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### Original Article

## Epidemiological Profile of Mycotic Keratitis in North Karnataka

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### ABSTRACT

**Purpose:** This study was conducted to determine the epidemiological characteristics of Mycotic Keratitis in rural North Karnataka and identify the specific fungal organisms. **Methods:** All patients with suspected ulcerative keratitis presenting to the Ophthalmology department at Shri B.M. Patil Medical College, Bijapur from September 2006 to August 2007 were prospectively evaluated. Socio-demographic data and information about risk factors were obtained. All patients underwent a detailed examination followed by scrapings for smear and culture. **Results:** Of the 70 patients with ulcerative keratitis, 32 patients (45.71%) were diagnosed with fungal keratitis. Of the 32 patients, 22 (68.75%) were males. Twenty four patients (75%) came from a rural area. Ocular trauma was the most common predisposing factor, seen in 23 patients (71.88%). 10% KOH (Potassium Hydroxide) staining was found to be the most reliable, rapid efficient diagnostic aid in detecting fungal keratitis. Predominant fungal isolate was *Fusarium* spp. seen in 16 (50%) patients. **Conclusion:** Central corneal ulceration leading most often to uniocular blindness continues to be a common ophthalmologic problem. In North Karnataka, which has a dry climate, fungal keratitis is the leading cause of microbial keratitis. Agricultural activity and related ocular trauma are the most common predisposing factors. A KOH wet mount preparation is a simple and sensitive method for diagnosis. Early detection and appropriate treatment will reduce the incidence of corneal blindness to a large extent and also help plan preventive strategies.

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### 1. Introduction

Corneal infections are the second most common cause of monocular blindness after cataract in the developing tropical countries.[1-3] According to a WHO (World Health Organization) report, it is estimated that ocular trauma and corneal ulceration result in 1.5 – 2 million new corneal patients annually.[4] Corneal infections of fungal etiology is very common and represents 30 – 40% of all cases of culture positive infective cases in South India.[5-7]

Some of the factors responsible for increased incidence of fungal keratitis include the widespread use of broad-spectrum antibiotics and steroids, frequent and sometimes prolonged use of contact lenses, and the growing number of corneal surgeries being performed. In India, a favorable tropical environment coupled

with a primarily agrarian population are the additional predisposing factors. Heightened awareness of the problem among ophthalmologists and medical microbiologists has also contributed to the increasing recognition of the disease.[8]

The Epidemiological and causative agents of corneal ulceration depend on a multitude of factors like patient population, health of the cornea, geography of that region, climate, season of the year etc. Even in the same country, it varies from region to region. In order to develop a comprehensive strategy for diagnosis, treatment and ultimately for the prevention of corneal infections, etiological factors predisposing to infection and the pathogenic organisms must be identified.[9]

A detailed study on the etiological and demographic patterns of fungal keratitis in North Karnataka is lacking. The purpose of our study was to evaluate the epidemiological factors and to identify the specific fungal organisms causing suppurative fungal infections in this region for early diagnosis and treatment.

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## 2. Materials and Methods

The data on ulcerative keratitis was collected prospectively at Shri.B.M.Patil Medical College, Ophthalmology OPD (Out Patient Department) between 1 September 2006 and 31 August 2007 after Ethical clearance. Medical College is a tertiary care institute in North Karnataka which serves the patients from the district of Bijapur and surrounding areas of neighboring districts as well.

Ulcerative keratitis was defined as a loss of the corneal epithelium with underlying stromal infiltration and suppuration associated with signs of inflammation with or without hypopyon.[5]

All patients were included consecutively after the initial diagnosis of ulcerative keratitis was made clinically. The ulcers that were excluded from the study were viral ulcers, healing ulcers, atheromatous ulcers, Mooren's ulcer, marginal keratitis, interstitial keratitis, neurotrophic keratitis and any ulcer associated with systemic diseases.

