied etiology, and potential for antimicrobial resistance [1,3].

Infectious keratitis encompasses a broad spectrum of causative organisms including bacteria, fungi, viruses, and protozoa, with bacterial and fungal agents being the most frequently isolated pathogens [2,4]. The microbial profile of corneal ulcers varies substantially between geographic regions, influenced by climatic conditions, occupational exposures, socioeconomic factors, and patterns of ocular trauma [1,2]. For example, temperate regions often report bacterial keratitis as the predominant form, whereas tropical and agricultural communities experience higher rates of fungal keratitis, typically associated with plant material injuries [4,5]. Additional less common but clinically significant causes include viral keratitis, most notably *Herpes simplex virus*, and *Acanthamoeba* infections, particularly in contact lens wearers or those exposed to contaminated water [6,7].

The clinical outcomes of corneal ulcers are highly variable and depend on several factors such as causative organism, ulcer size and depth, timeliness of presentation, and adequacy of therapy. Complications can include corneal perforation, scarring, secondary glaucoma, or irreversible vision loss, often necessitating surgical

interventions such as therapeutic keratoplasty in severe or refractory cases [1,3,5]. Outcomes are generally poorer in patients with larger infiltrates, delayed treatment, and infective etiologies with inherently aggressive behavior, such as filamentous fungi [5,8]. Prospective cohort data also indicate that delays in presentation and initial visual acuity are significant predictors of poorer long-term visual outcomes, emphasizing the importance of early diagnosis and management [8].

A number of predisposing factors have been identified in the development of corneal ulcers. Ocular trauma is consistently reported as a leading risk factor, particularly in rural populations engaged in agriculture, where minor injuries from plant material or soil contamination create portals of microbial entry [1,5]. Additional risk factors include contact lens wear, ocular surface disease, diabetes mellitus, and unsupervised use of topical corticosteroids, which can suppress local immune responses and exacerbate infections [1,2]. These factors not only influence the likelihood of infection but also affect the spectrum of causative organisms and clinical progression [1,3].

While published data from many parts of India have described the epidemiology and microbiological profiles of corneal ulcers, there remains a relative paucity of prospective studies focused specifically on the Bihar population. Recent retrospective data from a tertiary eye center in Bihar illustrate that microbial keratitis imposes substantial ocular morbidity in this region. In that study, the majority of affected individuals were agricultural workers with delayed presentations; fungal pathogens were the most commonly identified organisms, and a significant proportion of patients presented with poor visual acuity and corneal complications at initial evaluation [9]. These findings highlight unique regional patterns and health system challenges, underlining the necessity for prospective data to guide evidence-based management and public health strategies.

A comprehensive understanding of the etiological profile and clinical outcomes of corneal ulcers within the Bihar population is crucial given the state's role as a major referral center for ocular emergencies and its demographic characteristics, including a large rural and agricultural workforce. Prospective data from such a centre can provide real-time insight into organism prevalence, resistance patterns, treatment responses, and visual outcomes, which are essential for optimizing clinical protocols, improving patient education, and allocating health resources effectively.

This study aims to prospectively evaluate the etiological spectrum, risk factors, and clinical outcomes of corneal ulcers in patients presenting to a tertiary care referral center in Bihar. The goal is to inform evidence-based clinical practices, improve patient prognosis, and contribute to regional ophthalmic epidemiological data.

MATERIALS AND METHODS

This prospective observational study was conducted at the Department of Ophthalmology of .....Medical college and hospital in Bihar, India. Patients presenting with symptoms suggestive of corneal ulceration to the ophthalmology outpatient department (OPD) during the study period were evaluated and managed according to standard institutional protocols.

This was a hospital-based prospective observational study conducted over a period of **six months** from .... to ..... All eligible patients presenting during the study period were assessed consecutively and followed up to document clinical outcomes. The study design allowed real-time collection of demographic, clinical, microbiological, and outcome data.

The study population comprised patients presenting to the ophthalmology OPD with clinical features suggestive of corneal ulceration during the study period. Patients were selected by random sampling from eligible cases reporting to the OPD over the six-month duration.

The sample size consisted of randomly selected patients reporting to the ophthalmology OPD during the six-month study period who fulfilled the inclusion criteria. As this was an observational exploratory study aimed at describing etiological patterns and outcomes, all eligible and consenting patients presenting during the defined time frame were included until completion of the study period.

