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Research Article

Prevalence Of Keratomycosis Among Corneal Ulcer Cases Attending Department of Ophthalmology in A Tertiary Care Hospital at Northern Bihar

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ABSTRACT

Background: Keratomycosis is a major cause of corneal blindness in tropical regions, particularly among rural populations exposed to agricultural trauma. Despite its clinical importance, regional data from Northern Bihar remain limited.
Objectives: To determine the prevalence, etiological profile, and therapeutic outcomes of fungal keratitis among corneal ulcer cases in a tertiary care hospital in Northern Bihar.
Materials and Methods: This analytic-observational cohort study was conducted at Mata Gujri Memorial Medical College and L.S.K. Hospital, Kishanganj, Bihar, over 23 months (June 2023–May 2025). A total of **105** patients with corneal ulcers were evaluated. Corneal scrapings were examined by **KOH mount, Gram staining, and culture** on Sabouraud Dextrose Agar. Fungal isolates were identified by colony morphology and LPCB mount. Data were analyzed using SPSS v26.
Results: Fungal etiology was confirmed in **42.9%** of corneal ulcers. Most patients were **21–40 years** old (40%) and **male (64.8%)**, reflecting occupational exposure. **Vegetative trauma** was the predominant predisposing factor (58.3%). The leading isolates were *Aspergillus spp.* (55.6%), *Fusarium spp.* (33.3%), and *Candida spp.* (11.1%). Bacterial co-infections accounted for 9.5% of cases, with *Staphylococcus aureus* being the most common. Early diagnosis (< 7 days) correlated with better outcomes—**66.7%** of fungal cases achieved complete healing.
Conclusion: Keratomycosis remains a significant cause of infectious corneal ulceration in Northern Bihar, strongly linked to vegetative trauma and agricultural exposure. *Aspergillus* species predominate, and early microbiological confirmation with prompt antifungal therapy markedly improves prognosis. Public education on eye protection and early care after ocular injury is essential to reduce preventable blindness in high-risk communities.

Keywords*: Fungal keratitis, keratomycosis, corneal ulcer, Aspergillus, Fusarium, Northern Bihar, vegetative trauma.*

INTRODUCTION:

Corneal ulcers represent a significant public health concern, particularly in developing countries like India, where they contribute substantially to ocular morbidity and preventable blindness [1]. Among the various etiologies of corneal ulcers, fungal keratitis (keratomycosis) poses unique diagnostic and therapeutic challenges due to its indolent progression, nonspecific clinical features, and limited treatment options [2]. The burden of fungal keratitis is disproportionately high in tropical and subtropical regions, including India, where agricultural activities expose populations to trauma from vegetative matter, a major risk factor for fungal corneal infections [3].

In India, fungal pathogens account for 30-50% of microbial keratitis cases, with Fusarium and Aspergillus species being the most commonly isolated organisms [4]. Northern Bihar, with its predominantly agrarian economy and high incidence of ocular trauma, is expected to have a significant prevalence of keratomycosis, though comprehensive regional data

remain limited [5]. The clinical presentation of fungal keratitis often mimics bacterial ulcers, leading to delayed diagnosis and inappropriate initial treatment with antibiotics, which may exacerbate the condition [6].

Diagnostic challenges further complicate management, as conventional methods like potassium hydroxide (KOH) wet mount and fungal culture have variable sensitivity and often require expertise not readily available in peripheral health centers [7]. Advanced diagnostic tools such as confocal microscopy and polymerase chain reaction (PCR), while more accurate, are rarely accessible in resource-limited settings like northern Bihar [8]. This diagnostic uncertainty frequently results in delayed initiation of appropriate antifungal therapy, contributing to poor visual outcomes and complications such as corneal perforation or endophthalmitis[9].

