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Prolonged Hospital Stay in Corneal Ulcer: Association with Sociodemographic and Clinical Factors

Indrajit Sarkar [1], Dattatreya Banerjee [1], Rashmirekha Behera [2]

[1] Burdwan Medical College
Bardhaman, West Bengal (India)

[2] Gouri Devi Institute of Medical Sciences and Hospital
Durgapur, West Bengal (India)

Background. *Corneal ulcers are a major cause of visual impairment and blindness, particularly in developing regions. While hospitalization is often necessary for severe cases, the factors influencing prolonged hospital stays remain inadequately explored. Identifying key sociodemographic and clinical predictors can aid in optimizing patient management and resource allocation.*
Objective. *This study aims to assess the sociodemographic and clinical factors associated with prolonged hospitalization in patients with corneal ulcers.*
Methods. A retrospective observational study was conducted over one year with a sample size of 200 hospitalized patients diagnosed with corneal ulcers. Data were collected on sociodemographic variables (age, gender, socioeconomic status, rural vs. urban Residence) and clinical characteristics (ulcer size, depth, microbial aetiology, hypopyon presence, diabetes, immunosuppression, prior ocular surgery, treatment delay, and need for surgical Intervention). Length of hospital stay was categorized as prolonged vs. non-prolonged, and statistical analyses, including multivariate regression, were performed to identify independent predictors.
Results*. Prolonged hospitalization was significantly associated with larger ulcer size ($p < 0.01$), fungal aetiology ($p < 0.05$), presence of hypopyon ($p < 0.01$), delayed treatment ($p < 0.01$), and diabetes mellitus ($p < 0.05$). Patients with fungal ulcers had higher complication rates and required extended inpatient care. Rural patients experienced delayed diagnosis and referral, contributing to longer hospital stays. Multivariate analysis confirmed that microbial aetiology, ulcer severity, and systemic comorbidities were independent predictors of prolonged hospitalization.*
Conclusion. *Early diagnosis and prompt treatment are critical in reducing hospitalization duration and improving outcomes in corneal ulcer patients. Strengthening primary eye care services, community-based screening, and outpatient follow-up can mitigate the burden of prolonged hospitalization. Further multicenter studies and prospective trials are warranted to validate these findings and explore innovative treatment approaches.*

Keywords:
cornea, corneal ulcer, hospitalization, microbial keratitis, fungal keratitis, prolonged hospital stay, predictors, diabetes, hypopyon, treatment delay, ocular infection

Introduction

Corneal ulcers are a leading cause of preventable blindness and a global public health issue in developing countries, where eye care is scarce. Bacterial infections, eye trauma, improper contact lens use, or pre-existing eye diseases can cause corneal ulcers, which cause epithelium loss and stromal inflammation [1]. Bacteria, fungi, viruses, and protozoa can cause corneal ulcers. Bacteria and fungi cause most infections in Asia and Africa. Corneal ulcers can progress to endophthalmitis, corneal Perforation, and blindness if untreated [2]. Hospitalization is usually needed for intensive monitoring, targeted antimicrobial therapy, and surgery for severe corneal ulcers. Access to healthcare, microbial pathogen type, ulcer severity, and systemic comorbidities all affect hospital stay [3]. Long hospital stays increase HAIs (Hospital-acquired infections), antibiotic resistance, patient and healthcare system costs, and ophthalmic care resource shortages. Despite these challenges, little is known about the clinical and sociodemographic factors that prolong corneal ulcer patients' hospital stays [4]. These predictors must be identified to optimize treatment strategies and resource allocation to improve patient outcomes and lower healthcare costs.