A standardised proforma was completed for each patient with details of occupation, duration of symptoms, history of corneal trauma and the type of traumatizing agent, predisposing factors like contact lens wear, prolonged steroid use, therapy received prior to presentation and any associated ocular or systemic diseases.

Visual acuity was measured in a standard manner by an Ophthalmologist. All patients were examined by an ophthalmologist with a slit lamp biomicroscope. After staining with sterile wet fluorescein strip, the site, shape and size of the ulcer in millimeters was recorded. A note was made of the type of surface and edges of the ulcer. Size and depth of the infiltrates were recorded in millimeters. Any satellite lesions, endothelial plaque, pigmentation, immune rings, descemetocoele or vascularisation were noted. Anterior chamber reaction and Hypopyon if present was recorded and its height measured in millimeters. Associated ocular conditions like blepharitis, Bell's palsy, lagophthalmos, chronic dacryocystitis, dry eyes, corneal anaesthesia, trichiasis were noted.

After explaining the procedure of scraping to the patient, informed consent was taken. Corneal scraping was performed in all patients at the slit lamp by an ophthalmologist under sterile conditions using a sterile Bard Parker (BP) blade No.15 after instillation of 0.5% proparacaine eye drops. The material obtained from the base and leading edge of the ulcer was directly smeared onto a labeled slide for 10% KOH wet mount as well as inoculated onto Sabouraud's Dextrose Agar (SDA). The SDA medium was incubated at room temperature and observed daily for a minimum period of 2 weeks. Fungi were identified by their colony characteristics on SDA and by the morphological appearance of spores in lactophenol cotton blue and slide culture. In cases where hyphae were detected by microscopy but culture growth was negative, the organism was considered to be fungal. All patients, both culture positive as well as culture negative but smear positive patients were put on topical natamycin 5% eye drops supplemented by regular ulcerative keratitis treatment.

## 3. Results

Of the 70 patients with microbial keratitis enrolled in the study a diagnosis of fungal keratitis was made in 32 patients (45.71%) based on clinical findings, positive KOH smear and positive culture findings. Among these 32 patients, 28 (87.5%) were culture positive and 26 (81.25%) were smear positive.

### 3.1. Epidemiological characteristics - (TABLE.1)

Fungal keratitis was predominantly seen between the 3rd to 6th decade of life. The mean age was 42.96 years. Males were predominantly affected 22 (68.75%) compared to females. Fungal keratitis was seen predominantly in farmers - 20 (62.5%).

TABLE 1. EPIDEMIOLOGICAL CHARACTERISTICS

CHARACTERISTIC	PARTICULAR	N (%)
AGE	LESS THAN 20 YEARS	3 (9.37)
	21-30 YEARS	6 (18.75)
	31-40 YEARS	4 (12.50)
	41-50 YEARS	8 (25)
	51-60 YEARS	6 (18.75)
	MORE THAN 60 YEARS	5 (15.62)
SEX	MALE	22 (68.75)
	FEMALE	10 (31.25)
BACKGROUND	RURAL	24 (75)
	SEMI-URBAN	8 (25)
OCCUPATION	FARMER	20 (62.5)
	HOUSEWIFE	4 (12.5)
	BUSINESS	3 (9.38)
	LABOURER	2 (6.25)
	STUDENT	3 (9.38)
TRAUMA	PRESENT	23 (71.88)
	ABSENT	9 (28.12)
PREDISPOSING	TRAUMA	23 (71.88)
FACTOR	CHR. DACRYOCYSTITIS	2 (6.25)
	DIABETES MELLITUS	1 (3.13)
	DRY EYE	1 (3.13)
	CONTACT LENS	1 (3.13)
	HIV	1 (3.13)
	NONE	3 (9.38)
DURATION	LESS THAN 5 DAYS	14 (43.75)
	6-15 DAYS	12 (37.5)
	MORE THAN 16 DAYS	6 (18.75)
PREVIOUS	ANTIBIOTICS	9 (28.13)
MEDICATION	STERIODS + ANTIBIOTICS	5 (15.63)
	ANTIFUNGALS	4 (12.5)
	HERBAL MEDICINES	3 (9.38)
	NONE	11 (34.38)

### 3.2. Predisposing factors

In our study 23 patients (71.88%) had trauma, 2 patients had chronic dacryocystitis and 1 patient each had dry eye, diabetes, contact lens wear and immunosuppression as a predisposing factor.

