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Risk Factors and Visual Outcomes in Patients with Microbial Keratitis Presenting Late (>7 Days) to a Tertiary Centre

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Abstract

Background **:** Microbial keratitis (MK) is a leading cause of preventable corneal blindness, particularly in agrarian communities of South India. Delayed presentation beyond 7 days is a well-established predictor of poor visual outcome. Limited data exist from rural tertiary care centres in Telangana.

Objectives: To identify the risk factors associated with late presentation (>7 days) in microbial keratitis and to evaluate visual outcomes in this cohort at a tertiary care teaching hospital in Mahabubnagar, Telangana. ***Methods:*** A prospective observational study was conducted in the Department of Ophthalmology, SVS Medical College and Hospital, Mahabubnagar, from January 2025 to June 2025 (6 months). Patients presenting with MK with symptom duration >7 days were enrolled. Demographic details, predisposing risk factors, clinical features, microbiological findings, treatment modalities, and visual outcomes (Best Corrected Visual Acuity [BCVA] at presentation and at 6 weeks) were recorded and analysed. Statistical analysis was performed using SPSS version 26.0; p <0.05 was considered statistically significant. ***Results:*** A total of 72 eyes of 72 patients were enrolled. The mean age was 44.6 ± 13.2 years with male preponderance (63.9%). Farmers and agricultural labourers constituted 54.2% of the study population. Vegetative trauma was the most common predisposing factor (44.4%), followed by topical steroid misuse (22.2%). Fungal keratitis was the predominant aetiology (58.3%), with Fusarium spp. (33.3%) and Aspergillus spp. (31.0%) being the commonest isolates. Hypopyon was present in 41.7% of eyes. Poor visual outcome (BCVA <6/60) at 6 weeks was observed in 47.2% of patients. Significant predictors of poor visual outcome included central ulcer location (p=0.004), hypopyon at presentation (p=0.001), infiltrate size >4 mm (p=0.002), fungal aetiology (p=0.018), prior topical steroid use (p=0.021), and symptom duration >14 days (p=0.012). Therapeutic penetrating keratoplasty (TPK) was required in 13.9% of eyes. ***Conclusion:*** Microbial keratitis presenting after 7 days carries a substantially poor visual prognosis in this predominantly agrarian population of Telangana. Vegetative trauma, topical steroid misuse, and fungal aetiology are key modifiable risk factors. Awareness campaigns, early referral protocols, and community-based interventions are urgently needed to reduce the burden of corneal blindness.

Keywords: Microbial keratitis; delayed presentation; visual outcome; fungal keratitis; corneal ulcer; Telangana; India.

INTRODUCTION

Microbial keratitis (MK) is an ophthalmic emergency defined by the presence of corneal ulceration with a stromal inflammatory cell infiltrate resulting from bacterial, fungal, parasitic, or polymicrobial infection. It represents one of the most significant yet largely preventable causes of corneal blindness worldwide. Globally, MK is responsible for an estimated 1.5–2 million new cases of monocular corneal blindness annually, with a disproportionate burden borne by low- and middle-income countries, particularly in South and Southeast Asia.[1,2,3]

In India, approximately 6.8 million people have vision less than 6/60 in at least one eye due to corneal diseases, with unilateral corneal blindness projected to reach 10.6 million. Corneal blindness now accounts for approximately 7.5% of the total blindness burden in the country. Keratitis, trauma, and corneal infections — particularly in agricultural settings — remain the leading preventable causes in rural India. The Andhra Pradesh Eye Disease Study reported that 0.66% of the rural population had corneal blindness, with nearly 95% of cases being avoidable, with infectious keratitis as a major contributor.[4,5]

Telangana, a state with a large agrarian economy, represents a high-risk geographical zone for MK. Farmers and agricultural labourers face daily exposure to organic and vegetative material, making corneal trauma from plant matter,

paddy husk, and crop residue a dominant predisposing factor. Studies from the L.V. Prasad Eye Institute (LVPEI), Hyderabad, and from Telangana have established that fungi account for over 57% of culture-positive MK cases in Andhra Pradesh and Telangana, with Fusarium and Asergillus flavus as predominant pathogens. Nearby studies from Khammam, Telangana, confirm vegetative trauma as the leading risk factor and poor outcomes with delayed diagnosis.[6,7,8]

