ORIGINAL ARTICLE

e-ISSN: 2349-0659 p-ISSN: 2350-0964
doi: 10.21276/apjhs.2018.5.2.30

Spectrum of mycotic corneal ulcers in a tertiary care hospital in Eastern India

Parikshit Nandi[1], Poulami Nandi[2]*, Surankita Sukul[3], Suman Adhikari[4], Rajen P. Pradhan[5], R. K. Deb[5]

[1]Department Ophthalmology, Gouri Devi Institute of Medical Sciences and Hospital, Durgapur - 713 212, West Bengal, India, [2]Department of Microbiology, Nil Ratan Sircar Medical College and Hospital, Kolkata - 700 014, West Bengal, India, [3]Department of Biochemistry, IQ City Medical College and Narayana Multispecialty Hospital, Durgapur - 713 206, West Bengal, India, [4]Department of Ophthalmology, ICARE Institute of Medical Sciences and Research, Haldia - 721 645, West Bengal, India, [5]Department of Ophthalmology, Mata Gujri Memorial Medical College and LSK Hospital, Kishanganj - 855 108, Bihar, India

ABSTRACT

Background: Fungal keratitis is a major ophthalmic problem. Many microorganisms can cause infectious corneal ulcer. Among them are bacteria, fungi, viruses, protozoa, and chlamydia. Mycotic keratitis is an infection caused by fungus that leads to inflammation and ulceration.

Materials and Methods: The cases for the present study were selected from the patients admitted in the eye ward of M.G.M. Medical College and L.S.K. Hospital, Kishanganj (Bihar) during the period from June 2011 to November 2013. Out of all corneal ulcer cases admitted during this period 100 cases clinically suspected to be due to fungal infection were selected for the study. Conjunctival swab cultures were carried out from eyes of 10 clinically normal cases to study the fungal flora of conjunctival sac.

Results: During the course of study, out of 100 cases fungi could be isolated from 29 cases only. This showed that only 29% of the suspected cases suffered from mycotic keratitis. The majority of cases were in between 30 and 50 years. The incidence of keratomycosis was found to be the highest during the period from December to February (58.60%) which is a harvesting season of this region. Circumcorneal congestion was present in all the proved mycotic keratitis cases. Culture positive cases showed growth of fungus within 2 weeks of incubation in Sabouraud's glucose agar media at room temperature. Incidence of *Aspergillus* keratitis was the highest (65.50%), *Candida* (13.79%), *Penicillium* (13.79%), and *Fusarium* 96.89%).

Conclusion: The fungal etiology in the causation of corneal ulcer varies in relation to age, sex and occupation of the population and climatic condition of the region. Keratomycosis occurs more frequently during the harvesting season of the year. *Aspergillus* is the commonest variety among the species of fungus from the mycotic corneal ulcer.

Key words: *Aspergillus*, *Candida*, conjunctival swab culture, corneal ulcer, keratomycosis

INTRODUCTION

In all over the world, especially in developing and underdeveloped countries mycotic keratitis is still one of the major vision-threatening ophthalmic problems. Gruby (1847) was the first man to suspect the fungus as one of the etiopathological agents of ocular affection.[1] A German ophthalmologist, Leber [2] who first successfully isolated the fungus "*Aspergillus glaucus*" from a corneal ulcer of a farmers' eye sustained injury from oats chaff while working with a threshing machine and enlisted the fungus as one of the etiopathological agents of corneal ulcer.

Corneal ulceration is defined as a loss of corneal epithelium with underlined stromal infiltration and suppuration associated with signs of inflammation with or without hypopyon. It is frequently caused by trauma with the vegetative material, other major risk factors are frequent use of broad-spectrum antibiotics and steroids and increasing use of corneal contact lenses.[3] The typical feature of fungal infection is slow-onset and gradual progression, where signs are much more than symptoms. Satellite lesions around the ulcer are a common feature of fungal keratitis, and hypopyon is usually seen.[3]

Fungal infection of the cornea may result in the disastrous outcome of the vision. In comparison to that of bacteria, the study of pathogenic fungi has received less attention. At present, there are thousands of different species of fungi which have been identified by only a few are capable of invading the human cornea.[4]

In fungal corneal infection, the preservation of visual function depends on quick correct diagnosis and prompt initiation of effective antifungal treatment. The fungal infection is difficult to manage in comparison to bacterial corneal infection. It is because confirmed laboratory diagnosis of fungus is time-consuming and non-availability of broad-spectrum effective antifungal drugs freely in the market.

Mycotic keratitis has been reported from many different parts of the world, with a worldwide reported incidence varying from

Address for correspondence:
Dr. Poulami Nandi, Department of Microbiology, Nil Ratan Sircar Medical College and Hospital, 138, Acharya Jagadish Chandra Bose Road, Sealdah, Raja Bazar – 700 014, Kolkata, West Bengal. E-mail: drpnandi2000@gmail.com

Received: 10-05-2018 **Revised:** 31-05-2018 **Accepted:** 13-06-2018

17% to 36% in various studies.[5] It is particularly common in tropical areas, where the incidence ranges between 14% and 40% of all ocular mycoses, or of all cases of microbial keratitis.[6] The incidence in India is 44% to 47%.[6]

The frequency and spectrum of fungi involved vary from place-to-place as several factors such as climate, age, sex, geographical, and socioeconomic conditions play a significant role in modulating the incidence and prevalence of fungal corneal infections.[7,8]

Bihar is located in the semitropical region. Its climatic condition is humid and moist which helps fungal spores to get widely distributed. This type of weather favors the growth of fungi, therefore in this region, the incidence of fungal corneal ulcers appears to be quite high.

