Section: Ophthalmology

Original Research Article

# CLINICAL AND MICROBIOLOGICAL PROFILE OF SUSPECTED INFECTIVE KERATITIS IN A HOSPITAL-BASED STUDY

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## Abstract

**Background:** Microbial keratitis can be caused by bacteria, fungi, viruses, parasites or can be polymicrobial. There is lot of diversity in the causative organisms depending on the geographical area. We aim to determine the microbiological profile of infective keratitis, and to ascertain the association between the etiological agent and clinical manifestations, the demographic profile as well as risk factors including trauma in the etiology of microbial keratits among patients who presented to the ophthalmology out-patient department. **Materials and Methods:** 90 patients with probable microbial keratitis who visited the Department of Ophthalmology at a teaching medical college hospital in the state of Telangana, India between February 2021 and January 2023 were included in the study. Corneal scrapings were obtained and subjected to microbiological examination in every patient of microbial keratitis. **Results:** Prevalence was more in the age group of 3th to 5th decade. Males (72.22%) were more commonly affected than females. Microscopic examination showed fungi (33.33%) as the most common causative organism for microbial keratitis followed by bacteria (22.23%). No organism was found in 27.77%. Among fungi, Aspergillus species and in bacteria Staphylococcus species were the commonest organisms isolated. **Conclusion:** Corneal ulcer is a major ocular emergency and important cause of corneal blindness in the Indian subcontinent. Vision loss or impairment can be prevented if it is treated promptly and appropriately that includes ascertaining the etiological agent for instituting the right therapy.

## INTRODUCTION

Infections of the cornea are among the most serious threats to eyesight. It is estimated that in India, the annual incidence of corneal ulcer is approximately 1.5-2 million.[1] Microbial keratitis represents the leading cause of corneal blindness among various etiologies like infection, trauma, chemical injuries, inflammations, degenerations, dystrophies and nutritional deficiency.[2] Invasive microorganisms can induce corneal perforations in as little as 24 hours. There should be prompt intervention to halt the progression of the condition. Scarring of the cornea, which can result in blindness, may be mitigated if therapy begins early enough. While awaiting for culture results, it is common practice to begin aggressive, broad-spectrum treatment with a combination of strengthened antimicrobials. The prevalence of microorganisms in certain geographic areas, forms the basis for empirical therapy. The bacteria species responsible for infectious keratitis and their susceptibility to various antibiotics and antifungals follow a diverse epidemiological trend in different parts of the world. A study from Madurai, South India showed bacterial and fungal infections to be equally common in the etiology of corneal ulcer and Streptococcus pneumoniae, Fusarium species being the most common causative organisms.[3]

Based on the soil, climate, and patient referral patterns of each location, the most common isolates change from one part of the world to another. The objectives of the present study are to understand the variables that affect the onset, frequency and patterns of corneal infections in patients presenting with infectious keratitis and to identify the common causative agents, risk factors and treatment response among them.


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## MATERIALS AND METHODS

This is a prospective observational study of 90 patients with probable microbial keratitis who visited the Department of Ophthalmology at a teaching medical college hospital in the state of Telangana, India between February 2021 and January 2023.

**Inclusion Criteria**

- Treatment naïve patients with infective keratitis
- Ulcer following trauma
- Ulcers in patients with ocular anomalies.
- Ulcers in individuals who wear contact lenses.

**Exclusion Criteria**

- Penetrating injury and Intraocular foreign body (IOFB)
- Patients under treatment for corneal ulcer
- Healed ulcer.
- Children younger than three years of age.
- Viral keratitis

Patient demographic details like age, sex, occupation, history of injury, contact lens usage and systemic disease were obtained. Visual acuity was assessed in all the cases.Cases with epithelial defect along with stromal infiltrate were identified as corneal ulcer clinically on slit lamp biomicroscopy. Corneal scarping was done by 15 no blade in every case of suspected microbial keratitis and were sent for gram staining, KOH wet mount, culture and sensitivity. Informed consent was taken from every patient.

## RESULTS

Age of the patients

The table below shows the frequency of corneal ulcer in different age groups. Highest prevalence was found in fifth decade.

**Table 1: Age distribution of patients with infective keratitis**

| Age distribution | Number of Cases | Percentage (%) |
|---|---|---|
| 10–20 | 11 | 12.22% |
| 21-30 | 15 | 16.66% |
| 31-40 | 16 | 17.77% |
| 41-50 | 26 | 28.88% |
| Above 51 | 22 | 24.44% |

In the present study, 65 (72.22%) cases were males and 25 (27.77%) cases were female.