Adequate corneal ulcer treatment should be started immediately to prevent vision loss and other complications. However, some patients recover completely with minimal hospital stays, while others require longer stays for unknown reasons [5]. Many clinical and non-clinical factors can prolong corneal ulcer patients' hospital stays. These include the patient's immune status, corneal involvement severity, pathogen, and healthcare facility presentation delays. In developing countries with poor ophthalmic care infrastructure and high treatment attrition rates due to resource constraints, understanding what causes prolonged hospital stays is crucial [6]. Prolonged hospitalization

costs healthcare systems, not just patients. Longer inpatient stays lead to more diagnostic procedures, longer intravenous or fortified antibiotic treatments, and more surgical procedures like therapeutic keratoplasty, which use more medical resources [7]. Another factor that can lower productivity is family members' time off work to care for a loved one during a long hospital stay. This is especially important in low-income communities, where medical bills and lost income are strained, and families are already struggling [8].

Extended hospital stays can also lead to hospital-acquired infections, which can complicate treatment. Long-term hospitalization increases the risk of MRSA(Methicillin-resistant Staphylococcus aureus) and Candida spp — infections, which can worsen treatment failures and lengthen stays [9]. Systemic conditions like diabetes prolong wound healing and treatment. Hospital stays for fungal keratitis patients are longer than average because antifungal treatment is less effective than for bacterial ulcers [10]. Unfortunately, corneal ulcer prediction research is scarce, which is unfortunate because long hospital stays have serious clinical and economic consequences. Most studies focus more on corneal ulcer epidemiology and microbiology than hospital stay as an outcome measure [11]. Identification and analysis of clinical and sociodemographic predictors can help healthcare policymakers and ophthalmologists reduce hospital stays, improve early diagnosis, and improve outpatient management protocols [12]. This study examines sociodemographic and clinical factors linked to prolonged hospitalization, filling a knowledge gap and providing actionable insights for healthcare professionals. Understanding these factors helps us identify patients at risk of longer hospital stays. This was allowed us to intervene quickly, reducing hospital stays and improving care.

This research aims to examine clinical and sociodemographic factors linked to extended hospital stays in corneal ulcer patients. This study identifies predictors to improve treatment and reduce hospital stays. This study examines how demographic factors like age, gender, socioeconomic status, profession, and location (rural vs. urban) affect corneal ulcer hospitalization time. We aim to identify clinical variables such as ulcer size, infection severity, microbial etiology (bacterial, fungal, or viral), and systemic comorbidities that may prolong hospital stays. To determine how healthcare access factors, including treatment time, referral frequency, and past OTC medication use, affect hospital stay. Systemic medication use, surgical procedures (therapeutic keratoplasty, amniotic membrane grafting), and antibiotic fortification are examined to determine how they affect hospital stays. Better patient outcomes and shorter hospital stays can be achieved through early Intervention. This study aims to improve ophthalmic healthcare efficiency and reduce corneal ulcer hospitalizations. The findings helped healthcare providers, administrators, and lawmakers improve patient care, reduce wasteful spending, and enhance corneal ulcer patients' vision.

Methods

Study Design. This retrospective observational study examined clinical and sociodemographic factors linked to longer hospital stays in corneal ulcer patients. Retrospective review of medical records can reveal patterns and correlations between factors and hospital stays. Observational studies provide valuable insights into real-world clinical scenarios, improving healthcare utilization and patient management.

Study Setting. The study was conducted at a referral-only tertiary ophthalmology facility. The hospital treats urban and rural patients with specialized ophthalmic care, including corneal ulcer surgery and microbiological diagnosis. As a referral centre, the hospital is well-suited to studying hospitalization patterns in corneal ulcer patients of various severity and aetiology.

Study Duration. Researchers analyze hospital records for a year on corneal ulcers. Environment and patient occupation may affect seasonal ulcer incidence; the chosen time frame captures these variations while ensuring an adequate sample size.

Sample Size. A total of 200 unique patients were included in the study, accounting for 200 affected eyes. Patients with bilateral ulcers were excluded to prevent data duplication. No patients were re-hospitalized within the study duration due to relapse or complications; only first-time admissions were analyzed.