MATERIALS AND METHODS

The cases for the present study were selected from the patients admitted in the eye ward of M.G.M. Medical College & L.S.K. Hospital, Kishanganj (Bihar) during the period from June 2011 to November 2013. Out of all corneal ulcer cases admitted during this period 100 cases clinically suspected to be due to fungal infection were selected for the study. Conjunctival swab cultures were carried out from eyes of 10 clinically normal cases to study the fungal flora of conjunctival sac.

Investigations

General

Blood for total count, differential leukocyte count, hemoglobin %, erythrocytes sedimentation rate, blood sugar.

Special investigations for fungus

Direct examination of materials from corneal lesions: KOH Preparation and Gram stain; the fungal culture of materials from a corneal ulcer, conjunctival swab culture for fungus, and biochemical study.

After completing the routine clinical examination, the cornea was anesthetized by instillation of 4% xylocaine drops. Since the commercially prepared 4% xylocaine contains a preservative and this preservative is antifungal, so after instillation, the eye was washed with normal saline. After that, the floor of the ulcer was scrapped with a sterile platinum wire loop. The little amount of the scrapped material was inoculated in Sabouraud's dextrose agar media for culture, and the remaining part of the material was smeared on two slides – one for treating with 10% potassium hydroxide solution and the other for Gram staining.

Conjunctival Swab Culture

The presence of fungus in the conjunctival sac was also examined by taking a swab from it and cultured in Sabouraud's dextrose agar media then the culture tubes were incubated at 37°C and at room temperature for 2–3 weeks and examined for the growth of fungus.

Examination of Materials from the Corneal Lesion

A little bit of the material was taken and placed in a clean, dry glass slide. Then, it was treated with 10% potassium hydroxide solution and examined under a microscope for the presence of fungal elements.

McGuire's Stain

A little bit of scarping material from the sterile tube was taken over a clean, dry glass slide with the help of a sterile platinum loop. A drop of McGuire's stain was placed over it which was teased with a sterile needle. It was then covered with a clean cover glass. The excess of stain, if any, was mopped away with a filter paper. Then, the slide was first examined under low power objective of the microscope and then under high power objective to identify the fungus.

Culture of Scrapped Material

The other part of the scrapped material from the corneal tissue is taken out from the test tube by a sterile platinum loop. The material is inoculated in Sabouraud's dextrose agar media (in two test tube slant). One tube is kept at room temperature and another is kept in the incubator at 37°C. These tubes were kept for 2–4 weeks for growth of any fungus. If there is the growth of fungus, the morphology of the colony of the fungus is studied for the identification of the species of the fungus. Sometimes, it was examined under low power objective of the microscope and then for further identification of the species, the material from the growth was routinely stained with Gram stain and examined under the microscope.

Biochemical Test

The isolates were subjected to biochemical tests for identification of the species. A small amount of material from the growth in Sabouraud's dextrose agar media was taken and placed in sugar tubes. There will be fermentation of the sugar if there is a fungus because the fermentation of different species is constant. Furthermore, the proteolytic activity of the fungi is characterized by the liquification of coagulated serum gelatin.

RESULTS

The present study was carried out in 100 cases of the clinically suspected fungal corneal ulcer. All these cases were attended the Eye Out Patient Department of M.G.M. Medical College and L.S.K. Hospital, Kishanganj (Bihar) during the period from June 2011 to November 2013. In all these patients, a thorough clinical examinations and laboratory investigations for fungus were done. Conjunctival swab culture for fungi was also done from 10 clinically normal cases as a control. The observations and results are enumerated under the following heading.

Incidence of Mycotic Keratitis

During study out of 100 cases, fungi could be isolated from 29 cases only. This showed that only 29% of the suspected cases suffered from mycotic keratitis.

Incidence in Relation to Age

In this study, the youngest patient was 8 years old and oldest one was 74 years. The majority of cases were in between 30 and 50 years. The incidence of corneal ulcer and fungus positive cases in different age groups are tabulated in Table 1.

Incidence in Relation to Sex

In the present series, it has been observed that incidence of fungal keratitis was more in males than females both in clinically suspected and fungus positive cases. Out of 29 positive cases, 18 were male and 11 were female. The incidence about sexes is given below in Table 2.