Trauma with vegetative matter was seen in 17 (53.12%) out of the 23 cases which had trauma as a predisposing factor. Among them, injury with sugarcane and jowar predominated (Table 2).



TABLE 2. TRAUMA CHARACTERISTICS

TRAUMA CHARACTERISTICS	N (%)
VEGETATIVE MATTER	17 (53.12)
SUGARCANE LEAF-8	
JOWAR --5	
PADDY --2	
THORN PRICK --1	
GROUNDNUT SEED--1	
FOREIGN BODY, STONE, DUST	05 (15.625)
FINGER NAIL INJURY	01 (3.13)

A majority of the patients presented to us within the first 2 weeks (26 patients - 81%). As many as 21 patients (65.63%) had some sort of medication before presenting to us. 9 of them had antibiotics, 4 of them had proper antifungal - antibiotic treatment, 5 of them had steroid or steroid - antibiotic eye drops combination and 3 patients had local herbal medicines in the form of oil and/or plant juice.

Twenty cases (62.5%) were seen between the months of October and March. KOH wet mount was effective in detecting fungal elements in 26 (81.25%) patients. SDA culture was positive for fungi in 28 (87.5%) patients.

*Fusarium* spp was the most common isolate. The other isolated species were *Aspergillus*, *Curvularia* and *Candida*. 4 cases where KOH was positive had no culture growth (Table 3).

TABLE 3. SPECIES ISOLATED

SPECIES	N (%)
<i>Fusarium</i> spp.	16 (50)
<i>Aspergillus</i> spp.	09 (28.13)
<i>Penicillium</i> spp.	01 (3.13)
<i>Curvularia</i> spp.	01 (3.13)
<i>Candida</i> spp.	01 (3.13)
No growth	04 (12.5)

#### 4. Discussion

Fungal keratitis is one of the leading cause of visual loss in developing countries. Proper understanding of the local epidemiological and risk factors followed by appropriate preventive and therapeutic measures will play an important role in reducing the burden of visual disability.

Our study revealed that fungal keratitis accounted for 45.71% of all ulcerative keratitis. Similar findings from other studies include - 32% to 39.8% in South India [5,6], 38.9% in West India [10] and 32% in East India [9]. Recent study in West Bengal, has quoted an incidence of 38.06% [12].

The high incidence in our study could be attributed to the predominantly rural background of our patients and hence increased agricultural activity as an occupation. Male preponderance was seen in our study similar to other studies. [1,5,6,13] This can be explained on the basis of males being involved in more outdoor activity and hence their increased vulnerability to trauma.

Majority of the patients were in the age group of 21 - 60 years (75%). Agriculture was the main occupation of 62.5% of our

patients, which is similar to other studies [5,7,9,14-16]. The increased frequency in housewives can be attributed to the fact that even though most of the females look after household work, in the harvesting season they lend a helping hand to their men folk. Hence they are exposed to the risk of vegetative trauma during the farming process.

#### 4.1. Predisposing factors

Trauma was the most common predisposing factor accounting for almost 72%. Trauma as a risk factor to fungal keratitis has been reported to vary from 55% to 65% in various studies. [5,6,12,17,18]. Chronic dacryocystitis and dry eyes play an important role in the management of corneal ulcers, since their recognition and treatment have a final bearing on the management of the ulcer itself. Non recognition of these entities can lead to non - healing ulcers. Though use of topical steroids are frequently reported in the literature. [5,6,17,18], in our study only 1 patient, a contact lens wearer having itching symptoms was using topical steroids.

