Brief Original Article

Mycotic keratitis in India: a five-year retrospective study

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Abstract

Background: Mycotic keratitis is a fungal infection of the cornea. This infection is difficult to treat and it can lead to severe visual impairment or blindness. It is worldwide in distribution, but is more common in the tropics and subtropical regions. Trauma is the major predisposing factor, followed by ocular and systemic defects, prior application of corticosteroids, and prolonged use of antibiotic eye-drops. The objective of this study was to determine causative agents and to identify the predisposing factors of mycotic keratitis.

Methodology: Corneal scrapings from 90 corneal ulcer patients with suspected fungal etiology were subjected to direct examination by 10% KOH mount, Gram stain and culture.

Results: This study included 90 subjects with corneal ulcers, based on clinical suspicion, of whom 41 cases were diagnosed with mycotic keratitis in the laboratory. Among these 41 cases, culture showed fungal growth only in 36 cases whereas the remaining five cases were positive only by potassium hydroxide (KOH) preparation. Males were more commonly affected and were mostly in the age group of 31-40 years. *Aspergillus flavus* was the most common fungus isolated followed by fusarium solani.

Conclusion: Rapid diagnosis and early institution of antifungal therapy is necessary to prevent ocular morbidity and blindness. Although culture helps in definite diagnosis and identification, direct microscopic detection of fungal structures in corneal scrapes or biopsies permits a rapid presumptive diagnosis.

Key words: corneal infections, fungal keratitis, mycotic keratitis, *Fusarium* spp., *Aspergillus* spp.

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Introduction

Corneal infection is a leading cause of ocular morbidity and blindness worldwide. Early diagnosis and treatment are important in preventing further complications such as hypopyon formation, endopthalamitis, or loss of vision. [1-3]. Many micro organisms can cause infectious corneal ulcers. Among them are bacteria, fungi, viruses, protozoa and *Chlamydia*. Mycotic keratitis is an infection caused by fungus that leads to inflammation and ulceration, usually following trauma or treatment for a bacterial infection with steroids or antibiotics [4].

The ocular surface is constantly exposed to a large number of infectious agents; however, only a few pathogens can cause a corneal infection. Several mechanisms play a major role in the protection of the surface of the eye from infectious agents Filamentous fungi are frequent causes of fungal corneal ulcers in humans. More than 105 species of fungi, classified in 56 genera, have been identified as the aetiological agents of fungal keratitis. Fungal keratitis can cause a deep and severe corneal ulcer. It is caused by *Aspergillus spp*., *Fusarium* spp., *Candida* spp., *Rhizopus*, *Mucor*, and other fungi [5]. The typical feature of fungal infection is slow onset and gradual progression, where signs are much more than the symptoms. Small satellite lesions around the ulcer are a common feature of fungal keratitis and hypopyon is usually seen. Keratitis due to filamentous fungi is believed to usually occur following trauma, the key predisposing factor, in healthy young males engaged in agricultural or other outdoor work.The traumatising agents can be of plant or animal origin (even dust particles), that either directly implant fungal conidia in the corneal stroma or abrade the epithelium, permitting invasion by exogenous fungi.

Environmental factors (humidity, rainfall, wind) greatly influence the occurrence of fungal keratitis. Two basic forms have been recognised (1) filamentous fungi (especially *Fusarium* and *Aspergillus*), and (2) yeast (particularly *Candida).* Fungal infections of the cornea must be promptly recognised to facilitate a complete recovery. Symptoms are usually nonspecific, although possibly more prolonged in duration (5–10 days) than in bacterial corneal ulcers. [5-6]

Materials and methods

A retrospective analysis was performed of all patients with culture-proven fungal keratitis seen over a period of five years from January 2004 to December 2008. A total of 90 clinically suspected cases of corneal scrapings were included in the study. A detailed history of present illness was undertaken on all patients with special reference to occupation, trauma, medication to eye and surgical intervention, immunosuppression, and use of cosmetic or therapeutic contact lenses. In all cases, corneal scrapings were aseptically collected directly from the base and margins of ulcers using kimura spatula under direct vision through slit lamp after instillation of anaesthetic eye drops.

Direct microscopy was done under 10% KOH examination and Gram staining. Corneal material was inoculated on two blood agars, and on Sabouraud's glucose agars in the form of C streaks; only growth occurring on the C streaks was considered to be significant. All the media were incubated at 37°C and 25°C for a period of four weeks. Although fungal growth is usually seen within three to four days, negative culture media may require incubation for up to four weeks. Cultures were checked every day during the first week and twice a week for the next three weeks. Any growth present on the medium was identified by standard laboratory techniques viz. the rate of growth, colony morphology, and microscopic appearances in lactophenol cotton blue mount and slide culture.