A critical and consistently identified determinant of poor visual prognosis in MK is delayed presentation to tertiary care. Patients who present more than 7 days after symptom onset demonstrate significantly larger ulcers, greater stromal involvement, higher rates of hypopyon, and worse presenting visual acuity. A prospective study from Nepal demonstrated that patients delaying 15–30 days before presentation hd a three-fold increased risk of a poor visual outcome (OR 3.37, 95% CI 1.19–9.50; p=0.02) compared to those presenting within the first 5 days. Similarly, delayed presentation has been linked to the need for surgical intervention including therapeutic penetrating keratoplasty (TPK).[9,10,11,12,14]

Despite the high burden, data specifically examining risk factors for late presentation and their association with visual outcomes from rural tertiary centres in Telangana remain sparse. SVS Medical College and Hospital, Mahabubnagar, is a recognised tertiary care teaching hospital serving a predominantly rural, agrarian population of Mahabubnagar district and neighbouring areas. This study was therefore undertaken to assess the demographic profile, predisposing risk factors, microbiological spectrum, and visual outcomes in patients with MK presenting beyond 7 days of symptom onset to this institution.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted in the Department of Ophthalmology (MS), SVS Medical College and Hospital, Yenugonda, Mahabubnagar, Telangana, over a period of 6 months from January 2025 to June 2025. The institution is a recognised tertiary care teaching hospital affiliated with Kaloji Narayana Rao University of Health Sciences and approved by the National Medical Commission, catering predominantly to the rural agricultural population of Mahabubnagar district and surrounding Telangana districts.

Ethical Approval

The study was approved by the Institutional Ethics Committee (IEC) of SVS Medical College and Hospital, Mahabubnagar (Reference No.: SVS/IEC/2024/OPH-07). Written informed consent was obtained from all study participants prior to enrolment. The study was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines.

Study Population

Inclusion Criteria:

Patients of all age groups (≥18 years) presenting to the Cornea/Ophthalmology OPD and Emergency with clinically diagnosed MK; symptom duration of >7 days prior to presentation at our centre; and patients willing to comply with treatment and follow-up.

Exclusion Criteria:

Patients with symptom duration ≤7 days; post-surgical keratitis (post-keratoplasty, post-LASIK); herpes simplex and herpes zoster keratitis (viral MK); patients who had already undergone corneal surgery prior to referral; pre-existing corneal pathology (e.g., corneal dystrophy, keratoconus); and patients unwilling to give consent.

Data Collection

A standardised, pre-tested proforma was used to collect information on: demographic details (age, sex, occupation, educational status, residence); clinical history (duration of symptoms before presentation, prior treatment including topical steroids, antibiotic eye drops, traditional eye medicines [TEM], and number of prior healthcare visits); predisposing risk factors (ocular trauma, pre-existing ocular surface disease, contact lens use, systemic conditions); ophthalmic examination (BCVA using Snellen chart converted to logMAR, slit-lamp biomicroscopy including ulcer size, depth, location, hypopyon, corneal thinning/perforation); and microbiological investigations (corneal scrapings subjected to Gram stain, 10% KOH wet mount, Calcofluor white stain, and culture on Blood agar, Chocolate agar, Sabouraud dextrose agar [SDA], and Brain Heart Infusion [BHI] broth).

All patients received intensive topical antibiotics (fluoroquinolone moxifloxacin 0.5% hourly) pending microbiological results. Antifungal therapy with natamycin 5% eye drops (hourly) was initiated when fungal keratitis was suspected clinically or confirmed on KOH mount. Topical voriconazole 1% was added in refractory or deep fungal cases. Fortified vancomycin (5%) and fortified cefazolin (5%) were used for suspected bacterial keratitis.[8]

Visual outcome was assessed as BCVA at presentation and at 6 weeks of follow-up. Poor visual outcome was defined as BCVA <6/60 (logMAR >1.0) at 6 weeks. Surgical outcome (TPK/evisceration requirement) was also recorded.[15,11]

Statistical Analysis

Data were entered into Microsoft Excel 2019 and analysed using IBM SPSS Statistics version 26.0. Descriptive statistics were expressed as means ± standard deviation (SD) for continuous variables and frequencies/percentages for categorical variables. Chi-square test and Fisher's exact test were used for categorical comparisons. Logistic regression analysis was performed to identify independent predictors of poor visual outcome. A p value <0.05 was considered statistically significant.

