

Clinical characteristics and treatment outcomes of infectious Corneal ulcers in a teaching Hospital: A hospital-based observational study.**Dr. R Prameela^{1*}, Dr. Shaik Mohammed Pervaiz Hussain¹**¹Associate Professor, Department of Ophthalmology, Sarojini Devi Eye Hospital, Osmania Medical College, Hyderabad, Telangana, India**Abstract****Background:**

Infectious corneal ulcers remain a leading cause of ocular morbidity and preventable blindness, particularly in developing countries. Delayed presentation, occupational exposure, and limited access to early ophthalmic care contribute to poor outcomes.

Objectives:

To evaluate the demographic characteristics, predisposing risk factors, clinical and microbiological features, and treatment outcomes of patients with infectious corneal ulcers presenting to a tertiary-care teaching hospital.

Methods:

This hospital-based observational study was conducted in the Department of Ophthalmology, Regional Eye Hospital, Kakatiya Medical College, Warangal, Telangana, India, from July 2023 to June 2024. A total of 100 consecutive patients with clinically diagnosed infectious corneal ulcers were included. Detailed history, slit-lamp examination, and corneal scraping for microbiological analysis were performed in all cases. Patients were managed with appropriate topical antimicrobial therapy based on clinical suspicion and culture sensitivity, where available. Treatment outcomes and visual acuity were assessed during follow-up.

Results:

The majority of patients were aged 31–60 years (56%), with a male predominance (64%) and rural background (58%). Ocular trauma was the most common predisposing factor, particularly vegetative matter injury (38%). Central corneal involvement was observed in 46% of cases, and moderate-sized ulcers (2–5 mm) were most frequent (47%). Hypopyon was present in 29% of patients. Microbiological evaluation revealed bacterial etiology in 52% of cases, fungal infection in 34%, mixed infection in 6%, and culture-negative ulcers in 8%. Favorable anatomical outcomes were achieved in 80% of patients, while complications occurred in 20%. Visual improvement following treatment was noted in 62% of cases.

Conclusion:

Infectious corneal ulcers predominantly affect middle-aged males from rural areas, with ocular trauma as the principal risk factor. Early diagnosis and timely, appropriate antimicrobial therapy significantly improve clinical and visual outcomes.

Recommendations:

Strengthen community awareness, promote early referral, ensure routine microbiological testing, and develop region-specific treatment protocols to reduce corneal blindness.

Keywords: Infectious corneal ulcer; microbial keratitis; ocular trauma; treatment outcome; visual acuity.**Submitted:** September 17, 2025 **Accepted:** November 19, 2025 **Published:** December 25, 2025**Corresponding author:** Dr. R. Prameela, MBBS, MS.**Email:** rathnavathprameela@gmail.com

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Introduction

Infectious corneal ulcers represent a true ophthalmic emergency and continue to be a major cause of corneal blindness worldwide, particularly in low- and middle-income countries [1,2]. Severe cases often require hospitalization and intensive care, imposing a substantial clinical and economic burden on healthcare systems [1]. Because the cornea is essential for optical clarity, even short delays in diagnosis or treatment can lead to irreversible visual impairment.

The burden of infectious keratitis is disproportionately higher in rural and agrarian populations, where occupational exposure, ocular trauma, and delayed access to specialized eye care are common [2,4,6]. Trauma—especially with vegetative matter—remains a dominant initiating factor in tropical regions, predisposing the cornea to microbial invasion [2,4]. Other well-recognized risk factors include contact lens wear, chronic ocular surface disease, inappropriate use of topical corticosteroids, and systemic conditions such as diabetes mellitus, all of which compromise corneal defense mechanisms [3,6].

The etiology of infectious corneal ulcers is multifactorial, with bacteria and fungi accounting for the majority of cases in tropical climates such as India [2,5]. Fungal keratitis is particularly prevalent following plant-related trauma, whereas bacterial keratitis remains common across diverse clinical settings [2,5]. Although viruses and protozoa are also implicated, their contribution is comparatively lower in routine hospital-based series [3]. Clinically, infectious corneal ulcers demonstrate a wide spectrum of severity, ranging from small superficial infiltrates to deep stromal ulcers associated with hypopyon, corneal thinning, and perforation [3,4]. Visual outcome is influenced by multiple interacting factors, including ulcer size and location, microbial virulence, host immune status, and the timeliness of appropriate therapy [1,4]. Microbiological evaluation through corneal scraping and culture remains the cornerstone for organism-specific treatment; however, empirical therapy is frequently initiated in real-world practice due to delayed presentation or culture-negative results [3,6].