**Table 2: Occupation of the study subjects**

| Occupation | Number of Patients | Percentage (%) |
|---|---|---|
| Merchant | 10 | 11.11% |
| Farmer | 20 | 22.22% |
| Student | 10 | 11.11% |
| Industrial labourer | 17 | 18.88% |
| Mechanic | 13 | 11.11% |
| Housewife | 10 | 11.11% |
| Auto driver | 10 | 11.11% |

**Table 3: Etiology of infective keratitis**

| Etiology | Number of Cases | Percentage (%) |
|---|---|---|
| Chemical injury | 5 | 5.55% |
| Trauma with organic matter | 23 | 25.55% |
| Trauma with non organic matter | 10 | 11.11% |
| Contact lens wear | 7 | 7.77% |
| Exposure keratitis | 4 | 4.44% |
| Post corneal refractive procedure | 1 | 1.11% |
| Systemic immunosupression alone | 5 | 5.55% |
| Dacryocystitis | 6 | 6.66% |
| Nutritional | 3 | 3.33% |
| No risk factors | 26 | 28.88% |

Most common etiology was found to be trauma seen in 36.66%

**Table 4: Corneal Ulcers Microbiological Study for 90Cases**

| Distribution of Organisms | Number ofCases | Percentage (%) |
|---|---|---|
| No organisms | 25 | 27.77% |
| Bacteria | 20 | 22.22% |
| Fungi | 30 | 33.33% |
| Bacteria+Fungi | 05 | 5.55% |
| Acanthamoeba | 10 | 11.11% |

Microscopic examination showed fungi (33.33%) as the most causative organism for microbial keratitis.


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**Table 5: Corneal Ulcers and Bacterial Isolation**

| Frequency of bacterial pathogen | Number of cases (n=20) | Percentage (%) |
|---|---|---|
| Staphylococcus aureus | 5 | 25% |
| Staphylococcus epidermidis | 5 | 25% |
| Streptococcus pneumoniae | 4 | 20% |
| Pseudomonas aeruginosa | 3 | 15% |
| E.Coli | 2 | 10% |
| Klebsiella | 1 | 5% |

All the patients with dacryocytitis and contact lens wear had bacterial corneal ulcer. 3 patients had history of trauma.

Among these cases, 5 cases presented with yellowish round paracentral infiltrate, 7 cases presented with deep stromal infiltrate with mobile hypopyon, 2 cases presented with greenish yellow infiltrate, 3 cases presented with small greyish infiltrate.

All the cases with a clinical suspicion of bacterial corneal ulcer were started on fortified cefazolin(5 %) and fortified gentamycin(1.4%) empirically. Once the culture sensitivity reports were obtained, patients were treated based on the antibiotic sensitivity. No patient received steroids in any form.

**Table 6: Corneal Ulcers and Fungi Isolation**

| Distribution of Type of Fungi | Number of cases (n=30) | Percentage (%) |
|---|---|---|
| Aspergillus flavus | 6 | 20% |
| Fusarium | 9 | 30% |
| Aspergillus Fumigatus | 4 | 13.33% |
| Aspergillus niger | 3 | 10% |
| Candida | 2 | 6.66% |
| Demataceous fungi | 2 | 6.66% |
| Unidentified fungi | 4 | 13.33% |

Aspergillus species (43.33%) was the commonest fungi isolated followed by fusarium (30%).

16(out of 30) cases of fungal corneal ulcer had history of trauma.

Among these cases 6 cases presented with dry elevated lesions, 4 cases presented with stromal infiltrate with hyphaete margins, 2 cases presented with endothelial plaque, 7 cases presented with satellite lesions, 11 cases presented with dense stomal infiltrate and hypopyon.

All the cases with clinical suspicion of fungal keratitis were started on natamycin (5%) drops. Oral ketoconazole at a dosage of 200 mg twice daily was added in cases with ulcer more than 6 mm in diameter, ulcer involving more than half of stroma, and if anterior chamber exudates were present.

Majority of polymicrobial cases had infiltrate with hypopyon.(4 out of 5)

Among the cases with infective keratitis, hypopyon was seen in 31 patients (34.44%). Majority of cases with hypopyon was associated with fungal keratitis(35.48%).

Systemic disease association without an associated ocular risk factor was present in 5 patients. Out of which, 2 patients (2.22%) had HIV infection, 2 patients (2.22%) had diabetes mellitus and 1 patient (1.11%) had tuberculosis.

## DISCUSSION

Outcome of infective keratitis depends on various factors like duration of keratatis, severity of ulcer, etiological agent involved, assocaited systemic disease of the patient and the treatment adivsed. Epidemiology of microbiological agents vary from region to region. It is important to know the common microbiological entities causing infective keratitis in a particular region in order to give appropriate empirical therapy while awaiting the laboratory results. We have conducted this study to know the clinical and microbial profile, response to treatment and timely intervention in medchal district, Telangana state. Majority of the study participants were middle aged (3rd to 5th decade) and males. The male to female ratio in the present study was 2.6:1 which is comparable to study by Usha Gopinathan et al.[5] Male preponderanc is proved by many studies previously.[3,4] In our study, the highest incidence was seen among farmers and industrial labourers that constituted about 33.32%. According to literature available, farmers (54-70%) and manual labourers(11-17%) constituted main occupations in Asia, where as our study showed incidence among farmers(22.22%) and industrial workers (18.88%). This disparity is because of geographic location of our hospital situated in urban and industrial area. High incidence among these groups was due to the increased occupational exposure to plant materials and foreign bodies compounded by the lack of eye protection.[7-9] The predominant predisposing factor for infectious keratitis in this study population was trauma (36.66%). Other risk factors include contact lens wear (7.77%), dacrocystitis (6.66%), chemical injury(5.55%), systemic immunosuprresion(5.55%), exposure keratitis (4.44%), nutritional (3.33%) and post refractive surgery (1.11%)(Table 3). No risk factor was found in 28.88% patients. Trauma with organic matter included injury with plant stem, thorn, paddy husk, animal tail, stick. Trauma with non-organic matter included injury with stone, metallic foreign body.