The treatment landscape for fungal keratitis remains challenging, with topical natamycin and amphotericin B being the mainstay of therapy despite their limited availability in many healthcare facilities[10]. The rising costs of antifungals and emerging drug resistance further complicate management, underscoring the need for region-specific epidemiological data to guide clinical practice and resource allocation[11]. This study aims to determine the prevalence of keratomycosis among corneal ulcer patients attending a tertiary care hospital in northern Bihar, identify common fungal isolates, and assess current diagnostic and treatment practices.

By providing crucial insights into the local epidemiology of fungal keratitis, this study will help inform better clinical management strategies and highlight gaps in healthcare delivery that need to be addressed to reduce corneal blindness in this high-risk population. The findings may also serve as a basis for advocating improved diagnostic facilities and ensuring consistent availability of essential antifungal medications in the region.

Objective

To determine the prevalence of fungal colonization in cases of corneal ulcer following trauma by performing microscopic and culture identification of etiological agents and assessing their clinical response to topical antifungal therapy.

Materials & Methods:

Study Design: The present study was designed as an **analytic–observational cohort study** conducted in the Department of Microbiology in collaboration with the Department of Ophthalmology, **Mata Gujri Memorial Medical College and L.S.K. Hospital, Kishanganj, Bihar**.

Study Period: The study was carried out over a period of 23 months (June 2023 to May 2025).
Sampling Technique: Judicious corneal scrapings were obtained from the ulcer bed and margins by an ophthalmologist under aseptic precautions. The samples were immediately processed at the collection point by a microbiologist to minimize contamination and delay. Clinically suspected cases of keratomycosis were referred to the Department of Microbiology for etiological diagnosis.

Sample Size Determination: Mycotic keratitis is recognized as one of the major causes of infectious keratitis, with a worldwide prevalence ranging from 17% to 36%. The regional prevalence of corneal ulcers in Northern India is reported to be **7.3%** according to **Gopinathan et al. (2002).[12]** the calculated sample size was 105

Inclusion Criteria

- All patients attending the Ophthalmology Department of MGMMC & LSK Hospital with corneal ulcers during the study period, with or without a known history of ocular trauma, irrespective of age or gender.
- Patients who provided written informed consent.

Exclusion Criteria

- Cases previously treated with topical antifungal medication.
- Patients unable or unwilling to cooperate during sample collection.
- Very small ulcers yielding insufficient material for microbiological examination.
- Absence of informed consent.

Sample Collection and Clinical Procedure

After instillation of topical anesthetic drops (proparacaine 0.5%), corneal scrapings were aseptically obtained from the ulcer bed and margins using a sterile disposable 15-0 surgical blade. Care was taken to avoid corneal perforation or bleeding during the procedure.

Microbiological Work-Up

A portion of the scraped material was immediately transferred to a clean glass slide with a drop of 10% KOH for rapid microscopic examination of fungal filaments or yeast cells. The slide was either examined promptly or kept in a moist chamber until evaluation.

Residual material on the blade was inoculated onto Blood Agar and Sabouraud Dextrose Chloramphenicol Agar (SDCA) in McCartney bottles. Bacterial and fungal cultures were incubated at appropriate temperatures (25 °C and 37 °C) and observed daily for growth. When fungal colonies developed, identification up to the genus level was carried out by colony morphology and Lactophenol Cotton Blue (LPCB) mount microscopy.

Diagnostic and Therapeutic Approach

Preliminary KOH microscopy results were communicated to the treating ophthalmologist within one hour, enabling early initiation of antifungal therapy regardless of the species identification. In cases with inconclusive microscopy (approximately 16%), empirical combined topical antibacterial and antifungal therapy was initiated considering the history and type of ocular trauma. Minimum inhibitory concentration (MIC) testing was not included, as antifungal susceptibility testing remains non-standardized for routine clinical use.

Outcome Assessment

Therapeutic success was defined as complete corneal re-epithelialization observed on slit-lamp examination. However, visual recovery was evaluated over a longer follow-up period, as scarring in fungal keratitis may persist. All clinical data and treatment outcomes were systematically recorded in patient case sheets and reviewed periodically during the study.