Despite advances in diagnostic modalities and antimicrobial therapy, infectious corneal ulcers continue to pose significant therapeutic challenges and remain a leading contributor to preventable corneal blindness [1,2]. Marked geographic variation in risk factors, microbial profile, and treatment response underscores the importance of generating region-specific clinical data to guide management strategies [2,5,6]. In this context, the present study was undertaken to evaluate the clinical characteristics, microbiological spectrum, and treatment outcomes of infectious corneal ulcers in a teaching hospital setting, with the objective of identifying key

prognostic factors and opportunities for early intervention to reduce vision-threatening complications.

Methodology

Study design and setting

This hospital-based observational study was conducted in the Department of Ophthalmology, Regional Eye Hospital, Kakatiya Medical College, Warangal, Telangana, India, from July 2023 to June 2024. Kakatiya Medical College is a government tertiary-care teaching institution serving as a major referral center for northern Telangana. The attached Regional Eye Hospital provides comprehensive ophthalmic services, including cornea clinic, glaucoma services, retina services, pediatric ophthalmology, cataract surgery units, emergency eye care, and subspecialty outpatient clinics. The hospital caters predominantly to rural and semi-urban populations and receives referrals from surrounding district hospitals and primary health centers. The ophthalmology department manages high outpatient volume and admits patients requiring intensive medical or surgical management.

Participants

A consecutive sampling method was employed. All eligible patients presenting with clinically diagnosed infectious corneal ulcers during the study period were screened for inclusion. Patients who met the eligibility criteria and provided written informed consent were enrolled consecutively until the required sample size of 100 participants was achieved.

Study size

The sample size was calculated using the single population proportion formula:

$$n = Z^2 \times p \times q / d^2$$

Where

n = required sample size

Z = 1.96 for 95% confidence level

p = expected prevalence of bacterial keratitis (assumed 50% based on previous regional studies to ensure maximum sample size)

q = 1 – p

d = absolute precision (10%)

$$n = (1.96)^2 \times 0.5 \times 0.5 / (0.1)^2$$

$$n = 3.84 \times 0.25 / 0.01$$

$$n = 96$$

The calculated minimum sample size was 96. Considering rounding and feasibility during the study period, a total of 100 patients were included.

Inclusion Criteria

Patients of either gender and all age groups presenting with signs and symptoms suggestive of infectious corneal

ulcers, such as corneal epithelial defect with underlying stromal infiltration, with or without hypopyon, were included in the study.

Exclusion Criteria

Patients with non-infective corneal ulcers, viral keratitis, neurotrophic ulcers, Mooren's ulcer, autoimmune-related peripheral ulcerative keratitis, chemical injuries, and postoperative corneal ulcers were excluded. Patients who were unwilling to participate were also excluded.

Data Collection and Clinical Evaluation

A detailed history was obtained, including demographic details, occupation, residence, duration of symptoms, history of ocular trauma, contact lens use, topical medication usage, and systemic comorbidities such as diabetes mellitus. All patients underwent a comprehensive ophthalmic examination, including assessment of visual acuity using Snellen's chart and slit-lamp biomicroscopy to evaluate ulcer size, depth, location, presence of hypopyon, and associated anterior segment findings.

Microbiological Evaluation

Corneal scrapings were obtained under aseptic conditions after instillation of a topical anesthetic. Smears were prepared for Gram staining and potassium hydroxide (KOH) wet mount. Samples were inoculated onto appropriate culture media for bacterial and fungal growth. Microbiological reports were used to guide modification of therapy where applicable.

Treatment Protocol and Follow-up

Empirical broad-spectrum topical antimicrobial therapy was initiated in all cases and later tailored based on microbiological findings and clinical response. Adjunctive therapy, including cycloplegics and supportive measures, was provided as required. Patients were followed up regularly until resolution of the ulcer or development of complications. Treatment outcome and post-treatment visual acuity were documented.

Bias

Several measures were implemented to minimize potential bias. Selection bias was reduced by enrolling consecutive eligible patients during the defined study period. Standardized clinical evaluation using slit-lamp biomicroscopy was performed for all participants. Microbiological investigations were conducted using uniform laboratory protocols. Data were recorded using a structured case-record proforma to ensure consistency. Observer bias was minimized by adhering to predefined clinical definitions for ulcer size, location, and outcomes.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA). Categorical variables were summarized as frequencies and percentages. Descriptive statistical analysis was performed to assess demographic distribution, predisposing risk factors, clinical characteristics, microbiological spectrum, and treatment outcomes.