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Mechanical and chemical trauma that disrupts the integrity of corneal epithelium was found to be a significant contributing factor among patients with both fungal and bacterial corneal ulcer.

Systemic disease association like diabetes mellitus, human immunodeficiency viruses (HIV), tuberculosis without an associated ocular risk factor was present in 5(5.55%) patients. Hyperglycaemia facilitates microbial growth and alters the microbiota of ocular surface causing upregulation of Pseudomonas spp. and Acinetobacterspp.[10] It also affects homeostasis, corneal sensation and wound healing of the corneal epithelium, thereby increasing the risk of microbial keratitis.[11]Jeng et al observed an approximately tenfold increased risk of infective keratitis in individuals affected by HIV when compared to healthy individuals highlighting the importance of host immunity in ocular surface defence.[12]

In the present study, culture was negative in 27.77%, whereas culture was positive in 72.23% (fungi 33.33%, bacteria 22.22%, acantheomba 11.11%, polymicrobial 5.55%). Our results were similar to that of Srinivasan et al study[3] where positive culture rates were 68.40%, Kaliamurthy et al[6] which showed microbial isolation rate of 77%. Bacterial and fungal isolation rates were similar to Lalitha et al which showed fungal keratitis in 34.3% and bacterial keratitis in 24.7%.[13]

Cases presenting with clinical characteristics like stromal infiltrate with dry elevated lesions, hyphaete margins, satellite lesions, endothelial plaque, thick immobile hypopyon, history of tauma with organic matter were suspected as fungal keratitis and were proven microbiologically later on further investigations. Fungal keratitis was the commonest among culture proven cases constituting 33.33%. Among these, Aspergillus species was seen in 43.33% and fusarium was seen in 30%. Most of the fungal keratitis cases were associated with trauma with organic matter as reported by various studies conducted in South India previously which are dominated by agricultural communities.[5,7] Previous studies from South India by Usha Gopinathan et al[14] stated that Fusarium(37.2%) and Aspergillus species (30.7%) predominated the hyaline fungal spectrum but our study had showed aspergillus species as the most common organism causing fungal keratitis. Our results are comparable to a study by YaminiTawde et al which showed Aspergillus followed by fusarium as the commonest organisms in fungal keratitis.[15]

Cases with clinical characteristics like yellowish or greenish or greyish single infiltrate, deep stromal infiltrate with mobile hypopyon, history of contact lens wear, chronic dacryocystitis were suspected as bacterail keratitis and were culture proven on further investigations. Bacteria were isolated in 22.22% cases, out of which stapyhlococcus aureus(25%), staphyloccoccus epidermidis(25%) and streptococcus pneumoniae(20%) were the commonest organisms among gram positive organisms. Pseudomonas was the commenest organism isolated in gram negative organisms. Our study showed Staphylococcus species as the commonest organism among gram positive bacteria and pseudomonas among gram negative bacteria which is similar to study by Acharya et al.[16] and Manisha singh et al.[17]

Mixed growth was seen in 5.55% cases. Acanthamoeba was isolated in 11.11% cases. Acanthamoeba keratitis was found in farmers and children, contact lens wear was not associated with Acanthamoeba keratitis in our study.

Medical management using antibiotics was tapered according to clinical course using parameters like-decreased density of the stromal infiltrate, reduction in the size of epithetlial defect, reduced anterior chamber inflammation including hypopyon and improvement in symptoms. About 90% patients in bacterial, fungal and unidentified etiology for microbial keratitis responded to medical management. Patients who progressed to corneal thinning and descematocele were referred to higher centres for surgical management.

## CONCLUSION

Characteristic clinical features of fungal ulcer like dry elevated lesions, stromal infiltrate with hyphate margins, endothelial plaque, presence of satellite lesions and (or) dense stomal infiltrate and hypopyon had high probability of being confirmed microbiologically to be fungal keratitis likewise features like yellowish single infiltrate, deep infiltrate with hypopyon, greyish round infiltrate were diagnosed and microbiologically proven to be bacterial keratitis. The most common fungal species isolated was Aspergillus and bacterial pathogen commonly found was Staphylococcus and streptococcus pneumonia. Common risk factors for bacterial keratitis were dacryocystitis and contact lens wear. Trauma with vegetative matter was the most common risk factor for fungal keratitis.

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