Statistical Analysis

All collected data were entered into **Microsoft Excel 2021** and analyzed using **IBM SPSS Statistics version 26.0 (Armonk, NY, USA)**. Categorical variables such as prevalence and fungal species distribution were expressed as **frequency and percentage**, while continuous variables (e.g., age) were presented as **mean ± standard deviation (SD)**. Associations between categorical variables were analyzed using the **Chi-square test**, with **$p < 0.05$** considered statistically significant.

Ethical Considerations

The study protocol was reviewed and approved by the **Institutional Ethics Committee (IEC)** of Mata Gujri Memorial Medical College & L.S.K. Hospital, Kishanganj, prior to commencement. Written informed consent was obtained from all participants (or legal guardians for minors/incapacitated patients) after explaining the study objectives, procedures, potential risks, and benefits in the participant's local language (**Hindi or Bengali**). Confidentiality was ensured, and participants were informed of their right to withdraw from the study at any time without affecting their medical care.

Results & Analysis:

Table 1: Age Distribution of Corneal Ulcer Patients (n=105)

Age Group (Years)	Number of Cases	Percentage (%)
18 - 20	18	17.1
21–40	42	40.0
41–60	30	28.6
>60	15	14.3
Total	**105**	**100.0**

The majority of patients belonged to the 21–40 years age group (40.0%), followed by 41–60 years (28.6%). Younger (18 - 20 years) and elderly (>60 years) patients accounted for 17.1% and 14.3%, respectively.

Table 2: Sex Distribution of Corneal Ulcer Patients (n=105)

Sex	Number of Cases	Percentage (%)
Male	68	64.8
Female	37	35.2
Total	**105**	**100.0**

A male predominance (64.8%) was observed, with a male-to-female ratio of 1.8:1.

Table 3: Prevalence of Fungal Colonization in Traumatized Corneas (n=105)

Parameter	Total Cases	Fungal Culture Positive (n=45)	Percentage (%)
History of Trauma	105	45	42.9
Vegetative Trauma	60	35	58.3
Non-Vegetative Trauma	25	7	28.0
No Trauma History	20	3	15.0

In the present study, out of a total of 105 corneal ulcer cases, 45 (42.9%) were found to be fungal culture positive. Among these, a significant number had a history of trauma. Specifically, 60 patients had a history of vegetative trauma, of which 35 (58.3%) tested positive for fungal infection. In contrast, among the 25 patients with non-vegetative trauma, only 7 (28.0%) were culture positive. Notably, even among the 20 patients who reported no history of trauma, 3 (15.0%) showed fungal growth

Table:4. Prevalence of Keratomycosis Cases

Parameter	Number of Cases (n=105)	Percentage (%)
Total Keratomycosis Cases	45	42.9
Fungal Hyphae (Microscopy)	45	42.9
Bacterial Organisms	35	33.3
Mixed Infections	10	9.5
No Organisms Detected	15	14.3
Total	105	100.0

A total of 105 cases were studied, out of which 42.9% were diagnosed with keratomycosis, and 33.3% had bacterial infections. Mixed infections accounted for 9.5%, while 14.3% showed no organisms detected.

Table: 5. **Fungal Isolates (n=45)**

Fungal Isolates	No of Cases	Percentage
- *Aspergillus spp.*	25	55.6
- *Fusarium spp.*	15	33.3
- *Candida spp.*	5	11.1
- Other Fungi	0	0.0
Total	45	100.0

Among the 45 fungal isolates, 55.6% were identified as *Aspergillus spp.*, followed by 33.3% of *Fusarium spp.*, and 11.1% as *Candida spp.* There were no other fungi isolated.

Table: 6. Bacterial Isolates (n=35)

Bacterial Isolates	No of acses	Percentage
- *Staphylococcus aureus*	20	57.1
- *Pseudomonas aeruginosa*	10	28.6
- *Streptococcus pneumoniae*	5	14.3
- Other Bacteria	0	0.0
Total	35	100.0

Of the 35 bacterial isolates, *Staphylococcus aureus* was the most prevalent, accounting for 57.1%. *Pseudomonas aeruginosa* was isolated in 28.6% of cases, and *Streptococcus pneumoniae* accounted for 14.3%. No other bacterial organisms were detected.

