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Original Research Article

A Study Of Predisposing Factors And Aetiological Diagnosis Of Fungal Corneal Ulceration In Patients Attending K.R. Hospital Mysore

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ABSTRACT

Background
Corneal ulcers are an important cause of blindness and fungal corneal ulcers are common in Karnataka. Trauma is an important predisposing factor for fungal corneal ulcers. Laboratory diagnosis of corneal ulcer etiology is important for prevention and treatment.

Methods
In this present cross sectional study, all patients with signs and symptoms of fungal corneal ulceration presenting to the Department of Ophthalmology, K.R. Hospital Mysore, from March 2021 to September 2022 were evaluated. Sociodemographic data and information pertaining to risk factors were recorded, all patients were clinically examined, and corneal cultures and scrapings were sent.

Results
51 patients with either KOH or culture positive fungal corneal ulceration were evaluated. A history of previous corneal injuries was present in 40 patients (78.4%). Fungal corneal cultures were positive in 48 patients (94.1%). KOH was positive for fungal elements in 38 (74.5%) cases. The most common fungal pathogens isolated were Fusarium species 25 (49.0%), Aspergillus species 21 (41.2%) and Candida species 2 (3.9%) of all positive fungal cultures.

conclusion
In this region of Karnataka, corneal ulceration is a prevalent issue that often arises from a superficial ocular lesion caused by an organic or wooden object. In this area, fungal

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infections are more prevalent than bacterial infections. Most fungal infections were caused by Aspergillus and Fusarium species. The treatment and prevention of fungal corneal ulcers in underdeveloped nations will be significantly impacted by these findings in terms of public health.

Keywords: Corneal Scraping, Culture, Smear, Fungi.

INTRODUCTION

Corneal ulcer is defined as loss of the corneal epithelium with underlying stromal infiltration and suppuration associated with signs of inflammation with or without hypopyon.[1,2] The conjunctiva and its adnexa are usually sterile at birth and are rapidly colonized by saprophytic bacteria. The relative frequency of different organisms in normal conjunctival flora were found to be Staphylococcus albus in 85%, diptheroids in 50%, Staphylococcus aureus in 20% and proteus in 3% and gram negative rods in 5% of the cases.[3]

Fungi are part of the normal external ocular flora. They have been isolated from the conjunctival sac in 3% to 28% of healthy eyes in various series. Diseased eyes have an even greater frequency (17–37%) of isolation. The most commonly found species in healthy eyes are Aspergillus species, Candida species, Penicillium species, Cladosporium species, and Alternaria species.[4,5]

The early diagnosis of fungal keratitis is supported by a high index of clinical suspicion and the presence of suggestive findings on slit lamp biomicroscopy.[6] Kaufman and Wood[7] described the salient features of mycotic keratitis in 1965. The following manifestations of fungal keratitis appear to be so typical that, while not absolutely pathognomonic, they should suggest the diagnosis of fungal infection with a high degree of accuracy.

Severe ocular reaction, hyphate ulcers, elevated lesions, hypopyon, endothelial plaques, corneal ring, satellite lesions, conjunctival hyperemia, anterior chamber reaction, mild iritis; pigmentation in the ulcer bed is seen in dematiaceous fungal keratitis; progressive infection with stromal ulceration and necrosis may lead to corneal perforation and endophthalmitis. The epithelium may be intact or ulcerated.

Predisposing factors[8] for fungal corneal ulceration in filamentous fungi are:

1. Climate and geography: Common in warmer conditions in tropical countries.
2. Correlation to trauma, occupation and sex. It is commonly observed in the normal eyes of healthy young people who have had mild corneal trauma with vegetative matter. Such trauma is seen more in farmers and outdoor labourers. Males are affected more commonly than females and may be related to outdoor activity and potential risks of trauma in male occupations.
3. Contact lens wear.
4. Penetrating keratoplasty and radial keratotomy
5. Pre-existing corneal disease

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Local ocular resistance may be compromised by atopic disease, long-term therapy with topical corticosteroids, eye lid malposition, keratitis sicca, neurotrophic or herpetic keratitis treated with topical corticosteroids and bandage soft contact lenses.

Knowledge of the 'local' aetiology within a region is of value in the management of suppurative keratitis when microscopy cannot be performed. Infections of the cornea due to filamentous fungi are a frequent cause of corneal damage in developing countries in the tropics and are difficult to treat.