Ethical considerations

Ethical approval for the study was obtained from the Institutional Ethics Committee of Kakatiya Medical College, Warangal, Telangana, India, prior to initiation of the study. Written informed consent was secured from all participants after explaining the study objectives and procedures. Confidentiality of patient information was strictly maintained throughout data collection, analysis, and reporting, and the study adhered to the principles of the Declaration of Helsinki.

Results

Participants

During the study period, 128 patients were assessed for eligibility. Twenty-eight patients were excluded: 12 had non-infective corneal ulcers, 6 had viral keratitis, 5 had autoimmune, chemical, or postoperative ulcers, and 5 declined to provide consent. A total of 100 eligible patients with infectious corneal ulcers were consecutively enrolled in the study. Of these, 96 completed the scheduled follow-up visits. All 100 enrolled participants were included in the final analysis.

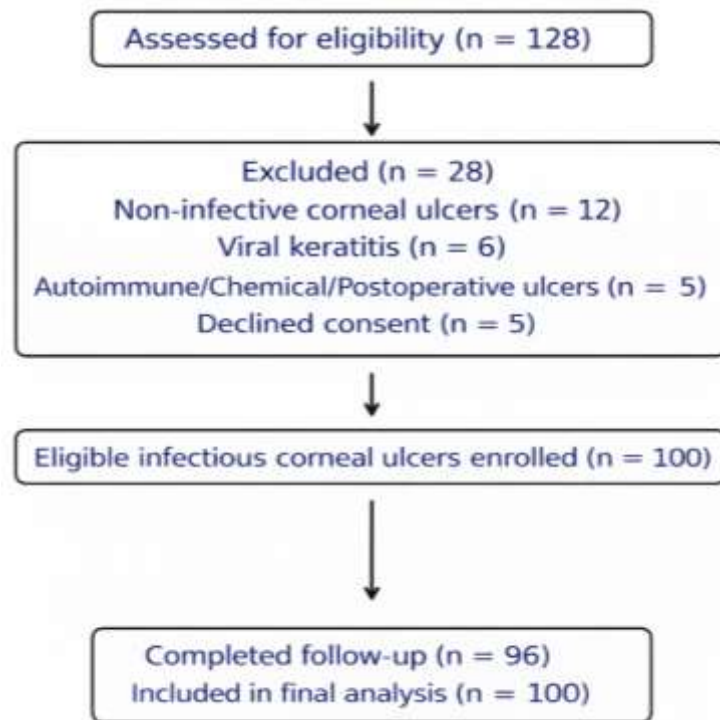


Figure 1: Participant Flow Diagram

A total of 100 patients with infectious corneal ulcers were evaluated during the study period. The demographic and baseline clinical characteristics of the study population are summarized in Table 1. The majority of patients belonged to the 31–60-year age group (56%), followed by those

aged above 60 years (26%). A male predominance was observed (64%), and more than half of the patients were from rural areas (58%). Laterality was almost equally distributed between the right and left eyes.

Table 1: Demographic and Clinical Profile of Study Participants (n = 100)

Variable	Number	Percentage
Age (years)		
≤30	18	18%
31–60	56	56%
>60	26	26%
Gender		
Male	64	64%
Female	36	36%
Residence		
Rural	58	58%
Semi-urban/Urban	42	42%
Laterality		
Right eye	49	49%
Left eye	51	51%

The predisposing risk factors associated with infectious corneal ulcers are detailed in Table 2. Ocular trauma was the most frequently identified risk factor, with trauma due to vegetative matter accounting for 38% of cases and non-

vegetative trauma for 14%. Contact lens use was noted in 12% of patients. Other contributory factors included chronic ocular surface disease (10%), prior topical steroid

usage (9%), and diabetes mellitus (11%). No identifiable risk factor was documented in 6% of cases.

Table 2: Predisposing Risk Factors for Infectious Corneal Ulcers (n = 100)

Risk Factor	Number	Percentage
Ocular trauma (vegetative matter)	38	38%
Ocular trauma (non-vegetative)	14	14%
Contact lens use	12	12%
Chronic ocular surface disease	10	10%
Prior topical steroid use	9	9%
Diabetes mellitus	11	11%
No identifiable risk factor	6	6%

Clinical and microbiological characteristics of the ulcers are presented in Table 3. Central corneal involvement was most common (46%), followed by paracentral (34%) and peripheral ulcers (20%). Moderate-sized ulcers measuring 2–5 mm were observed in nearly half of the patients (47%), while large ulcers (>5 mm) were seen in 25%.

