Epidemiological survey of fungal keratitis in rural population of Nadia district of West Bengal

by
Arup Roy[1], Dr. Suman Chahar[2], Dr. Debargha Sengupta[3]
[1]Ph.D. Scholar, Department of Optometry,
Nims College of Allied and Health Care Sciences,
Nims University Rajasthan, Jaipur
[2]Guide and Assistant Professor, Department of Ophthalmology,
National Institute of Medical Sciences and Research, Nims University Rajasthan, Jaipur
[3] Co-Guide and Sr. Resident, Department of Ophthalmology,
Midnapore Medical College and Hospital, West Bengal

Abstract

Corneal diseases are one of the major causes of visual loss and blindness. Amongst corneal diseases, microbial keratitis is a major blinding disease. In some countries, fungal keratitis accounts for almost 50% of patients with culture-proven microbial keratitis. The study was conducted to determine the epidemiological characteristics of fungal keratitis in rural population of Nadia district of West Bengal and identify the specific pathogenic organisms. The charts of patients with microbial keratitis who attended for the Cornea Services of Netra Deep Eye Clinic, Santipur, Nadia from January to September 2024 were retrospectively reviewed. Records of patients with 10% Potassium Hydroxide (10% KOH) mount and culture positive fungal keratitis were analysed for epidemiological features, laboratory findings and treatment outcomes. Total 139 patients of microbial keratitis were included in the study, 61 patients (44.20%) were diagnosed with fungal keratitis (10% Potassium Hydroxide mount positive). Out of the 139 patients, 61 fitted the study inclusion criteria (10% Potassium Hydroxide mount and culture positive). Ocular trauma in 29 (47.54%) cases was identified as a high-risk factor and vegetative injuries in 18 cases were identified as a significant cause for fungal keratitis. The predominant fungal species isolated was Aspergillus species followed by Candida albicans and Fusarium species. Agricultural activity related ocular trauma was the principal cause of mycotic keratitis and males were more commonly affected. The culture positive patients healed with corneal scar formation with medical treatment whereas some cases required therapeutic keratoplasty. Fungal keratitis is an important cause of microbial keratitis with injury to the cornea being a leading predisposing factor. Although Aspergillus species was implicated in most of the patients in our study population, Candida species were found in higher numbers than previously reported. Keratitis caused by filamentous fungi responds adequately to medical management. Therapeutic keratoplasty continues to remain an important treatment modality in infections with Candida species. Early diagnosis with prompt identification of the pathogenic organism is mandatory to initiate appropriate therapy and thereby reduce morbidity.

Keywords: *fungal keratitis, candida species, therapeutic keratoplasty, rural area, Nodia district, West Bengal*

Introduction

Fungal keratitis is a serious eye infection of the cornea caused by fungi, potentially leading to vision loss or blindness if left untreated. It often presents with pain, redness, and blurred vision,

and can be triggered by trauma, contact lenses, or underlying conditions like diabetes. Treatment typically involves antifungal eye drops and oral medications, and in severe cases, surgery may be needed. Corneal blindness is a major health problem throughout the world.[1] According to the World Health Organization report, it is estimated that ocular trauma and corneal ulceration result in 1.5 to 2 million new patients of corneal blindness annually, posing a major public health problem for developing countries.[2] The etiological and epidemiological pattern of corneal ulceration varies significantly with patient population, geographical region and prevailing socioeconomic conditions.[3] Srinivasan et al from South India reported that 44% of all central corneal ulcers were caused by fungi.[4] More than 70 species of filamentous fungi have been identified as the etiological agents of fungal keratitis.[5] Early diagnosis of fungal keratitis and its treatment is important in preventing complications and loss of vision. We conducted this study to identify the epidemiological features, laboratory findings and treatment outcomes amongst patients attending for the Cornea service of a rural eye care clinic in Santipur, Nadia, West Bengal.

Aim of the Study

The study was conducted to determine the epidemiological characteristics of fungal keratitis in rural population of Nadia district of West Bengal and identify the specific pathogenic organisms.

Materials and Methods

After obtaining approval from the institutional review board, the medical records of 139 clinically diagnosed patients of microbial keratitis, who attended for the Cornea service of a rural eye care clinic in Santipur, Nadia, West Bengal, from January to September 2024, following the introduction of microbiology services, were evaluated retrospectively for duration of symptoms, predisposing factors like trauma, associated ocular conditions, any systemic diseases, therapy received before presentation, history of corticosteroids use and previous eye surgery.