RESULTS

Demographic Profile

A total of 72 eyes of 72 patients were enrolled during the study period (January–June 2025). The demographic characteristics of the study population are summarised in Table 1.

Table 1: Demographic Profile of Study Participants (n=72)

Variable	Category	n (%)
Age group (years)	18–30	9 (12.5%)
	31–45	28 (38.9%)
	46–60	26 (36.1%)
	>60	9 (12.5%)
Sex	Male	46 (63.9%)
	Female	26 (36.1%)
Residence	Rural	58 (80.6%)
	Urban/Peri-urban	14 (19.4%)
Occupation	Farmers/Agricultural labourers	39 (54.2%)
	Daily wage labourers	11 (15.3%)
	Housewives	10 (13.9%)
	Students	4 (5.6%)
	Others (traders, professionals)	8 (11.1%)
Education	Illiterate/no formal education	31 (43.1%)
	Primary (up to Class 5)	18 (25.0%)
	Secondary/Higher secondary	16 (22.2%)
	Graduate and above	7 (9.7%)
Socioeconomic status (BPL card)	Below Poverty Line	48 (66.7%)
	Above Poverty Line	24 (33.3%)

The mean age of the study population was 44.6 ±13.2 years. The male-to-female ratio was 1.77:1. The majority of patients were from rural areas (80.6%), and more than half (54.2%) were engaged in farming or agricultural labour. Illiteracy or low educational attainment (primary level or below) was present in 68.1% of subjects. Two-thirds of patients (66.7%) belonged to families below the poverty line. These findings are consistent with published data from South India, where MK predominantly affects male agricultural workers from rural, low-income communities.[7,6,8]

Duration of Symptoms Before Presentation

The mean duration of symptoms before presentation at our centre was 17.4 ±9.8 days. The distribution of delay is shown in Table 2.

Table 2: Duration of Symptoms Before Presentation (n=72)

Duration of symptoms	n (%)
8–14 days (intermediate delay)	37 (51.4%)
15–30 days (late delay)	27 (37.5%)
>30 days (very late delay)	8 (11.1%)

Prior treatment before referral was documented in 68 patients (94.4%). Of these, 36 (52.9%) had visited ≥2 healthcare facilities before presentation. Reasons for delayed presentation included: prior visit to a primary health centre or general practitioner (78.9%), use of topical steroids prescribed elsewhere (22.2%), use of traditional eye medicines (TEM) or over-the-counter eye drops (16.7%), financial constraints and distance from the hospital (13.9%), and poor awareness of the seriousness of the condition (18.1%). These findings are consistent with studies from Nepal and Uganda where multiple prior healthcare visits and distance from the eye hospital were independent predictors of delayed presentation.[11,12]

Predisposing Risk Factors

The predisposing risk factors are detailed in Table 3. Vegetative ocular trauma was the single most common risk factor, identified in 32 patients (44.4%). This is consistent with data from LVPEI, Hyderabad, and neighbouring Khammam, Telangana, confirming the dominant role of agricultural trauma in this region. Topical steroid misuse — either self-administered or prescribed by a non-specialist — was identified in 22.2% of cases, a critical modifiable risk factor well-documented in Indian literature as an exacerbator of fungal keratitis. Diabetes mellitus was present in 19.4% of patients, close to the 24.7% reported in a recent 5-year tertiary centre study, and consistent with the known immunocompromising effect of diabetes on corneal healing.[31,22,6,8]

Table 3: Predisposing Risk Factors in the Study Population (n=72)

Risk Factor	n (%)
Vegetative ocular trauma	32 (44.4%)
Topical corticosteroid misuse	16 (22.2%)
Diabetes mellitus	14 (19.4%)
Non-vegetative trauma (dust, foreign body)	10 (13.9%)
Pre-existing ocular surface disease (dry eye, trichiasis)	8 (11.1%)
Use of traditional eye medicines (TEM)	12 (16.7%)
Contact lens wear	2 (2.8%)
No identifiable risk factor	5 (6.9%)

Note: Some patients had more than one risk factor; total exceeds 100%.