Trauma with vegetative matter is the major risk factor in the causation of fungal keratitis. In our study, trauma with vegetative matter in the form of sugar cane leaf, jowar, paddy, groundnut seed was seen in as many 17 cases (53.13%). Sugarcane and jowar, are the major crops of our region and hence the increased injury chances during the harvesting season. Our statistics on the higher side, and can be attributed to the fact that our hospital caters to a predominantly rural population involved in agriculture. Similar reports on fungal keratitis describes an antecedent injury with leaves, paddy, grain, cow tail, tree branch, metal pieces etc. [5,6,19-21].

The time of presentation to the ophthalmologist is an important factor in management since earlier the presentation, faster the detection and institution of appropriate therapy. In our study almost 81% of patients presented within the first 2 weeks and the rest later with some presenting as late as late as 2 months similar to the south Indian study [5]. The earlier presentation to the doctor in so many patients could be due to the nature of the disease itself prompting the patients to seek medical help. It could also be attributed to the increased awareness about the health related issues even among rural people in recent times.

As many as 21 (65.63%) patients had taken some medication before presenting to us. The usage of over the counter steroid eye drops and native herbal medicines poses a greater risk for the development and persistence of fungal keratitis. It is clear that even though the patients were aware of the need for a medical consultation soon after the onset of symptoms, it is the lack of proper education, ignorance and village customs which forced them to consult a non-ophthalmologist at the first consultation. Hence precious time is lost in initiating appropriate therapy at the earliest. Also the general practitioners and ophthalmologist at the village level tend to prescribe antibiotics as an empirical treatment and tend to refer patients if this therapy fails. Only 4 (12.5%) patients in our study were using antifungals when they presented to us. All of them were using the drugs in an insufficient dose. This demonstrates the tendency of the general practitioners and the ophthalmologists at the primary level to treat the condition inadequately [6]. Hence it is very important to reach a correct



clinical diagnosis and then initiate appropriate adequate therapy. Training of these medical professionals at the primary level about the signs and symptoms of ulcerative keratitis, proper usage of antibiotics/antifungals and timely referral to the next level of care will help save precious time and eyes as well.

Considering the cost effectiveness, easy availability of reagents, ease of preparation and sensitivity of the method, KOH wet mount preparation continues to be an ideal technique for revealing fungal elements in smears of corneal scrapings[6]. KOH serves as a simple and rapid diagnostic technique, which can be done even in small clinics and laboratories at the village level without the need for the more complex media for culture[25]

Fungal keratitis is more frequently reported in India in winter with a humid climate favoring fungal growth[17,23,24]. The period between October and January is cool and dry and represents the harvest months. The increased incidence of fungal keratitis over a major part of the year in India may be attributable to the enormous amount of fungal spores prevalent in the environment[22]. In our study 62.5% of the cases were seen between the months of October and March, which happens to be an important period for harvesting. Similar observations were made by Kotigadde subbannayya et al in their study[8]. Basak et al also have noted a higher incidence during the harvesting season of November – December[9]. This indicates that corneal ulceration has a casual relationship to occupation than season itself.

The biomicroscopic appearance of a dry elevated surface with feathery edges- 24(75%), stromal infiltration, satellite lesions- 16(50%) and immune ring -4(12.5%) assisted in diagnosis [27-30]

Fungal elements were seen in direct microscopy by 10% KOH in 26(81.25%) patients. 6 patients who were initially smear negative however had positive culture growths. However antifungal therapy was initiated based on clinical suspicion without waiting for culture reports and the patients responded well to treatment. On the other hand, 4 patients who had a positive smear failed to grow any organism in culture. This can be attributed to prior medications [26] and very little material being obtained from the ulcer bed [25]. In conclusion, considering its low cost, convenience, rapidity and high sensitivity and specificity, direct microscopic examination with KOH wet mounts continues to be an ideal technique to assist the diagnosis of fungal keratitis.