Hypopyon was present in 29% of cases, indicating severe infection. Microbiological evaluation revealed bacterial etiology in 52% of cases, fungal infection in 34%, and mixed infections in 6%, while 8% remained culture-negative.

Table 3: Clinical and Microbiological Characteristics (n = 100)

Parameter	Number	Percentage
Ulcer location		
Central	46	46%
Paracentral	34	34%
Peripheral	20	20%
Ulcer size		
Small (<2 mm)	28	28%
Moderate (2–5 mm)	47	47%
Large (>5 mm)	25	25%
Hypopyon present	29	29%
Microbiological etiology		
Bacterial	52	52%
Fungal	34	34%
Mixed infection	6	6%
Culture-negative	8	8%

Treatment outcomes and visual results are summarized in Table 4. Complete healing with a clear corneal scar was achieved in 41% of patients, whereas 39% healed with residual corneal opacity. Poor outcomes or complications were observed in 20% of cases. Among complications,

corneal thinning was most common (9%), followed by perforation (6%) and the need for therapeutic keratoplasty (5%). Visual acuity improved following treatment in 62% of patients, while 28% showed no significant improvement and 10% experienced worsening of vision.

Table 4: Treatment Outcomes and Visual Results (n = 100)

Outcome Measure	Number	Percentage
Complete healing with a clear scar	41	41%
Healing with corneal opacity	39	39%
Poor outcome/complications	20	20%
Complications observed		
Corneal thinning	9	9%
Perforation	6	6%
Therapeutic keratoplasty required	5	5%
Visual outcome		

Improved vision	62	62%
No significant improvement	28	28%
Worsened vision	10	10%

Discussion

This hospital-based observational study evaluated 100 patients with infectious corneal ulcers over a 12-month period and demonstrated that the disease predominantly affected individuals aged 31–60 years (56%), with a marked male predominance (64%) and a higher representation from rural areas (58%). Ocular trauma was identified as the principal predisposing factor (52%), particularly vegetative matter injury (38%). Microbiologically, bacterial pathogens accounted for 52% of cases, fungal organisms for 34%, mixed infections for 6%, and 8% were culture-negative. Favorable anatomical healing was achieved in 80% of patients, and visual improvement was observed in 62%, while 20% developed complications.

The predominance of middle-aged males likely reflects occupational exposure and greater engagement in outdoor agricultural activities, increasing susceptibility to corneal trauma. Similar demographic distributions have been reported in both tropical and temperate settings. A 10-year analysis from the United Kingdom documented male predominance in fungal keratitis, although with a different exposure profile [7]. Prognostic assessments from tertiary centers have also identified age and occupational risk as important determinants of ulcer severity and outcome [8]. These findings support the interpretation that environmental exposure and healthcare accessibility strongly influence disease burden.

Ocular trauma, especially vegetative matter injury (38%), was the leading risk factor in this cohort. This pattern is characteristic of agrarian regions and aligns with observations from tropical countries, where fungal keratitis frequently follows plant-related trauma. Pediatric fungal keratitis series and rare fungal case analyses have similarly emphasized trauma as a key initiating event [11,12]. The relatively lower proportion of contact lens-associated ulcers (12%) contrasts with patterns reported in developed nations, suggesting regional variation in risk exposure [7]. The contribution of diabetes mellitus (11%) further underscores the role of compromised host immunity in increasing susceptibility and delaying epithelial healing.

Clinically, central corneal involvement was observed in 46% of patients, and moderate-sized ulcers (2–5 mm) constituted 47% of cases. Hypopyon was present in 29%, indicating an advanced inflammatory response. Central ulcers are known to carry a poorer visual prognosis due to involvement of the visual axis. Prognostic studies have demonstrated that ulcer size, depth, and location significantly predict treatment outcome and visual

recovery [8]. The relatively high frequency of hypopyon in the present study suggests delayed presentation, a finding commonly observed in resource-limited settings. Bacterial keratitis was the most frequent microbiological etiology (52%), followed by fungal infection (34%). This distribution parallels reports from both developed and developing regions, although the proportion of fungal ulcers remains higher in tropical climates [7,12]. Culture-negative ulcers (8%) may reflect prior empirical antimicrobial therapy, inadequate sample volume, or low organism load. Similar diagnostic challenges have been documented in institutional studies evaluating infectious ocular conditions [9].