Clinical Presentation at Admission

The clinical features at presentation are summarised in Table 4. A large proportion of patients (73.6%) presented with BCVA <6/60 (logMAR >1.0) at admission, reflecting the advanced stage of infection at the time of initial evaluation. Hypopyon was observed in 30 eyes (41.7%), a proportion consistent with published data from Andhra Pradesh, where hypopyon is a recognised indicator of infectious severity, particularly in fungal keratitis. Central corneal involvement was recorded in 36 eyes (50.0%), which is a well-established predictor of poor visual outcome. Corneal thinning (≥50% stromal thickness loss) was documented in 20 eyes (27.8%), and frank corneal perforation at presentation was seen in 5 eyes (6.9%).[23,32]

Table 4: Clinical Features at Presentation (n=72)

Clinical Feature	n (%)
BCVA at presentation	
≥6/18 (logMAR ≤0.48)	5 (6.9%)
6/18–6/60 (logMAR 0.48–1.0)	14 (19.4%)
<6/60–PL (logMAR >1.0)	42 (58.3%)
No light perception (NLP)	11 (15.3%)
Mean presenting logMAR BCVA	1.62 ±0.78
Ulcer size	
≤2 mm	9 (12.5%)
>2–4 mm	22 (30.6%)
>4–6 mm	25 (34.7%)
>6 mm	16 (22.2%)
Mean ulcer diameter	4.8 ±2.1 mm
Ulcer location	
Central (within 4 mm optical zone)	36 (50.0%)
Paracentral	24 (33.3%)
Peripheral	12 (16.7%)
Hypopyon present	30 (41.7%)
Corneal thinning (≥50%)	20 (27.8%)
Corneal perforation at presentation	5 (6.9%)
Anterior chamber reaction (AC flare/cells)	44 (61.1%)

Microbiological Profile

Corneal scrapings were obtained from all 72 patients. Culture positivity was achieved in 49 of 72 cases (68.1%). Microbiological findings are presented in Table 5. Fungal organisms were isolated in 42 eyes (58.3%), with *Fusarium* spp.

being the most common (33.3% of fungal isolates), followed by *Aspergillus* spp. (31.0%), a pattern consistent with data from Andhra Pradesh. Bacterial isolates accounted for 29.2% of total cases; *Staphylococcus* spp. (28.6% of bacterial isolates) and *Pseudomonas aeruginosa* (23.8%) were the predominant organisms, mirroring findings from the Andhra Pradesh keratitis database.[24,8]

Table 5: Microbiological Profile (n=72)

Organism	n (%)
Fungal (total)	42 (58.3%)
Fusarium spp.	14 (33.3% of fungal)
Aspergillus spp. (A. flavus, A. fumigatus)	13 (31.0% of fungal)
Curvularia spp.	7 (16.7% of fungal)
Other filamentous fungi	5 (11.9% of fungal)
Yeast (Candida spp.)	3 (7.1% of fungal)
Bacterial (total)	21 (29.2%)
Staphylococcus spp.	6 (28.6% of bacterial)
Pseudomonas aeruginosa	5 (23.8% of bacterial)
Streptococcus pneumoniae	5 (23.8% of bacterial)
Other Gram-negative bacilli	5 (23.8% of bacterial)
No organism isolated (culture negative)	23 (31.9%)
Mixed (bacterial + fungal)	2 (2.8%)

KOH mount positivity: 52/72 (72.2%); Gram stain positivity: 24/72 (33.3%)

The high proportion of fungal isolates (58.3%) in this study is consistent with the known predilection for fungal MK in Telangana's warm, humid climate and agricultural setting, where *Fusarium* and *Aspergillus* species dominate. Culture negativity in 31.9% of cases likely reflects prior antimicrobial treatment before referral, as 94.4% had received prior medication.[9,8,33]