Of the 28 fungal isolates, *Fusarium* spp was the most common (50%), followed by *Aspergillus* spp.(28.13%). The other species isolated were *Penicillium*, *Curvularia*, and *Candida*. Similar reports of frequent isolation of *Fusarium* and *Aspergillus* species has been reported from South India [5,25,34], Ghana[13], Florida[31], North India[32] and Mumbai[33].

Even though the sample size in our study was small and it was a hospital based study, our study still gives an insight into the epidemiological features and the risk factors of mycotic keratitis in this region of Karnataka, which will help plan strategies to prevent the development of fungal keratitis.

Prevention and management of fungal keratitis requires a multipronged approach. Health education to the village masses about prevention of eye injuries (like wearing of protective eye goggles), non-usage of local herbal medicines in case of injury and immediate medical consultation should be emphasized. On the service sector, having a physician trained in diagnosing fungal keratitis followed by prompt initiation of antifungal therapy can definitely help reduce the incidence of blindness due to fungal keratitis.

## 5.Conclusion

Fungal keratitis continues to be a cause of concern to ophthalmologists. Predominance of agriculture activity with its associated risk of vegetative trauma is the leading cause of fungal keratitis. An understanding of the local risk factors, identification of typical presenting features and a simple KOH smear can establish the diagnosis of fungal keratitis.

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Conflict of Interests: NIL

## 6.References

- [1] Upadhyay MP, Karmacharya PC, Koirala S, Tuladhar NR, Bryan LE, Smolin G, et al. Epidemiologic characteristics, predisposing factors, and aetiological diagnosis of corneal ulceration in Nepal. *Am J Ophthalmol.* 1991;111:92-99.
- [2] Gonzales CA, Srinivasan M, Whitcher JP, Smolin G. Incidence of corneal ulceration in Madurai District, south India. *Ophthalmic Epidemiol.* 1996;3:159-66
- [3] Whitcher JP, Srinivasan M, Upadhyaya MP. Prevention of Corneal ulceration in the developing world. *Int Ophthalmol Clin.* 2002;42(1):71-77
- [4] Lalitha P. Aravind Atlas of fungal corneal ulcers clinical features and laboratory identification methods. Madurai, India: 2009
- [5] Srinivasan M, Gonzales CA, George C, Cevallos V, Macarenhas J, Asokan B et al. Epidemiological and aetiological diagnosis of Corneal ulceration in Madurai, South India. *Br J Ophthalmol.* 1997;8:965-971.
- [6] Gopinathan U, garg P, Fernandes M, et al.: The epidemiological features and laboratory results of fungal keratitis: a 10 – year review at a referral eye care center in South India. *Cornea* 2002;21:555-559.
- [7] Bharathi MJ, Ramakrishnan R, Vasu S, Meenakshi R, Palaniappan R. Aetiological diagnosis of microbial keratitis in South India. *Indian J Med Microbiol.* 2002;20:19-24
- [8] Kotigadde S, Ballal M, Jyothirliata, Kumar A, Sriniv R, Shivananda PG. Mycotic Keratitis: Study in Coastal Karnataka. *Indian J Ophthalmol.* 1992; 40: 31-33
- [9] 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: 17-22.
- [10] Varenkar MP, Shubhangi B, Pinto MJM, Naik PA. Study of mycotic keratitis in Goa. *Indian J Med Microbiol* 1998;16:58-60.
- [11] Dutta LC, Dutta D, Mohanty P, Sharma J. Study of fungal keratitis. *Indian J Ophthalmol* 1981;29:407-40
- [12] Suman Saha, Debdulal Banerjee, Archana Khetan, Jayangshu Sengupta. Epidemiological profile of fungal keratitis in urban population of West Bengal, India. *Oman Journal of Ophthalmology* 2009;2:114-118.
- [13] Hagan M, Wright E, Newman M, Dolin P, Johnson G. Causes of suppurative keratitis in Ghana. *Br J Ophthalmol.* 1995;79:1024-1028.
- [14] Reddy PS, Satyendran M., Satapathy M, et al. Mycotic keratitis. *Ind J Ophthalmol.* 1972;20:101-8