MATERIALS AND METHODS

It is a cross-sectional study conducted from March 2021 to September 2022. Patients attending the outpatient and inpatient Department of Ophthalmology at K. R. Hospital Mysore, diagnosed with either a KOH or culture-positive fungal corneal ulcer, who fulfilled the inclusion and exclusion criteria during the study period, were included in the study.
Convenience sampling was used to recruit patients.

Sample size 51(n = 51)

The sample size is calculated using the formula, where n = sample size, Z = 95% confidence interval, p = prevalence and d = absolute allowable error. The sample size estimated was 51.
$n=z^2pq/d^2$, Z=1.96, P=65.4%, d=13%.
All patients diagnosed with either a KOH or culture-positive fungal corneal ulcer were included in the study.
Healing ulcers, any ulcer with impending perforation or an already perforated ulcer and ulcers with mixed infections were excluded.

Study Procedure

Each patient was examined at the biomicroscopy and the size of the epithelial defect was recorded in mm in a standardized form. The first step was to obtain samples from lids and conjunctiva using calcium alginate swabs moistened with nutrient broth from both eyes (infected and non-infected). The corneal ulcer should then be cultured. Corneal scraping was performed under magnification (binocular loupe, slit lamp, operating microscope) using a blunt cataract knife and Bard Parker blades No. 15 and 21/26 disposable needles. The material was C-streaked on culture plates. If the patient is already on treatment, then treatment is stopped 12-24 hours prior to culture to enhance the recovery of the organism. Beyond its diagnostic value, corneal scraping may accelerate disease resolution by enhancing topical penetration and the therapeutic debridement of necrotic tissue. According to Coster D. J. and Bandenoch P.R.[9] a culture is considered positive when there is growth of the same organism on two or more media, confluent growth at site of inoculation on one solid medium, growth in one medium with consistent direct microscopy findings or growth of the same organism on repeated corneal scraping. The specimen was then placed on dried pre-cleaned glass sides with alcohol for staining. These include mainly Gram staining and KOH wet mount.

Scraping was performed after the instillation of 0.5% paracaine. Material obtained by scraping the leading edge and base of each ulcer was inoculated directly into Sabouraud's Dextrose Agar.

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Material from the corneal scraping was also smeared on two separate glass slides, one for Gram stain, and the second for microscopic examination as a KOH wetmount. Fungi were identified by their colony characteristics on SDA and by their microscopic appearance in KOH.

RESULTS

From 1 March 2021 to 30 September 2022, 51 patients with symptoms and signs suggestive of fungal corneal ulceration who were either KOH or culture positive were examined at K. R. Hospital Mysore.

	Age Group	**Frequency**	**Percentage**	
Age Group	21-30	7	14	
	31-40	12	24	
	41-50	13	25	
	51-60	10	19	
	61-70	5	10	
	71-80	4	8	
	Total	51	100	
Sex Distribution N (%)	**Gender**	**Frequency**	**Percentage**	
	Male	37	72.5	
	Female	14	27.5	
	Total	51	100	
	Area	**Number of Cases**	**Percentage**	
Demographic Distribution	Rural	35	68.6	
	Urban	16	31.4	
	Total	51	100	
		Frequency	**Percentage**	
Socioeconomic Status	Valid	Middle	16	31.4
		Poor	35	68.6
		Total	51	100.0
			Frequency	**Percent**
Occupation	Valid	Farmer	22	43.1
		Housewife	7	13.7
		Labourer	7	13.7
		Other	15	29.5
		Total	51	100

Table 1: Sociodemographic Details

The most productive age group was between 30 and 50 years old, accounting for more than 50 %, as they were more involved in outdoor and physical activities.

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Of the total 51 cases, 37 (72.5%) were males and 14 (27.5%) were females. The predominance of corneal ulceration in males was most pronounced in the middle decades of their lives, as they were more often involved in outdoor activities.

In our study, 68.6% of the total cases belonged to the rural population, compared to 31.4% of the urban population. As many as 68.6% of cases in this study were of poor socio-economic status.

The patients' occupations represented a diverse range of workers from Mysore and the nearby rural region. The majority consisted of 22 farmers (43.1%) or hired agricultural workers who were typically employed in the village's rice or sugar cane fields. Other professionals made up 15 (29.5%), housewives made up 7 (13.7%), and laborers made up 7 (13.7%) of the group.

		Frequency	Percent
Valid	DM	20	39.2
	DM & HTN	3	5.9
	Nil	28	54.9
	Total	51	100.0

Table 2: Comorbidities among the Patients

Among the sample of 51 patients, 20 (39.2%) were diabetics and 3 (5.9%) were diagnosed with both hypertension and diabetes.