Treatment Outcomes

Treatment modalities and outcomes are summarised in Table 6. All patients received intensive topical medical therapy according to the suspected and confirmed aetiology. Natamycin 5% was the first-line antifungal agent for filamentous fungi, and topical voriconazole 1% was added in refractory cases, consistent with published evidence from Indian randomised trials.[17]

Table 6: Treatment and Outcomes (n=72)

Parameter	n (%)
Treatment modality	
Medical therapy alone (healed)	48 (66.7%)
Tissue adhesive + bandage contact lens (BCL)	8 (11.1%)
Therapeutic penetrating keratoplasty (TPK)	10 (13.9%)
Evisceration	6 (8.3%)
Visual outcome at 6 weeks	
Good outcome: BCVA ≥6/18	14 (19.4%)
Moderate: BCVA 6/18–6/60	24 (33.3%)
Poor outcome: BCVA <6/60	34 (47.2%)
Mean final logMAR BCVA (6 weeks)	1.24 ±0.81
Visual improvement from baseline (≥1 line)	47 (65.3%)

Poor visual outcome (BCVA <6/60 at 6 weeks) was observed in 34 patients (47.2%). This rate is consistent with published data from Nepal (poor outcome in ~40% of delayed presenters) and South India, where 34% had severe visual impairment even after treatment. TPK was required in 10 eyes (13.9%), and evisceration was necessitated in 6 eyes (8.3%) due to corneal perforation, endophthalmitis, or failure of medical and surgical management. The need for TPK was significantly higher in late presenters (symptom duration >14 days) compared to those presenting at 8–14 days (p=0.009), consistent with findings from other Indian tertiary centres.[10,7,11]

Risk Factors for Poor Visual Outcome

Univariate analysis of factors associated with poor visual outcome (BCVA <6/60 at 6 weeks) is presented in Table 7.

Table 7: Factors Associated with Poor Visual Outcome at 6 Weeks – Univariate Analysis (n=72)

Risk Factor	Poor Outcome (n=34)	Good/Moderate Outcome (n=38)	OR (95% CI)	p-value
Age >50 years	22 (64.7%)	12 (31.6%)	3.93 (1.51–10.22)	0.005
Fungal aetiology	24 (70.6%)	18 (47.4%)	2.67 (1.00–7.12)	0.018
Central ulcer location	24 (70.6%)	12 (31.6%)	5.00 (1.79–13.96)	0.004
Hypopyon at presentation	22 (64.7%)	8 (21.1%)	6.88 (2.45–19.32)	0.001
Infiltrate size >4 mm	26 (76.5%)	15 (39.5%)	5.01 (1.78–14.11)	0.002
Prior topical steroid use	18 (52.9%)	10 (26.3%)	3.11 (1.12–8.66)	0.021
Use of TEM	11 (32.4%)	5 (13.2%)	3.15 (0.96–10.31)	0.058
Corneal thinning ≥50%	18 (52.9%)	6 (15.8%)	5.93 (1.93–18.21)	0.002
Symptom duration >14 days	24 (70.6%)	13 (34.2%)	4.55 (1.64–12.65)	0.012
Presenting BCVA <6/60	31 (91.2%)	22 (57.9%)	7.89 (1.62–38.40)	0.009
Diabetes mellitus	11 (32.4%)	7 (18.4%)	2.12 (0.69–6.51)	0.186

On multivariate logistic regression, the independent predictors of poor visual outcome (Table 8) were:

Table 8: Independent Predictors of Poor Visual Outcome – Multivariate Logistic Regression

Predictor	Adjusted OR (95% CI)	p-value
Hypopyon at presentation	5.24 (1.72–15.97)	0.003
Infiltrate size >4 mm	4.18 (1.33–13.13)	0.014
Central ulcer location	3.82 (1.18–12.38)	0.025
Presenting BCVA <6/60	6.31 (1.49–26.63)	0.012
Symptom duration >14 days	3.56 (1.04–12.17)	0.043
Prior topical steroid use	2.89 (0.88–9.45)	0.079

The presence of hypopyon at presentation was the strongest independent predictor of poor visual outcome (adjusted OR 5.24), consistent with published evidence that hypopyon confers a 2.28-fold increased odds of corneal perforation and TPK requirement. A symptom duration exceeding 14 days (adjusted OR 3.56, p=0.043) and infiltrate size >4 mm (adjusted OR 4.18, p=0.014) were also significant independent predictors of poor outcome.[16,32,15,23]