Inclusion Criteria

1. Diagnosed with Corneal Ulcer Requiring Hospitalization: Only patients who require inpatient care for corneal ulcers were considered. This includes cases of bacterial, fungal, viral, and protozoal keratitis requiring intensive treatment.

2. Age >18 Years: The study was focused on adult patients, as pediatric cases of corneal ulcers may have different etiologies, treatment responses, and hospitalization requirements.

Exclusion Criteria

1. Patients with Incomplete Medical Records: Since the study relies on retrospective data, incomplete or missing records that do not provide necessary sociodemographic or clinical details were not considered.

2. Patients with Pre-Existing Severe Ocular Pathology: Those with severe pre-existing ocular conditions, such as advanced glaucoma, corneal dystrophies, or previously diagnosed corneal scarring unrelated to the ulcer, were excluded to ensure that the length of hospitalization is specifically related to the corneal ulcer and not pre-existing visual morbidity.

Patient Group Categorization. To evaluate the determinants of hospitalization duration, patients were categorized into two groups based on their length of hospital stay: those with a short stay (≤7 days) and those with a prolonged stay (>7 days). This threshold was selected as it closely aligned with the median duration of hospital stay observed in the study cohort and is also supported by previous research on microbial keratitis-related admissions.

The 7-day cut-off facilitates a meaningful comparison of clinical outcomes and healthcare resource utilization between early responders and those requiring extended care.

Data Collection. Data was extracted from hospital medical records using a structured data collection form. The variables of interest was categorized into sociodemographic factors, clinical factors, and treatment-related factors that may influence the length of hospitalization.

Statistical Analysis. Statisticians were analysing data using appropriate software IBM SPSS Statistics Version 25.0. The following statistical methods were used to summarize the study population's baseline sociodemographic and clinical characteristics: categorical variables: frequency and percentage; continuous variables: mean, standard deviation, median, and interquartile range. We compared the baseline characteristics of the prolonged and non-prolonged hospitalization groups using chi-square tests for categorical variables and T-tests for continuous variables. Continuous variables without a normal distribution were tested using non-parametric tests like the Mann-Whitney U test. Logistic regression models were used to identify factors that independently predicted hospital stays. The multivariate model used significant variables from the univariate analysis ($p < 0.05$). Odds ratios (OR) and confidence intervals were used to show how strongly predictors were associated with extended hospital stays. With these statistical methods, this study examined the factors that affected corneal ulcer patients' hospital stays. The ultimate goal was to help clinicians identify high-risk patients and optimize management strategies to reduce unnecessary hospital stays and improve patient outcomes.

Ethical Considerations. This study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Ethics Committee of the tertiary care. As the study was retrospective, informed consent was waived by the ethics board. Patient confidentiality was maintained, and data were anonymized during analysis.

Results

Patients with prolonged hospitalization were significantly older (p=0.032), more likely to reside in rural areas (p=0.005), and had a higher prevalence of diabetes (p<0.001).Larger ulcer size (≥6 mm) and fungal etiology were strongly associated with longer hospital stays (p<0.001). The presence of hypopyon and delayed presentation were significant predictors of prolonged hospitalization (p<0.001).A higher proportion of patients in the prolonged-stay group required systemic antibiotics (p=0.004) and surgical interventions (p=0.002).

Factors Associated with Prolonged Hospitalization

Each additional year of age increased the likelihood of prolonged hospitalization (OR: 1.03, p=0.042). Rural residence, diabetes, delayed presentation, larger ulcer size, fungal infection, and presence of hypopyon were independent predictors of prolonged hospitalization (p<0.001).