Cement	1	2.0
Dust	6	11.8
Finger Nail	1	2.0
Foreign Body	1	2.0
Grass leaf	2	3.9
Mud	2	3.9
Paddy Husk	4	7.8
Plant matter	1	2.0
Plant stem	2	3.9
Sugarcane	4	7.8
Tree Branch	1	2.0
Vegetative Matter	2	3.9
Wooden stick	13	25.5
None	11	21.5
Total	51	100.0

Table 3: Nature of Trauma

A definite history of trauma was present in 40 (78.4%) cases. 13 (25.5%) of these were with wooden sticks, and 16 (31.4%) cases were with vegetative matter, sugar cane, grass, paddy stalks, leaves, and the rest with dust stones, etc. No other predisposing factors,

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like dacryocystitis, keratoconjunctivitis, LID disorders, contact lens use, etc., were noted in our study group.

Site	Number of Cases	Percentage
Central	35	68.6
Peripheral	3	5.9
Paracentral	13	25.5
Total	51	100

Table 4: Corneal U1cer Location

Out of 51 corneal ulcers, central corneal ulcers accounted for 35 (68.6%), followed by paracentral 13 (25.5%) and peripheral 3 (5.9%).

Findings on KOH Mount	Frequency	Percentage
Positive for fungal elements	38	74.5
Negative for fungal elements	13	25.5
Total	51	100

Table 5: Findings of KOH Mount

Out of 51 patients, 38 (74.5%) were positive for fungal elements in the KOH mount, and 13 (25.5%) were negative.

A total of 48 (94.1%) cases showed positive culture for fungal organisms. Of the 48 cases, Fusarium species accounted for 25 (49.0%), Aspergillus species 21 (41.2%), and Candida species 2 (3.9%).

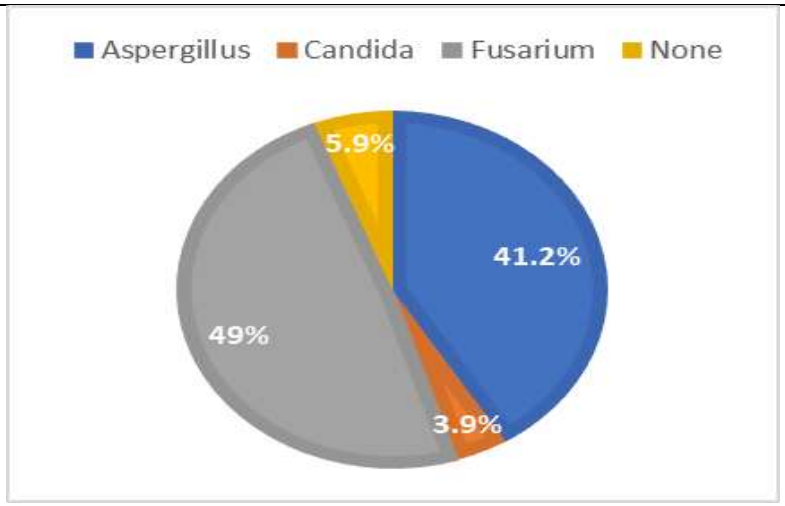

Figure 1: Distribution of Fungal Etiological Agent

DISCUSSION

Although accurate data on the frequency of blindness due to corneal scarring is not available in South India, the incidence of corneal ulcers is ten times greater (11.3/10000) than in a

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similar group in the United States.[1] There has been a progressive increase in microbial keratitis in recent years. Fungal keratitis, in particular, has the highest risk and possesses a significant threat for increased ocular morbidity owing to its slower course and diagnostic difficulty.

The ratio of male to female patients with corneal ulcers in this study is 3:1. Due to their increased physical activity and increased risk of corneal damage, people of both sexes are more likely to acquire corneal ulcerations in their middle years of life.[1]

The majority of ulcer patients (70.5%) were homemakers, laborers, or agricultural workers, an occupational profile resembling that of Madhurai in South India and Nepal (1) (72%).[2] (78.8%), but in marked contrast with Ghana[10] where only 16.1% of the patients were involved in agriculture activity. Most of the patients in this study were engaged in heavy labour, either in an agricultural setting or in construction.

23 out of the 51 individuals in the research who had non-traumatic risk factors linked to the development of corneal ulcerations also had predisposing systemic diseases. The history of ocular trauma was unquestionably the most frequent predisposing factor for corneal ulcers in South India. Of the 51 patients, 40 (78.4%) had previously had corneal damage brought on by a range of items.