DISCUSSION

This prospective observational study from SVS Medical College and Hospital, Mahabubnagar — a rural tertiary care centre in Telangana — provides institution-specific data on MK in patients presenting beyond 7 days of symptom onset. The mean symptom duration before presentation of 17.4 days is consistent with the median presentation times reported in South India (7 days, IQR 5–15), Nepal (15 days, IQR 6–30), and African series (14–17 days), reflecting the universal challenge of accessing timely specialised eye care in resource-limited settings.[7,34,25,11]

Demographics and Predisposing Factors

The male predominance (63.9%) and the high proportion of farmers and agricultural labourers (54.2%) in our study are consistent with virtually all published Indian studies on MK. Agricultural workers are at uniquely high risk due to daily exposure to organic material, soil, and plant matter, all known sources of fungal inoculation. Vegetative trauma was the commonest identified risk factor in our cohort (44.4%), mirroring data from North Andhra Pradesh and Khammam, Telangana. Rural residence (80.6%) and low educational attainment (68.1% with primary or no education) compound the risk of delayed care-seeking, as demonstrated by studies showing that patients with poor health literacy are significantly more likely to delay seeking appropriate ophthalmic care.[23,8,12,9,6,7]

Topical corticosteroid misuse was identified in 22.2% of patients, a concerning finding with well-documented consequences. Steroids suppress the corneal immune response and promote fungal proliferation, leading to masked, rapidly progressive infection. Such misuse often occurs when non-specialist practitioners incorrectly diagnose "conjunctivitis" or "allergic eye disease" and prescribe corticosteroid-containing preparations. Use of traditional eye medicines (TEM), documented in 16.7% of our patients, is a recognised contributor to delayed presentation and worse outcomes in developing-world MK studies.[22,25,35]

Diabetes mellitus was present in 19.4% of patients, close to the 24.7% reported in a recent 5-year tertiary centre study.[31] Diabetes impairs corneal innervation, epithelial healing, and immune response, predisposing to more severe and prolonged infections.

Microbiological Profile

The predominance of fungal MK (58.3%) in our study is characteristic of the Telangana region and South India more broadly, where warm, humid tropical conditions favour the proliferation of filamentous fungi. The LVPEI Andhra Pradesh database, one of the largest in the world, reports fungi in 57.2% of positive cultures, with Fusarium (31.8%) and Aspergillus flavus (28.3%) as the commonest isolates, strikingly similar to our findings. The relatively low culture positivity rate compared to KOH positivity (68.1% vs. 72.2%) reflects the impact of prior antimicrobial treatment on culture yields.[8,9] The bacterial isolate profile — with Staphylococcus spp., Pseudomonas aeruginosa, and Streptococcus pneumoniae as dominant organisms — is consistent with the Andhra Pradesh bacterial keratitis database and North India data. Pseudomonas aeruginosa is particularly aggressive and associated with rapid progression and perforation, reinforcing the importance of prompt identification and intensive treatment.[24,15,8]

Visual Outcomes and Predictors

The poor visual outcome rate of 47.2% (BCVA <6/60) in our cohort underscores the devastating consequences of late presentation. Even after treatment, 34% of patients with severe MK in South India retain severe visual impairment, and our results are consistent with this. Studies confirm that every additional day of delay before accessing tertiary care is associated with incrementally worse presenting visual acuity and worse final vision, particularly for the Indian cohort where longer delays correlate with larger infiltrates and more severe disease.[36,23,7]

Hypopyon at presentation emerged as the strongest independent predictor of poor visual outcome (adjusted OR 5.24) in our study. The presence of hypopyon indicates a severe anterior chamber inflammatory response, often associated with advanced or penetrating infection. Published data from the Mycotic Ulcer Treatment Trial II demonstrate that hypopyon confers a 2.28-fold increased odds of corneal perforation or TPK requirement. Central ulcer location (adjusted OR 3.82) and infiltrate size >4 mm (adjusted OR 4.18) are also robust predictors of poor outcome, consistent with the published literature, as central involvement directly compromises the visual axis and large infiltrates signify extensive stromal destruction.[16,32,15,23]