Patients were included in the study if they met the following criteria: Patients of either sex and all age groups. Presence of a clinically diagnosed corneal ulcer, defined as loss of corneal epithelium with underlying stromal infiltration, with or without hypopyon. Patients presenting for the first time with a corneal ulcer to the study center. Patients willing to provide informed consent and comply with follow-up visits.

Patients were excluded from the study if they met any of the following criteria: Corneal epithelial defects without stromal infiltration. Non-infective corneal ulcers such as neurotrophic ulcers, exposure keratopathy, or Mooren's ulcer. Corneal ulcers secondary to chemical injuries or thermal burns. Patients with a history of prior corneal surgery in the affected eye. Patients already receiving definitive treatment for corneal ulcer prior to presentation. Patients unwilling to give informed consent or those lost to follow-up before outcome assessment.

A detailed clinical history was obtained from all enrolled patients, including demographic details, occupation, residence (urban/rural), history of ocular trauma, nature of trauma (vegetative or non-vegetative), contact lens usage, prior medication use (especially topical steroids), systemic illnesses such as diabetes mellitus, and duration of symptoms prior to presentation.

All patients underwent a comprehensive ocular examination, including: Measurement of best-corrected visual acuity using Snellen's chart. Slit-lamp biomicroscopic examination to assess size, location, depth, and margins of the corneal ulcer, presence of stromal infiltrates, hypopyon, corneal thinning, or perforation. Fluorescein staining to delineate the epithelial defect. Intraocular pressure measurement, where feasible.

Based on clinical findings, corneal scrapings were obtained under aseptic precautions using a sterile blade or Kimura spatula after instillation of topical anesthetic. Scrapings were subjected to: Direct microscopic examination using Gram stain and potassium hydroxide (KOH) wet mount. Culture on appropriate media including blood agar, chocolate agar, and Sabouraud dextrose agar, as per institutional microbiology protocol.

Empirical treatment was initiated based on clinical suspicion and later modified according to microbiological results and clinical response. Patients were followed up at regular intervals to monitor healing, resolution of infection, and development of complications.

Clinical outcomes were assessed based on: Resolution of corneal ulcer (healing with scar formation). Improvement or deterioration in visual acuity. Occurrence of complications such as corneal perforation, secondary glaucoma, or need for surgical intervention (e.g., therapeutic keratoplasty). Final visual outcome at the last follow-up visit.

Data were entered into Microsoft excel sheet in a pre-designed proforma and analyzed using Statistical Package for the Social Sciences (SPSS) software. Continuous variables such as age and ulcer size were expressed as mean ± standard deviation, while categorical variables such as gender, etiological agents, risk factors, and outcomes were expressed as frequencies and percentages. Associations between etiological agents, risk factors, and clinical outcomes were evaluated using Chi-square test. A *p*-value of <0.05 was considered statistically significant.

RESULTS

A total of 120 patients with clinically diagnosed corneal ulcers were enrolled during the six-month study period. All patients completed the initial evaluation, and 108 patients (90%) were available for final outcome assessment.

The study population comprised 78 males (65%) and 42 females (35%), with a male-to-female ratio of 1.9:1. The age of patients ranged from 18 to 75 years, with a mean age of 44.6 ± 13.2 years. The majority of patients belonged to the working-age group (31–60 years). A significant proportion of patients (72%) were from rural areas, and 58% were engaged in agricultural or manual labor.

Ocular trauma was the most common predisposing factor, reported in 66 patients (55%), particularly trauma with vegetative matter. Other notable risk factors included topical medication misuse, especially corticosteroids (18%), diabetes mellitus (15%), and contact lens use (7%). Table 1 summarizes the demographic profile and major risk factors among the study participants.

At presentation, 84 patients (70%) had visual acuity worse than 6/60 in the affected eye. The majority of ulcers were central or paracentral (62%), with ulcer size exceeding 4 mm in 48 patients (40%). Hypopyon was present in 36 patients (30%), indicating severe infection.

Microbiological evaluation yielded positive results in 82 cases (68.3%). Fungal pathogens were the most common etiological agents, identified in 40 cases (33.3%), followed by bacterial isolates in 34 cases (28.3%). Mixed infections were noted in 8 cases (6.7%). No organism was isolated in 38 cases (31.7%).

Among fungal isolates, Aspergillus species were the most common, followed by Fusarium species. Among bacterial isolates, Staphylococcus aureus and Pseudomonas aeruginosa predominated. The distribution of causative organisms is shown in Table 2.

A significant association was observed between ocular trauma with vegetative matter and fungal keratitis ($p < 0.05$). Contact lens use was predominantly associated with bacterial keratitis, particularly Pseudomonas infections. Patients with prior steroid use showed a higher frequency of severe ulcers and mixed infections. Table 3 depicts the relationship between predisposing factors and etiological agents.