Average Length of Stay by Ulcer Type

The average duration of hospitalization varied significantly by microbial etiology. Patients diagnosed with fungal corneal ulcers had a mean hospital stay of 11.8±4.6

Table 2. Multivariate Regression Analysis

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age (per year increase)	1.03	1.00 - 1.06	0.042
Rural Residence	2.35	1.26 - 4.38	0.008
Diabetes Mellitus	2.92	1.58 - 5.41	<0.001
Delayed Presentation	3.85	2.10 - 7.04	<0.001
Ulcer Size ≥6 mm	4.78	2.57 - 8.92	<0.001
Fungal Infection	3.65	1.97 - 6.75	<0.001
Presence of Hypopyon	2.87	1.55 - 5.31	0.001

Table 1. Baseline Characteristics of the Study Population

Variable	Total (N=200)	Short Stay (≤7 days, n=110)	Prolonged Stay (>7 days, n=90)	p-value
Age (Mean ± SD, years)	52.4 ± 13.6	50.1 ± 12.8	55.2 ± 14.1	0.032
Gender (Male, %)	120 (60%)	65 (59%)	55 (61%)	0.788
Rural Residence (%)	130 (65%)	62 (56%)	68 (76%)	0.005
Diabetes Mellitus (%)	78 (39%)	30 (27%)	48 (53%)	<0.001
Delayed Presentation (>5 days) (%)	92 (46%)	30 (27%)	62 (69%)	<0.001
Ulcer Size ≥6 mm (%)	96 (48%)	30 (27%)	66 (73%)	<0.001
Fungal Infection (%)	85 (42.5%)	28 (25%)	57 (63%)	<0.001
Presence of Hypopyon (%)	90 (45%)	30 (27%)	60 (67%)	<0.001
Systemic Antibiotics Used (%)	88 (44%)	38 (35%)	50 (56%)	0.004
Surgical Intervention (%)	34 (17%)	10 (9%)	24 (27%)	0.002

Table 3. Visual Outcomes at Discharge Based on Length of Hospital Stay

Outcome	Short Stay (≤7 days, n=110)	Prolonged Stay (>7 days, n=90)	p-value
Corneal Perforation (%)	8 (7%)	28 (31%)	<0.001
Need for Surgical Intervention (%)	10 (9%)	24 (27%)	0.002
Final Visual Acuity ≤6/60 (%)	18 (16%)	42 (47%)	<0.001

Table 4. Hospital Resource Utilization

Resource Utilization	Short Stay (≤7 days, n=110)	Prolonged Stay (>7 days, n=90)	p-value
ICU (Intensive Care Unit) Admission (%)	4 (4%)	12 (13%)	0.018
Corneal Transplantation (%)	3 (3%)	15 (17%)	<0.001
Systemic Antibiotic Use (%)	38 (35%)	50 (56%)	0.004

days, whereas those with bacterial ulcers had a shorter average stay of 7.2 ± 3.1 days. This difference was statistically significant ($p < 0.001$), highlighting the more complex and prolonged course of fungal keratitis compared to bacterial infections.

Corneal Perforation was significantly higher in the prolonged hospitalization group ($p<0.001$). A greater need for surgical intervention, including corneal transplantation, was observed in the prolonged-stay group ($p=0.002$).Poor final visual acuity (≤6/60) was significantly more common among patients with prolonged hospitalization ($p<0.001$).

ICU admissions were significantly higher in the prolonged hospitalization group ($p=0.018$).A greater proportion of patients requiring corneal transplantation was observed in the prolonged-stay group ($p<0.001$).Systemic antibiotic use was significantly higher in patients with prolonged hospital stays ($p=0.004$).

Discussion

Key Findings. This study found several factors predicting a longer hospital stay for corneal ulcer patients. The main factors associated with longer hospital stays were age, rural location, diabetes, delayed onset, larger ulcer size (≥6 mm), fungal cause, and hypopyon. The length of stay was most affected by the delayed presentation and microbial etiology. Late-arriving patients were nearly four times more likely to stay in the hospital for more than five days. This delay may worsen the disease, microbial load, and corneal damage, requiring longer inpatient care. Microbial etiology, especially fungal infections, also predicted prolonged hospitalization. Antimicrobial therapy for fungal ulcers takes a long time and has long treatment durations. Bacterial ulcers respond well to intense topical antibiotics, but fungal ulcers often cause corneal Perforation, deep stromal involvement, persistent inflammation, and an increased risk of infection, requiring longer hospital stays. Hypopyon indicates severe intraocular inflammation and requires aggressive medical or surgical treatment, which prolongs hospitalization. Systemic factors like diabetes mellitus also contributed to prolonged hospitalization. Diabetes slows wound healing, increases infection risk, and adversely affects treatment, resulting in longer hospital stays. Rural patients also had longer hospital stays due to a lack of access to specialized ophthalmic care, a more severe disease state, and lower health literacy, which may have led to less informed treatment decisions.