According to Thylefor[11] superficial corneal injuries sustained while working in agriculture frequently results in fast progressing corneal ulcers and blindness in underdeveloped nations.

In South India, the most frequent cause of superficial corneal injuries was rice and paddy stalks in the field.[1] However, in this study, injuries from wooden sticks were the most frequent cause of superficial corneal damage, followed by injuries from sugarcane, vegetative materials, etc. Any programme of prevention obviously must address this high rate of corneal injury associated with corneal ulceration.

In the present study, KOH stain was positive in 38 (74.5%) out of 51 cases. KOH sensitivity was reported to be 94.3% in a research by Vajpajee RB[12] in Delhi, indicating its significance for the prompt beginning of antifungal therapy in mycotic keratitis.

Of the 51 corneas that were sampled, 48 (94.1%) had microorganisms isolated from them. This number is in good comparison to the 81.7 percent recovery rate in Bangladesh that Dunlop[13] recorded.

Out of the fifty-one corneal ulcers, twenty-one were Aspergillus species and twenty-five were Fusarium species. This pattern of fungal organisms, which is dominated by Fusarium species, is comparable to the range of microbial keratitis that Leisegang[14] and Foster and Hegan from Ghana described from South Florida.[15] In Ghana, fungi alone or in combination with bacteria were isolated from 56% of all culture positive patients. Fusarium species accounted for 50% of all fungal isolates.

Aspergillus species is the most common fungal infection worldwide that causes mycotic keratitis. Upadhyay is in the temperate climate of Nepal.[2] found that Aspergillus species accounted for 47% of all fungal pathogens. In the present study, 41.2% of fungal cultures were positive for Aspergillus species. Fungal keratitis is an enormous public health problem in India.

In order to pinpoint the precise microbial pathogen causing corneal ulcerations in South India, Bharati MJ examined 1618 patients. Of the patients, 1126 (69.59%) had positive

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corneal cultures. Thirty (1.85%) of the 1618 patients had mixed bacterial and fungal growth, whereas 522 (32.26%) of the patients had fungal growth. Aspergillus species (24.37%) and Fusarium species (45.85%) accounted for the majority of the isolates of fungal pathogens.[16] Norina T. J. et al. showed in their study that corneal trauma (62%) was the most common risk factor for corneal ulcers. Other factors were contact lens usage, topical steroid eye drops, and ocular pathology such as dry eyes, blepharitis, exposure keratopathy, and proptosis.[4]

Samar K. Basak et al. showed in their study that ocular trauma (82.9%) was the most common predisposing factor, followed by the use of topical corticosteroid (19.28%). Among the culture-positive cases, 62.7% had a pure fungal infection, 22.7% had a pure bacterial infection, and 14.1% had a mixed fungal and bacterial infection.[17]

Kumari N. examined 204 clinically suspected instances of keratomycosis in order to identify key diagnostic tests, predisposing variables, and etiological agents. 76 instances (37.23%) out of the 204 cases had positive results for fungus by microscopy and culture. Between the ages of 21 and 50, 77% of instances occurred, with more males than females. 82% of the patients worked as farmers. September through October were the months with the highest occurrences. In 63 patients (31%) there were single fungal isolates, whereas in 3 cases (1.47%) there were multiple isolates. Aspergillus species accounted for 42 cases (52.26%) of the isolates, with Candida accounting for 7 cases (9.21%). This study believed mycotic keratitis should be suspected in every patient with a corneal lesion and should be ruled out promptly to save sight and before commencing steroids and antibiotics.[18]

Williams A. examined 127 instances of microbial keratitis to ascertain the relative value of culture and Gram stain in identifying the causing organism. A total of 107 instances of microbial keratitis were confirmed by culture. Gram stain was positive in 89 cases out of the 127 patients, or 70% of the total, with 83% of those cases being confirmed by culture. The two most prevalent species of fungus that were isolated were Aspergillus and Fusarium. In the event of purulent keratitis, these findings corroborate the application of both Gram stain and culture in the identification of the pathogenic organism. Nonetheless, Gram stain's inexpensive cost and helpful recovery rates for both fungi and bacteria justify its usage as a first line of inquiry for microbial keratitis infections.[19]

Foster conducted a study of 61 cases of fungal keratitis and found a history of definite local body trauma in 24 cases and possible trauma in another 5 cases. The importance of outdoor occupations or hobbies was evident.