Results

Out of the 90 cases of corneal ulcer investigated, mycotic infection was observed in 41 patients. Of the 41 cases, KOH mount was positive in 41 and in 36 cases fungi were isolated by culture examination. There was male predominance (males 30 and 11 females). The most common age group affected was 31 to 40 years in both sexes. Mycelial fungi were isolated in 35 cases and yeast in one case. A high incidence of mycotic keratitis was observed from April to July conciding with the harvesting season in this area. Among the identified filamentous fungi, most were hyaline. Of the 36 culture positive cases the most frequent agent isolated was *Aspergillus* flavus followed by *Fusarium* species (Table 1). Occupationally 22 of the 41 cases of mycotic keratitis were farmers and labourers. The rest were housewives, students, one weaver and one serviceman. Trauma appeared to be the most common predisposing factors in our study as it was observed in 17 cases.

Discussion

Mycotic keratitis has emerged as a major ophthalmic problem since its recognition in 1879. In this study, the majority of mycotic keratitis was due to filamentous fungi, namely *Aspergillus* and *Fusarium* species. *Aspergillus* species was the most common isolate in fungal keratitis reported by Chander *et al*. [7]. However, *Fusarium* species was found to be the most common cause of fungal keratitis from south India (Madurai and Tamilnadu) by Barathi *et al*. (2002, 2003) [8-9] and Srinivasan *et al*. (1997) [10].

Gopinathan *et al.* reviewed the epidemiological features of 1,352 patients with culture-proven mycotic keratitis seen over a period of 10 years at a tertiary care eye hospital in southern India. Males were significantly more frequently affected than females (a ratio of 2.5:1), and 64% of patients were in the age group 16 to 49 years. Ocular trauma was predisposed to infection in 54% of patients; trauma occurred significantly more frequently in those working outdoors than in those who were indoors. Trauma by vegetable material was believed to be a specific risk factor for a fungal infection of the cornea in this series of patients [11].

Fungal corneal ulcers may be reported at any age and in the present study, the age of the patients varied from 12 to 76 years. However, the most susceptible age group was 31 to 40 years. In addition, fungal corneal ulcers were found to be more common in men than in women. Corneal trauma has been identified as the most common risk factor for mycotic keratitis, which was also the case in the present study. Plant material was reported to be the most frequent traumatising agent in our series (17 cases). Other predisposing risk factors were chronic antibiotic/ topical corticosteroids usage in nine cases. Six cases gave the history of cataract surgery. In the present

study, history of the use of contact lenses was not found in any case (Table 2).

Mycotic keratitis may occur at any age, but the highest incidence has been found in individuals between the ages of 20 and 45 years. In our study we also found that the most affected age group was 31 to 40 years. Mycological study on the clinically suspected cases of mycotic keratitis revealed that fungus was demonstrated by microscopy and culture in 41 cases and five cases did not yield any fungus despite positive direct microscopy. The reason for this observation could be that viable fungus may not be present in all areas of the ulcer crater and therefore every scraping from a corneal ulcer may not contain viable fungus. Mycotic keratitis is managed by medical or surgical treatment. Despite advances in diagnosis and medical treatment of fungal infections of the cornea, some patients require surgical intervention owing to failure of medical therapy. Medical therapy consists of nonspecific measures and the use of specific antifungal agents. Topical natamycin (5%) or amphotericin B 0.15% is usually selected as first-line therapy for superficial infection, whether or not septate hyphae or yeast cells are seen by direct microscopy. The presence of deep lesions necessitates the addition of some form of systemic therapy. Since mycotic keratitis usually responds slowly over a period of weeks to antifungal therapy, clinical signs of improvement should be carefully noted. If corneal infection progresses in spite of vigorous antifungal therapy, surgical intervention may be required.

Table 1. Etiological agents of mycotic keratitis.

Filamentous fungus	Number
Aspergillus flavus	10
Aspergillus fumigatus	3
Aspergillus terreus	2
Aspergillus niger	2
Fusarium solani	7
Penicillium species	1
Alternaria alternata	3
Acremonium species	1
Scedosporium species	1
Bipolaris spicifera	2
Cladophialophora carrionii	1
Curvularia lunata	2
Candida albicans	1

Table 2.

Predisposing factor	Number of cases	
	Total number of cases studied	Number of positive cases for fungus
History of corneal trauma	17	17
Topical antibiotic/steroids	9	4
Surgery (cataract)	6	6
Use of herbal medicine	0	0
Use of contact lens	0	0
Other local / systemic conditions *	0	0
No significant history	9	9

*Glaucoma, Diabetes, Anaemia etc.

In the present study, as soon as the diagnosis of fungal keratitis was made by potassium hydroxide preparation, antifungal treatment was started. Most (36 out of 41) of the patients responded to the treatment. The remaining five patient developed complication (corneal perforation). Keratoplasty was performed and the results were encouraging.

In conclusion, the key element in the diagnosis of mycotic keratitis is the clinical suspicion by ophthalmologists. Fungal corneal ulcer is common in India due to the tropical climate and a large agrarian

population that is at risk. Various factors are involved, such as trauma and the injudicious use of topical antibiotics and corticosteroids. However, due to the potential serious complications from mycotic keratitis, it is important to know the exact etiology of corneal ulcer to institute appropriate therapy in time.

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Conflict of interest: No conflict of interest is declared.