- [15] Rosa RH Jr, Miller D, Alfonso EC, The changing spectrum of fungal keratitis in South Florida. *Ophthalmology* 1994;101:1005-1013.
- [16] Kulshreshta OP, Bhargava S, Dube MK, Keratomycosis: a report of 23 cases. *Ind J Ophthalmol*. 1973;21:51-55
- [17] Panda A, Sharma N, Das G, Kumar N, Satpathy G. Mycotic keratitis in children. Epidemiologic and microbiologic evaluation. *Cornea* 1997;16:295-299
- [18] Anderson KL, Mitra S. Fungal keratitis cause by *Paecilomyces Lilacinous* associated with a retained intraocular hair. *Cornea*. 2004;23:516-521
- [19] Rodrigues MM, Laibson P. Exogenous corneal ulcer caused by *Tritirachium roseum*. *Am J Ophthalmol*. 1975;80:804-806.
- [20] Elliott ID, Halde C, Shapiro J. Keratitis and endophthalmitis caused by *Petriellidium boydii*. *Am J Ophthalmol*. 1977;83:16-18
- [21] Meyer RF, Hood CI. Fungus implantation with wooden intraocular foreign bodies. *Am J Ophthalmol*. 1977;9:271-278.
- [22] Prasad S, Nema HV. Mycotic infections of Cornea. *Ind J Ophthalmol* 1982;30:81-85.
- [23] Polack FM, Kaufman HE, Newmark E. Keratomycosis: medical and surgical treatment. *Arch Ophthalmol*. 1971;85:410-414.
- [24] Cruz OA, Sabir SM, Capo H et al. Microbial keratitis in childhood. *Ophthalmology* 1993;100:192-196.
- [25] Leck AK, Thomas PA, Hagan M, Kaliamurthy J, Ackuaku E, John M et al. Etiology of Suppurative Corneal Ulcer in Ghana and South India and Epidemiology of Fungal Keratitis. *Br J Ophthalmol*. 2002; 86: 1211-1215.
- [26] Dunlop AAS, Wright ED, Howlader SA et al. Suppurative corneal ulceration in Bangladesh. *Aus NZ J Ophthalmol*. 1994;22:105-110
- [27] Agarwal V, Biswas J, Madhavan HN, Mangat G, Reddy MK, Saini JS et al. Current perspectives in infectious keratitis. *Indian J Ophthalmol*. 1994;42:171-191.
- [28] Forster RK. Fungal keratitis and conjunctivitis. *Clinical disease in Smolin G, Thoft RA, editors. The Cornea*. New York. Little, Brown and Company; 1994. pp 239-252
- [29] Jones DB. Diagnosis and management of fungal keratitis. In: Tasman W, Jaeger EA, editors. *Duane's Clinical Ophthalmology*. Philadelphia. J.B. Lippincott company; 1994: Vol 4, Chapter 21
- [30] Kaufman HE, Wood RM. Mycotic keratitis. *Am J Ophthalmol* 1965;59:993-1000
- [31] Liesegang TJ, Forster RK. Spectrum of microbial keratitis in south Florida. *Am J Ophthalmol* 1980;90:38-47
- [32] Chander J, Sharma A. Prevalence of fungal corneal ulcer in northern India. *Infection* 1994;22:207-209.
- [33] Deshpande SD, Koppikar GV. A study of mycotic keratitis in Mumbai. *Indian J Pathol Microbiol* 1999;42:81-87 Garg P, Gopinathan U, Choudhary K, Rao GN. Keratomycosis : clinical and microbiological experience with dematiaceous fungus. *Ophthalmology*. 2000;107:574-580.
- [34] Garg P, Gopinathan U, Choudhary K, Rao GN. Keratomycosis : clinical and microbiological experience with dematiaceous fungus. *Ophthalmology*. 2000;107:574-580.