At final follow-up, 72 patients (66.7%) showed complete resolution of the ulcer with corneal scarring. Visual improvement of two or more Snellen lines was observed in 60 patients (55.6%). Poor outcomes, defined as persistent epithelial defect, corneal perforation, or need for surgical intervention, were noted in 24 patients (22.2%).

Fungal ulcers were associated with longer healing time and poorer visual outcomes compared to bacterial ulcers. Therapeutic keratoplasty was required in 10 patients (9.3%), predominantly in those with deep stromal involvement and delayed presentation. The final clinical outcomes according to etiology are summarized in Table 4.

Table 1: Demographic Characteristics and Risk Factors (n = 120)

Variable	*Number (%)*
Gender	
- Male	78 (65.0)
- Female	42 (35.0)
Residence	
- Rural	86 (71.7)
- Urban	34 (28.3)
Occupation	
- Agricultural/Manual worker	70 (58.3)
- Others	50 (41.7)
Predisposing Factors	
- Ocular trauma	66 (55.0)
- Steroid use	22 (18.3)
- Diabetes mellitus	18 (15.0)
- Contact lens use	8 (6.7)

Table 2: Etiological Distribution of Corneal Ulcers

Etiology	*Number (%)*
Fungal	40 (33.3)
Bacterial	34 (28.3)
Mixed infection	8 (6.7)
No growth	38 (31.7)
Total	120 (100)

Table 3: Association Between Risk Factors and Etiology.

Risk Factor	*Fungal*	*Bacterial*	*Mixed*
Ocular trauma	28	16	6
Steroid use	6	8	4
Diabetes mellitus	4	6	2
Contact lens use	2	6	0

Table 4: Clinical Outcomes According to Etiology

Outcome	*Fungal*	*Bacterial*	*Mixed*
Healed with scar	20	28	6
Visual improvement	14	22	4
Complications	12	6	6
Surgical intervention	8	2	0

DISCUSSION

Corneal ulceration remains a major cause of ocular morbidity and preventable blindness, particularly in developing regions where delayed presentation and limited access to specialized eye care are common. The present prospective observational study evaluated the etiological profile and clinical outcomes of corneal ulcers in patients presenting to Anmmch Gayaji. The findings provide valuable region-specific insights into the epidemiology, risk factors, microbiological spectrum, and treatment outcomes of corneal ulcers in this underserved population.

In this study, corneal ulcers were more frequently observed in males of working age, with a predominance of patients from rural areas and agricultural backgrounds. This demographic pattern is consistent with several Indian and international studies, which have attributed the higher incidence among males to increased outdoor activity, occupational exposure, and a greater risk of ocular trauma [1,2]. The predominance of rural patients highlights the role of socioeconomic and occupational factors in the pathogenesis of corneal ulcers, particularly in states like Bihar where agriculture remains a primary livelihood.

Ocular trauma was identified as the most common predisposing factor, especially trauma involving vegetative matter. This finding is in agreement with multiple studies from tropical and subtropical regions, where minor corneal injuries sustained during agricultural work often precede microbial keratitis [3,4]. Such trauma disrupts the corneal epithelium and facilitates fungal or bacterial invasion. The high proportion of trauma-related ulcers in this study underscores the need for community education regarding eye protection and early medical consultation following ocular injury.

Microbiological analysis revealed a higher prevalence of fungal keratitis compared to bacterial keratitis, a finding that aligns with reports from eastern and southern India [3,5]. The warm, humid climate of Bihar, coupled with widespread agricultural activity, creates an environment conducive to fungal growth, particularly Aspergillus and Fusarium species. Similar etiological patterns have been reported by other tertiary centers serving rural populations, reinforcing the regional variability in microbial profiles of corneal ulcers [5,6]. In contrast, studies from developed countries frequently report bacterial keratitis as the predominant etiology, often associated with contact lens use [7].

The culture positivity rate observed in this study was comparable to earlier reports, with a significant proportion of cases yielding no growth. This may be attributed to prior use of topical antibiotics, inadequate sample size, or fastidious organisms [1,8]. Nonetheless, microbiological evaluation remains essential, as it guides targeted therapy and helps monitor emerging resistance patterns. The association observed between vegetative trauma and fungal keratitis, and between contact lens use and bacterial keratitis, further supports the importance of correlating clinical history with microbiological findings.