CONCLUSIONS

Fungal infections occur more commonly than bacterial infections in this region. The majority of fungal infections were caused by Aspergillus and Fusarium species. Early diagnosis and treatment is the cornerstones of its effective control. We believe that in order to evaluate the distinct epidemiological features of corneal ulceration, which vary depending on the area and population, extensive surveys like the one conducted here are essential. First and foremost, this information is necessary to assess the scope of the issue in terms of the financial burden of blindness and the expenditures associated with medical treatment and human resources. The second goal is to create a successful public health program that will diagnose, treat and

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most importantly, prevent corneal ulcers in at-risk populations, particularly those in developing nations.

REFERENCES

[1] Srinivasan M, Gonzales CA, George C, Cevallos V, Mascarenhas JM, Asokan B, et al. Epidemiology and aetiological diagnosis of corneal ulceration in Madurai, south India. Br J Ophthalmol 1997;81(11):965-71.

[2] Upadhyay MP, Karmacharya PC, Koirala S, Tuladhar NR, Bryan LE, Smolin G, et al. Epidemiologic characteristics, predisposing factors, and etiologic diagnosis of corneal ulceration in Nepal. Am J Ophthalmol 1991;111(1):92-9.

[3] Limberg MB. A review of bacterial keratitis and bacterial conjunctivitis. Am J Ophthalmol 1991;112(4 Suppl):2S-9.

[4] Mohanty PK, Ambekar VA, Deodhar LP. Prevalence of mycotic infections of external eye. Indian J Ophthalmol 1984;32(3):153-5.

[5] Alfonso EC, Rosa RH. Fungal keratitis. In: Krachmer JH, Mannis MJ, Holland EJ, eds. Cornea and external disease: clinical diagnosis and management. St. Louis: Mosby 1997:1253-65.

[6] Yanoff M, Duker JS. Ophthalmology. Elsevier Health Sciences 2008.

[7] Kaufman HE, Woods RM. Mycotic Keratitis. Am J Ophthalmol 1965;59(6):993-1000.

[8] Smolin G, Thoft RA. The cornea: scientific foundations and clinical practice. Little, Brown 1994.

[9] Coster DJ, Badenoch PR. Host, microbial, and pharmacological factors affecting the outcome of suppurative keratitis. Br J Ophthalmol 1987;71(2):96-101.

[10] Hagan M, Wright E, Newman M, Dolin P, Johnson G. Causes of suppurative keratitis in Ghana. Br J Ophthalmol 1995;79(11):1024-8.

[11] Thylefors B. Epidemiological patterns of ocular trauma. Aust N Z J Ophthalmol 1992;20(2):95-8.

[12] Vajpayee RB, Angra SK, Sandramouli S, Honavar SG, Chhabra VK. Laboratory diagnosis of keratomycosis: comparative evaluation of direct microscopy and culture results. Ann Ophthalmol 1993;25(2):68-71.

[13] Dunlop AA, Wright ED, Howlader SA, Nazrul I, Husain R, McClellan K, et al. Suppurative corneal ulceration in Bangladesh: a study of 142 cases examining the microbiological diagnosis, clinical and epidemiological features of bacterial and fungal keratitis. Aust N Z J Ophthalmol 1994;22(2):105-10.

[14] Leisegang TJ. Fungal Keratitis. In: Kaufman HE, Barron BA, McDonald M Beds. The cornea. 2nd edn. Boston/Toronto/London: Butterworth – Heinmann Publication 1998:219-40.

[15] Foster RK. The diagnosis and management of keratomycosis. Arch Ophthalmol 1975;93:975-8.

[16] Bharathi MJ, Ramakrishnan R, Vasu S, Palaniappan R. Aetiological diagnosis of microbial keratitis in South India-a study of 1618 cases. Indian J Med Microbiol 2002;20(1):19-24.

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 06, 2024

[17] Basak SK, Basak S, Mohanta A, Bhowmick A. Epidemiological and microbiological diagnosis of suppurative keratitis in Gangetic West Bengal, eastern India. Indian J Ophthalmol 2005;53(1):17-22.
[18] Kumari N, Xess A, Shahi SK. A study of keratomycosis: our experience. Indian J Pathol Microbiol 2002;45(3):299-302.
[19] Williams G, McClellan K, Billson F. Suppurative keratitis in rural Bangladesh: the value of gram stain in planning management. International Ophthalmology 1991;15:131-5.