Table: 7. **Response to Anti-Fungal Therapy (n=45)**

Response to Anti-Fungal Therapy	No of cases	Percentage
- Complete Healing	30	66.7
- Partial Healing	10	22.2
- No Response	5	11.1
Total	45	100.0

The majority of the cases (66.7%) showed complete healing with anti-fungal therapy. Partial healing was observed in 22.2% of the cases, while 11.1% of the cases showed no response to the therapy.

Table 8: Association Between Trauma Type and Microbial Isolates (n=105)

Trauma Type	Fungal Positivity (n=45)	Bacterial Positivity (n=35)	Mixed Infections (n=10)
Vegetative Trauma	35 (77.8%)	12 (34.3%)	8 (80.0%)
Non-Vegetative Trauma	7 (15.6%)	18 (51.4%)	2 (20.0%)
No Trauma	3 (6.6%)	5 (14.3%)	0 (0.0%)

Among the 45 fungal-positive cases, the majority (77.8%) had a history of vegetative trauma, highlighting it as a significant risk factor for keratomycosis. In comparison, 15.6% of fungal infections were associated with non-vegetative trauma, while only 6.6% occurred in patients without any history of trauma. On the other hand, bacterial infections (n=35) were more commonly linked to non-vegetative trauma, accounting for 51.4% of cases, followed by 34.3% with vegetative trauma and 14.3% without trauma. Mixed infections (n=10) were predominantly seen in patients with vegetative trauma (80.0%), whereas 20.0% occurred in those with non-vegetative trauma, and none were observed among patients without any trauma history. These findings reinforce the association between trauma—particularly of vegetative origin—and the development of fungal and mixed microbial keratitis.

Table 9: Time-to-Diagnosis and Therapeutic Outcomes (n=45)

Time from Symptom Onset to Diagnosis	Complete Healing (n=30)	Partial/No Healing (n=15)
<7 days	22 (73.3%)	5 (33.3%)
7–14 days	7 (23.3%)	6 (40.0%)
>14 days	1 (3.4%)	4 (26.7%)

In this study, the timing of diagnosis from symptom onset was found to significantly influence healing outcomes. Among the 30 cases that achieved complete healing, a majority (73.3%) were diagnosed within 7 days of symptom onset. In contrast, only 33.3% of the 15 cases with partial or no healing were diagnosed within the first 7 days. Delayed diagnosis was associated with poorer outcomes; 40.0% of cases with partial or no healing were diagnosed between 7–14 days, and 26.7% were diagnosed after more than 14 days. In comparison, only 23.3% and 3.4% of completely healed cases were diagnosed within these respective timeframes.

Table 10: Ulcer Characteristics vs. Microbial Etiology

Ulcer Feature	Fungal (n=45)	Bacterial (n=35)	Mixed (n=10)
Size >3mm	38 (84.4%)	20 (57.1%)	9 (90.0%)
Hypopyon Present	28 (62.2%)	15 (42.9%)	7 (70.0%)
Central Location	32 (71.1%)	18 (51.4%)	8 (80.0%)

Analysis of clinical features revealed that larger ulcer size, hypopyon, and central corneal involvement were more commonly associated with fungal and mixed infections compared to bacterial ulcers. Among fungal cases (n=45), 84.4% had ulcers larger than 3 mm, 62.2% presented with hypopyon, and 71.1% had centrally located ulcers. In comparison, bacterial infections (n=35) showed a smaller proportion with these features: 57.1% had ulcers >3 mm, 42.9% had hypopyon, and 51.4% had central ulcer location. Mixed infections (n=10) showed the most aggressive presentation, with 90.0% of cases having ulcer size >3 mm, 70.0% presenting with hypopyon, and 80.0% exhibiting central corneal involvement.