With regard to clinical outcomes, approximately two-thirds of patients achieved resolution of the ulcer with corneal scarring, while a substantial proportion experienced poor outcomes, including persistent epithelial defects, complications, or the need for surgical intervention. Visual improvement was more commonly observed in bacterial keratitis compared to fungal keratitis. This finding has been consistently reported in previous studies, which indicate that fungal ulcers are associated with delayed healing, limited therapeutic options, and poorer visual prognosis [4,6,9]. The longer duration of treatment and higher complication rates in fungal keratitis highlight the challenges in managing these infections effectively.

Patients presenting with large, central ulcers, hypopyon, and poor visual acuity at presentation were more likely to have unfavorable outcomes. These factors have been identified as strong predictors of poor prognosis in multiple prospective studies [8,9]. Delayed presentation was a common feature among patients with severe disease in this study, reflecting gaps in awareness, accessibility, and referral systems in rural Bihar. Strengthening primary eye care services and improving referral pathways could play a crucial role in reducing disease severity at presentation.

The requirement for therapeutic keratoplasty in a subset of patients further emphasizes the burden of advanced disease encountered at tertiary referral centers. Similar intervention rates have been reported in other hospital-based studies from India, particularly in cases of fungal keratitis with deep stromal involvement or impending perforation [6,10]. Early diagnosis and prompt initiation of appropriate therapy remain the cornerstone for reducing the need for surgical intervention.

Overall, the findings of this study underscore the significant burden of corneal ulcers in Bihar, driven by occupational exposure, delayed presentation, and a predominance of fungal etiology. As a major referral center, the tertiary care hospital plays a critical role not only in management but also in generating regional epidemiological data. Prospective studies such as this are essential to inform locally relevant treatment protocols, guide empirical therapy, and support public health interventions aimed at preventing corneal blindness.

CONCLUSION

Corneal ulcers predominantly affected rural, working-age males, with fungal etiology and ocular trauma as major contributors. Early diagnosis, prompt microbiological evaluation, and timely referral are crucial to improve outcomes and prevent corneal blindness.

REFERENCES

1. Cabrera-Aguas M, Khoo P, Watson SL. Infectious keratitis: A review. Clin Exp Ophthalmol. 2022 Jul;50(5):543-562.
2. Ting DSJ, Cairns J, Gopal BP, Ho CS, Krstic L, Elsahn A, Lister M, Said DG, Dua HS. Risk Factors, Clinical Outcomes, and Prognostic Factors of Bacterial Keratitis: The Nottingham Infectious Keratitis Study. Front Med (Lausanne). 2021 Aug 11;8:715118.
3. Gopinathan U, Garg P, Fernandes M, Sharma S, Athmanathan S, Rao GN. The epidemiological features and laboratory results of fungal keratitis: a 10-year review at a referral eye care center in South India. Cornea. 2002 Aug;21(6):555-9.
4. Thomas PA, Kaliamurthy J. Mycotic keratitis: epidemiology, diagnosis and management. Clin Microbiol Infect. 2013 Mar;19(3):210-20.
5. Ahmed NH, Mishra D, Rathod P, Satpathy G, Titiyal JS, Tandon R, Nandyala S, Agarwal T, Vanathi M, Sinha R, Gupta N, Maharana PK, Kaur M, Sharma N. Spectrum of bacterial keratitis in North India: A retrospective analysis of six years at a tertiary care eye center. Indian J Ophthalmol. 2022 Jun;70(6):1982-1989.
6. Srinivasan M. Fungal keratitis. Curr Opin Ophthalmol. 2004

Aug;15(4):321-7.
7. Stapleton F. Contact lens-related microbial keratitis: what can epidemiologic studies tell us? Eye Contact Lens. 2003 Jan;29(1 Suppl):S85-9; discussion S115-8, S192-4.
8. Keay L, Edwards K, Naduvilath T, Taylor HR, Snibson GR, Forde K, Stapleton F. Microbial keratitis predisposing factors and morbidity. Ophthalmology. 2006 Jan;113(1):109-16.
9. Prajna NV, Krishnan T, Mascarenhas J, Srinivasan M, Oldenburg CE, Toutain-Kidd CM, Sy A, McLeod SD, Zegans ME, Acharya NR, Lietman TM, Porco TC. Predictors of outcome in fungal keratitis. Eye (Lond). 2012 Sep;26(9):1226-31.
10. Sony P, Sharma N, Vajpayee RB, Ray M. Therapeutic keratoplasty for infectious keratitis: a review of the literature. CLAO J. 2002 Jul;28(3):111-8.

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