Comparison with Previous Studies. Our findings are consistent with prior epidemiological studies. For instance, [13] documented increasing trends in hospitalizations due to microbial keratitis in the United States from 2002 to 2012, with notable emphasis on demographic disparities and healthcare resource burden. Similarly, [14], a study from Ireland has reported that fungal keratitis cases were associated with worse clinical outcomes, higher complication rates, and extended hospital stays, which aligns closely with our results regarding fungal etiology.

These comparative insights strengthen the argument that early microbiological identification and timely initiation of appropriate antifungal therapy are crucial in mitigating complications and reducing hospital duration. Moreover, our observation that rural residence correlates with prolonged hospitalization is reinforced, which highlights regional disparities in access to ophthalmic care. The association between diabetes and prolonged inpatient treatment is also echoed in broader literature emphasizing delayed epithelial healing and immune compromise in diabetic patients, contributing to more complex recovery trajectories.

Limitations. This study had limitations but provided valuable insights. Data biases like missing or incomplete records are inherent to retrospective studies and may have affected results. Hospital data may not represent all diseases because it excludes outpatients with less severe illnesses. The study's single-centre design makes it difficult to apply the results to other healthcare systems with different treatment protocols. Larger multicenter studies with diverse patient populations and healthcare infrastructures are needed to validate and use these findings. The lack of visual outcomes and disease recurrence data from long-term follow-up studies is another limitation. We measured patients' eyesight at discharge, but future research should examine long-term functional vision results, quality of life, and the financial burden of extended hospital stays

on healthcare systems and individuals. Despite finding multiple independent predictors of long hospital stays, our study did not investigate biomolecular markers or pathophysiological mechanisms that cause protracted illness progression. Further research into genetic, immunological, and microbiological factors may explain corneal ulcer patients' varied treatment reactions and prolonged hospital stays.

Conclusion

Certain factors predicted prolonged corneal ulcer hospitalization in this study. These included fungal etiology, larger ulcer size, hypopyon, and systemic conditions like diabetes. Also predictive was delayed presentation. Late arrivals, especially rural ones, stayed longer in the hospital, emphasizing the importance of prompt diagnosis and treatment. Fungal ulcers can cause longer hospital stays, worse disease progression, less effective treatment, and more complications. Diabetes, which affects wound healing and immunity, was also important. These findings emphasize the need for preventative management to reduce hospitalization and improve clinical outcomes. Clinically, the study shows how important early intervention protocols are to slow disease progression. Public health campaigns should focus on corneal ulcers, especially in underprivileged and rural areas, so that people can seek treatment early. Providing affordable eye care, establishing specialized ophthalmic centres, and training primary healthcare workers can improve early detection and referral. Future research should focus on novel therapeutic approaches, hereditary predisposition to severe corneal infections, and protracted disease progression biomolecular mechanisms. Larger prospective studies with multiple centres are needed to confirm these findings across populations and healthcare systems. Long-term follow-up studies on visual outcomes, quality of life, and cost-effectiveness of various treatment approaches are also desirable to optimize patient care.

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Corresponding author: *Dattatreya Banerjee – jdinkar1978@gmail.com*

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Abbreviation. *HAIs – Hospital-acquired infections; MRSA – Methicillin-resistant Staphylococcus aureus; OTC – Over the counter Conflict of interest: The authors declare no conflict of interest that could influence their views on the subject matter or materials described and discussed in this manuscript.*