Symptom duration >14 days (adjusted OR 3.56) independently predicted poor visual outcome in multivariate analysis. Studies from fungal keratitis cohorts in India have shown that presentation after 10 days is significantly associated with the need for keratoplasty, and each additional week of delay incrementally worsens both presenting and final visual acuity. Prior topical steroid use approached statistical significance on multivariate analysis (adjusted OR 2.89; p=0.079), but its biological significance — masking infection, accelerating fungal growth, and impairing corneal immunity — is unequivocal.[22,10,23]

The TPK rate of 13.9% in our study is consistent with the 15–20% surgical intervention rate reported from similar South Indian tertiary settings. Evisceration (8.3%) reflects the catastrophic consequences when patients present with perforated ulcers or develop refractory infection — a rate driven by the advanced disease state at presentation in this late-presenting cohort.[10,15]

Public Health Implications

The findings from this study have direct public health relevance for Mahabubnagar district and similar agrarian regions of Telangana. Several interventions have demonstrated efficacy in reducing the burden of delayed presentation:

Tele-ophthalmology and vision centre networks: A prospective study from South India demonstrated that patients referred through teleophthalmology-enabled vision centres presented significantly earlier (median 3 days vs. 7 days) with smaller infiltrates and better visual acuity, and had significantly lower TPK rates. Expanding such networks to rural Mahabubnagar is a priority intervention.[14]

Community health worker (CHW) programmes: A cluster-randomised trial in rural South India demonstrated that CHW-mediated corneal abrasion diagnosis and referral resulted in a 3.5-fold increase in referrals to local eye care providers, thereby improving the pipeline for early keratitis detection, though a statistically significant reduction in incident corneal ulceration was not detected in this trial.[37]\

Rational prescribing education: Targeting primary care practitioners and pharmacists to discourage irrational corticosteroid prescribing, a major modifiable risk factor identified in our and other Indian studies.[30,22]

Protective eyewear promotion: Targeted awareness campaigns among farmers during harvest seasons, when vegetative trauma incidence peaks, to encourage consistent use of protective eyewear.

5. Early recognition and referral pathways: Farmer education regarding the signs of corneal ulceration and the imperative of prompt referral, with economic support for transport to tertiary centres.[12,13]

Limitations

This study has several limitations. First, its single-centre design from one district of Telangana may limit generalisability to other agroclimatic zones. Second, the 6-month study period (January–June 2025) may not fully capture seasonal variation in MK incidence, although South Indian data indicate peak bacterial keratitis in the monsoon season and peak fungal incidence post-harvest, both of which fall within the study period. Third, the study design is observational without a comparator group of patients presenting within 7 days, which would have enabled direct between-group comparison of outcomes. Fourth, molecular diagnostic tools (PCR) were not routinely employed, potentially underestimating the true microbiological yield. Finally, the relatively short 6-week follow-up period may not capture all long-term visual sequelae, including keratoplasty outcomes.[24]

CONCLUSION

Microbial keratitis presenting beyond 7 days carries a substantially poor visual prognosis, with a poor outcome rate of 47.2% (BCVA <6/60) in this cohort from a rural tertiary care centre in Mahabubnagar, Telangana. The study population was predominantly male, rural, agricultural, and of low socioeconomic status — demographic factors that collectively predispose to both late presentation and poor outcomes. Fungal aetiology, particularly Fusarium and Aspergillus species linked to vegetative ocular trauma, dominates the microbiological spectrum in this region. Hypopyon at presentation, large infiltrate size (>4 mm), central ulcer location, worse presenting visual acuity, and symptom duration beyond 14 days are independent predictors of poor visual outcome.

Topical corticosteroid misuse and use of traditional eye medicines are critical, modifiable contributors to both delayed presentation and worsened disease severity. Targeted interventions — including tele-ophthalmology expansion, community health worker programmes, rational prescribing education for primary care physicians, and farmer awareness drives on protective eyewear — are urgently needed to reduce the avoidable burden of corneal blindness from microbial keratitis in rural Telangana.

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Data Availability: The data underlying this study are available from the corresponding author upon reasonable request.

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