The Cornea service protocol for management of patients with a clinical diagnosis of microbial keratitis was identical for all patients in this study. Corneal scraping was performed in all patients by an ophthalmologist using a sterile surgical blade, following the instillation of local anaesthetic eye drop such as 4% lignocaine or 0.5% proparacaine. The material was obtained from the active margin and base of the ulcer following debridement of superficial mucus. In patients with deep corneal infiltrates with or without anterior chamber exudates, a deep scraping, corneal biopsy or anterior chamber tap was additionally performed. Patients where therapeutic keratoplasty was performed, corneal scraping was repeated at the time of surgery, and excised corneal buttons were subjected to microbiological and histopathological procedures.

The material obtained was directly smeared on a labelled slide for 10% Potassium Hydroxide wet mount, Gram's staining and incubated directly in solid media like, 10% sheep blood agar, Sabouraud Dextrose agar, potato Dextrose agar, nutrient agar and chocolate agar, in a row of C-shaped streaks. Brain heart infusion broth was used for a few patients in whom fungal keratitis was strongly suspected. The culture plates of 10% sheep blood agar plate or chocolate agar and brain heart infusion broth were kept for 10 days at 37ºC, and discarded if no growth was obtained and no turbidity was seen after 10 days. The Sabouraud Dextrose Agar (SDA) plates were observed for 21 days in room temperature. Any growth obtained was further

identified by microscopic aspects of texture, pigmentation, mycelium arrangement and conidium types by lactophenol cotton blue mount. The culture was considered positive if the growth of the same fungal species was found in more than one solid media.

Patients with a diagnosis of fungal keratitis as determined by positive microbiology result were identified. Two modes of treatment were identified from the case records. Topical therapy with natamycin eye drops (5%), amphotericin B (0.15%) and prepared 2% voriconazole eye drops. And the therapeutic penetrating keratoplasty.

Patients undergoing topical therapy were started on either natamycin or voriconazole depending upon the choice of the examiner. Identification of Candida species in culture or worsening of ulcer to topical monotherapy led to initiation of therapy with Amphotericin B eye drops. All patients received oral ketoconazole as adjunctive therapy. Depending on the severity of keratitis at presentation, topical or surgical therapy was initiated.

Results

Microbial keratitis is a serious, sight-threatening infection of the cornea caused by bacteria, fungi, or parasites. It requires prompt diagnosis and treatment to prevent permanent vision loss. In the study total 139 microbial keratitis patients selected, out of that 61(43.88%) patients were diagnosed as fungal keratitis based on clinical findings as well as observation of fungal filaments in 10% Potassium Hydroxide (10% KOH) mount and Gram staining in different age group. In the study we considered only 61 fungal keratitis suffered patients. Of these patients, 42 (68.85%) patients were culture positive fungal keratitis; the remaining 19 (31.15%) patients were only smear positive. [Table – 1]

	Culture Positive	**Smear Positive**	**Total**
Fungal Keratitis	42 (68.85%)	19 (31.15%)	61 (100%)

[Table – 1] Prevalence of Fungal Keratitis

In the study, male sufferer patients were more than female sufferer patients. Out of 61 fungal keratitis patients 39(63.93%) were male and 22(36.07%) were female patients. The male and female ratio was (1: 1.77). [Table – 2]

	Male	**Female**	**Male: Female**	**Total**
Fungal Keratitis	39(63.93%)	22(36.07%)	1: 1.77	61 (100%)

[Table – 2] Gender wise Fungal Keratitis Sufferer

There was a history of trauma in 29(47.54%) patients followed by history of steroid usage in 08(13.11%) patients and previous ocular surgery in 06(9.84%) patients. No predisposing factor could be identified in 18(29.51%) patients in both sexes. [Table – 3]

History of Fungal Keratitis	**Patients**	**Percentage**
History of Trauma	29	47.54%
History of Steroid Usage	08	13.11%
History of Ocular Surgery	06	9.84%
Unidentified Factors	18	29.51%
Total	61	100%

[Table – 3] History of Fungal Keratitis

In the study, maximum culture positivity was found from corneal scraping, 36 (59.02%) patients; followed by recipient corneal button obtained during therapeutic keratoplasty, 12(19.67%) patients; anterior chamber taps 11(18.03%) and deep corneal biopsy in 2(3.28%) patients. [Table – 4]

Culture Positivity	Patients	Percentage
Corneal Scraping	36	59.02%
Therapeutic Keratoplasty	12	19.67%
Anterior Chamber Taps	11	18.03%
Deep Corneal Biopsy	02	03.28%
Total	61	100%

Table – 4 Culture Positivity for Fungal Keratitis

In the study it was also found that 42 patients with culture positive fungal keratitis patients showed response to topical medical therapy with the formation of corneal scar. The remaining patients of mycotic keratitis patients needed therapeutic keratoplasty. This included 16 cases Aspergillus keratitis and 5 cases Fusarium keratitis. In our study all patients with Candida species infections required a surgical intervention. Eleven patients among culture positive fungal keratitis cases need immediate therapeutic keratoplasty at presentation.