Anatomical healing was achieved in 80% of cases, yet 20% developed complications, including corneal thinning (9%), perforation (6%), and the requirement of therapeutic keratoplasty (5%). Visual improvement occurred in 62% of patients. Previous investigations have demonstrated that early targeted therapy significantly improves prognosis, whereas delayed presentation, fungal etiology, and larger ulcer size increase the likelihood of adverse outcomes [8,10]. The complication profile in this study is comparable to reports describing severe infectious keratitis requiring intensive intervention [9]. The association between fungal infection and poorer outcome may be explained by deeper stromal penetration, slower therapeutic response, and limited antifungal drug bioavailability [7,11].

Overall, the present findings reinforce that infectious corneal ulcers in tropical tertiary-care settings are primarily trauma-related, microbiologically diverse, and potentially vision-threatening. Timely microbiological evaluation, prompt initiation of appropriate antimicrobial therapy, and early referral remain critical determinants of visual prognosis. Regional epidemiological surveillance and preventive occupational eye-safety measures may substantially reduce the burden of corneal blindness.

Generalizability

The findings of this study are generalizable to patients presenting with infectious corneal ulcers in tertiary-care teaching hospitals in South India, particularly those serving predominantly rural and semi-urban populations. The observed clinical profile and microbiological spectrum are likely reflective of regions with similar climatic conditions, occupational exposures, and healthcare access patterns. However, caution should be exercised when extrapolating these results to community-based settings, pediatric populations, or regions with

different environmental and socioeconomic characteristics.

Conclusion

This study demonstrates that infectious corneal ulcers predominantly affect middle-aged males from rural backgrounds, with ocular trauma, especially with vegetative matter emerging as the most significant predisposing factor. Bacterial keratitis constituted the most common etiology, followed by fungal infections, underscoring the importance of region-specific microbial patterns. Favorable anatomical and visual outcomes were achieved in the majority of patients with timely diagnosis and appropriate antimicrobial therapy. Nevertheless, delayed presentation, large ulcer size, central corneal involvement, and fungal etiology were associated with poorer outcomes and higher complication rates. These findings emphasize the need for early referral, prompt microbiological evaluation, and targeted treatment to reduce corneal morbidity and prevent avoidable vision loss.

Limitations

The hospital-based observational design may limit the external validity of the findings and introduce referral bias toward more severe cases. Microbiological confirmation was not obtained in all patients, partly due to prior antimicrobial use and culture-negative results. Viral keratitis was excluded, which restricts the applicability of findings to non-viral infectious ulcers only. Long-term follow-up to assess final visual rehabilitation and quality-of-life outcomes was not undertaken.

Recommendations

Public awareness regarding ocular trauma prevention and early symptom recognition should be strengthened, particularly among agricultural workers. Primary healthcare providers should be trained to recognize infectious keratitis early and refer patients promptly to tertiary centers. Routine microbiological evaluation of corneal ulcers should be encouraged to facilitate targeted therapy. Development of region-specific treatment protocols based on local microbial patterns is recommended. Future studies with larger sample sizes, multicentric participation, and longer follow-up are warranted to better understand long-term outcomes and resistance patterns.

Acknowledgements

The authors sincerely acknowledge the support and cooperation of the faculty and staff of the Department of Ophthalmology, Regional Eye Hospital, Kakatiya Medical College, Warangal, for their guidance and assistance during the study. The authors also extend their

gratitude to all patients who participated in the study for their cooperation.

Abbreviations

- ICK – Infectious Corneal Keratitis
- KOH – Potassium Hydroxide
- BCVA – Best Corrected Visual Acuity
- OPD – Outpatient Department
- IEC – Institutional Ethics Committee

Source of funding

The study had no funding.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

RP -Concept and design of the study, results interpretation, review of literature, and preparation of the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript. **SMPH** results interpretation, review of literature, preparing the first draft of the manuscript, and revision of the manuscript.

Data availability

Data available on request

Author Biography

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Student's Journal of Health Research Africa

e-ISSN: 2709-9997, p-ISSN: 3006-1059

Vol.6 No. 12 (2025): December 2025 Issue

<https://doi.org/10.51168/sjhrafrica.v6i12.2309>

Original Article

PUBLISHER DETAILS

Student's Journal of Health Research (SJHR)

(ISSN 2709-9997) Online

(ISSN 3006-1059) Print

Category: Non-Governmental & Non-profit Organization

Email: studentsjournal2020@gmail.com

WhatsApp: +256 775 434 261

Location: Scholar's Summit Nakigalala, P. O. Box 701432,
Entebbe Uganda, East Africa