Table 11: Antifungal Treatment Response by Fungal Species (n=45)

Fungal Isolate	Complete Healing	Partial Healing	No Response
Aspergillus spp.	18/25 (72.0%)	5/25 (20.0%)	2/25 (8.0%)
Fusarium spp.	9/15 (60.0%)	4/15 (26.7%)	2/15 (13.3%)
Candida spp.	3/5 (60.0%)	1/5 (20.0%)	1/5 (20.0%)

The treatment outcomes varied among different fungal isolates in keratomycosis cases. Aspergillus spp. demonstrated the highest rate of complete healing, with 72.0% (18 out of 25 cases) showing full recovery, followed by 20.0% showing partial healing and 8.0% showing no response. Among the Fusarium spp. infections, 60.0% (9 out of 15 cases) achieved complete healing, while 26.7% had partial healing and 13.3% showed no response. Similarly, Candida spp. infections resulted in complete healing in 60.0% (3 out of 5 cases), with 20.0% each showing partial healing and no response.

Discussion:

This analytic-observational cohort study, conducted at a tertiary care hospital in Kishanganj, Bihar, evaluated the prevalence and etiological profile of keratomycosis among patients with corneal ulcers. The study identified fungal etiology in 42.9% of cases, confirming that fungal keratitis remains a major public-health concern in agrarian regions.

Most patients were between 21–40 years (40%), indicating higher risk among active, outdoor workers. The male predominance (M:F = 1.8:1) parallels reports by **Srinivasan et al. (1997)**[13] and **Chander et al. (1994)**[14], linking occupational exposure and ocular trauma with fungal keratitis.

Trauma, particularly with vegetative material (58.3%), emerged as the leading predisposing factor, consistent with **Nalamada et al. (2024)[15],** who found 54–64% of fungal ulcers associated with agricultural injuries. Even 15% of non-traumatic ulcers yielded fungal growth, suggesting unrecognized micro-injuries or delayed presentation.

Aspergillus spp. (55.6%) and *Fusarium spp.* (33.3%) predominated—comparable to Usha et al. (2012)[93] and **Idiculla et al. (2009)[16].** The relatively lower proportion of *Candida spp.* (11.1%) concurs with **Baruah et al. (2020)[17],** reflecting the rarity of yeast infections in rural, outdoor populations. Among bacterial isolates, *Staphylococcus aureus* (57.1%) was most frequent, aligning with Gram-positive predominance noted by **Baruah et al. (2020)[17].**

Mixed fungal–bacterial infections (9.5%) were also identified, similar to the 9.29% global incidence reported by **Ahmadikia et al. (2021)[18],** underscoring the need for dual antimicrobial coverage in trauma-related corneal ulcers.
Fungal and mixed ulcers displayed more severe features—larger size, hypopyon, and central location—compared with bacterial ulcers, consistent with the observations of **Nalamada et al. (2024)[15].** Early diagnosis significantly improved prognosis: 73.3% of completely healed cases were diagnosed within seven days, echoing **Brown et al. (2021)[19],** who emphasized early intervention as key to vision preservation.

Overall, 66.7% of patients responded completely to antifungal therapy, comparable to success rates reported by **Idiculla et al. (2009)[16].** *Aspergillus* infections showed the best response (72%), while *Fusarium* infections were more resistant (13.3% non-responsive), consistent with **Awad et al. (2024)[20].**

Conclusion:
Keratomycosis was identified in 42.9% of corneal ulcer cases, predominantly affecting young male adults engaged in agricultural work. Vegetative trauma emerged as the main risk factor, with Aspergillus spp. being the most common isolate, followed by *Fusarium* and *Candida*. Fungal ulcers were typically larger, centrally located, and more severe than bacterial ones. Early diagnosis within seven days was strongly associated with better outcomes, with 66.7% showing complete healing. The study underscores the need for prompt diagnosis, early antifungal therapy, and public awareness on eye protection to reduce the burden of fungal keratitis in rural Bihar.

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