Discussion

The study revealed that fungal keratitis accounted for 44.20% of the total microbial keratitis patients who presented in the eye clinic in rural area of Nadia district, West Bengal. This high prevalence of fungal pathogens in Eastern India was more from that found in similar studies in Bangladesh (36%), Ghana (37.6%) and South Florida (35%).[7,8]

Injury to the cornea was the leading cause of fungal keratitis in our study. A history of corneal trauma with vegetable matter or organic matter has been reported in 55–65% of fungal keratitis.[4,5,9] However, a study from the Northern United States reported trauma as the inciting event in only 8.3% of patients.[10] Steroid use as initial therapy has been reported in 1–30% of patients having microbial keratitis.[4,5,9,11] In our study, 08(13.11%) patients had history of steroid usage.

Direct examination of smears from corneal scrapings examined by 10% Potassium Hydroxide (10% KOH) wet mount preparation (95%) and or gram stain (85.22%) continue to be an important mode of identifying causative organism in patients with microbial keratitis. Other methods include anterior chamber tap, corneal biopsy and examination of corneal buttons from patients undergoing therapeutic keratoplasty. The sensitivity of 10% Potassium Hydroxide (10% KOH) and gram stain in preliminary identification of fungal filaments has been substantiated in other studies. [5,7,12,13] In 10% Potassium Hydroxide (10% KOH) mount slide, fungal filaments appear as refractile hyphae with septate or aseptate, branching or non-branching filaments. Some filaments look brown due to melanin pigments in some species of fungi. On the other hand, yeast cells are oval or round and colourless.

Aspergillus species and Candida species were found to be the major etiologic agents of fungal keratitis in this study followed by Fusarium species. Other studies have implicated Fusarium species and Aspergillus species as major pathogens with Dematiaceous fungi as the cause of patients with fungal keratitis.[5,12] In India, Aspergillus species is the main etiological organism responsible for mycotic keratitis followed by Fusarium species except in South India

where Fusarium keratitis was maximum to up to 43%.[5] In Nepal Upadhyay et al[7] found that Aspergillus sp. accounted for 47% of all fungal pathogens followed by Candida sp. (13.2%) and Fusarium sp. (11.7%). Gopinathan et al[11] from India have reported Candida sp. as a rare fungal corneal pathogen (0.7%).

In another series of 24 patients from Wills Eye Hospital, Philadelphia, Candida species was identified in 45.8% of patients of fungal keratitis.[10] The relatively high isolation of Candida species in this set of patients deserves attention. It has been reported that Candida infection is more common in temperate climate of the West compared to the tropical climate of East. However, it is also known that the growth rate of yeast is maximum in warm and moist condition.[14] Basak et al [15] reported 1.1% incidence of Candida positive patients among 509 mycotic keratitis patients. This study was conducted in a hospital with a rural population base. Factors other than climatic conditions, such as altered local defence mechanisms and immune suppression may also be responsible for the higher incidence of Candida infection in some studies compared to others.

Surgical intervention in the form of therapeutic keratoplasty continues to be an important mode of management. In our study, 42 patients showed response to medical therapy, while mycotic keratitis patients including Aspergillus keratitis and Fusarium keratitis needed therapeutic keratoplasty. Regina L et al reported from Texas that out of 29 Candida keratitis patients, 15 patient (51.72%) required surgical intervention of which 13 patient had therapeutic penetrating keratoplasty and 2 eyes needed enucleation.[16] Vemuganti et al reported that maximum fungal species identified from corneal buttons after therapeutic keratoplasty were Fusarium species in 30 (39%) and Aspergillus species in 25 (33%) buttons.[17] In our study it was seen that all patients suffering from Candida, Rhizopus, Bipolaris and Scedosporium species infections required a surgical intervention.

The study addresses the profile of fungal pathogens responsible for corneal ulceration among the rural population of West Bengal. While Aspergillus species remains the most predominant organism, Candida species was isolated in high numbers. Topical therapy is not always sufficient to eradicate infection in patients with fungal keratitis irrespective of the identified organism though Aspergillus and Fusarium infections seem to show some response to medical management. Therapeutic keratoplasty continues to remain an important treatment modality particularly in infections with Candida species Particular care should be taken in identification of the pathogenic organism with special stress on basic microbiological procedures like KOH and Gram staining to initiate appropriate therapy.

Conclusion: Fungal keratitis is an important cause of microbial keratitis with injury to the cornea being a leading predisposing factor. Although Aspergillus species was implicated in most of the patients in our study population, Candida species were found in higher numbers than previously reported. Keratitis caused by filamentous fungi responds adequately to medical management. Therapeutic keratoplasty continues to remain an important treatment modality in infections with Candida species. Early diagnosis with prompt identification of the pathogenic organism is mandatory to initiate appropriate therapy and thereby reduce morbidity.

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