Table 1: Incidence of corneal ulcer and fungus positive cases in different age groups

Age group (in years)	Total cases of corneal ulcer	Number of fungus positive cases	Percentage of keratomycosis (%)
0–10	8	1	3.44
11–20	13	2	6.89
21–30	15	3	10.34
31–40	23	6	20.68
41–50	19	10	34.48
51–60	13	4	13.79
61–70	6	2	6.89
71–80	3	1	3.44
Total	100	29	99.95

Incidence in Relation to Occupation

In the present series, it has been observed that the fungal keratitis is much common among the cultivators and farmers both in total suspected cases and positive cases. Out of 100 cases, 45 (48.27%) cases are cultivators, and among them, 14 cases are having fungal keratitis. The incidence of mycotic keratitis in different occupations is shown in Table 3.

Seasonal Variation

It has been observed the highest incidence of mycotic keratitis occurred during the month from December to February. The incidence in the different months is shown in Table 4.

Cases Having History of Trauma

There was a history of trauma to the eyes in 82 cases which include 28 (96.55%) fungal positive keratitis cases. The injury was mostly caused by paddy leaves. The agents causing injuries are shown in Table 5.

Associated Conditions

In this series, 4 cases had associated diseases such as diabetes mellitus and glaucoma out of 100 cases of suspected cases of the fungal corneal ulcer. The nasolacrimal duct was blocked in five cases.

Clinical Features

Out of 100 cases, 88 cases had mucopurulent discharge. All the cases presented with conjunctival and circum corneal congestion with blepharospasm. In most cases, the ulcer was characterized by dry looking, greyish white with elevated irregular rolled out margin. 67 cases out of 100 cases had hypopion, 4 cases with descemetocele, 6 cases presented with panophthalmitis, and 26 with iriocyclitis.

Out of 29 culture positive cases, all the cases have got conjunctival and circumcorneal congestion and the ulcers were characterized by dry looking, grayish-white with elevated rolled out irregular margins. Hypopyon and mucopurulent discharge observed in all culture-positive cases. 2 (6.89%) cases had descemetocele and 4 (13.79%) cases had panophthalmitis.

Laboratory Investigations

Conjunctival swab culture

The conjunctival swabs taken from 10 controlled eyes were cultured by inoculating in Sabouraud's dextrose agar media which were kept at room temperature for 2–3 weeks. However, only in one case, fungal colonies were grown in the present series. However, growth of fungal colonies was seen in 25 (25%) cases out of 100 conjunctival swabs culture which were collected from the clinically suspected cases of keratomycosis.

Direct microscopic examination of corneal scraping

The corneal scrapings were examined under microscope after treating with 10% KOH solution and Gram stain. Out of 100 cases, only in 29 cases, fungal elements were seen, when species of fungus could not be identifies.

Culture of corneal scraping in Sabouraud's dextrose agar media

The corneal scraping materials inoculated in Sabouraud's dextrose agar media were kept in room temperature for 3–4 weeks. Out of 100 cases, fungal colonies grew only in 29 (29%) cases. From the character of the colonies and after staining from the growth the different species of fungus were identified. The species identified in the present series are shown in Table 6 with their incidence.

Biochemical reactions

For confirmation of species, biochemical study was carried out using bacteriological sugar tubes. Different types of fungi have got the specific fermentation of the sugar.

DISCUSSION

In the present series, 100 clinically suspected cases of mycotic corneal ulcer have been selected for undertaking the study. Conjunctival swabs cultures were done in Sabouraud's dextrose agar media from 10 clinically healthy individuals to know the pattern of the fungal flora of normal conjunctival sac. The culture was positive in only one case, and the species was identified as *Aspergillus*.

Incidence of Isolation of Fungus from Corneal Ulcer

In the present series, fungi could be isolated in 29 cases (29%) out of 100 clinically suspected cases of the mycotic corneal ulcer. In India, highest incidence of 96% was reported by Polack *et al*.[9] and lowest incidence of 7.7% was reported by Balakrishnan[10]. In the present series, the incidence of keratomycosis simulated those as reported by Rao and RamaKrishnan[11] 33.07%, Puttanna[12] 34%, and Dutta *et al*[13] 32%. The climatic condition and agricultural environment of this region might be the cause of moderately high incidence of keratomycosis in this series.

Table 2: Incidence of corneal ulcers in relation to sexes

Group	Total number of cases		Total number of fungus positive cases	
	Male	Female	Male	Female
Number of cases (%)	70 (70.00)	30 (30.00)	18 (62.06)	11 (37.93)

Table 3: Incidence of mycotic keratitis in different occupations

Occupation	Total number of cases	Fungus positive cases
		Number of cases (%)
Cultivators	45	14 (48.27)
Housewife	25	8 (27.58)
Student	13	3 (10.34)
Garden Laborers	8	2 (6.89)
Service Holder	4	1 (3.44)
Carpenter	3	1 (3.44)
Businessman	2	-
Total	100	29 (99.96)

Table 4: Incidence of mycotic keratitis in the different months

Months	Total number of suspected cases	Number of fungal positive cases
		Number of cases (%)
January	13	6 (20.68)
February	14	5 (17.24)
March	10	2 (6.89)
April	8	2 (6.89)
May	7	-
June	8	1 (3.44)
July	6	1 (3.44)
August	9	2 (6.89)
September	5	1 (3.44)
October	4	1 (3.44)
November	6	2 (6.89)
December	10	6 (20.68)
Total	100	29 (99.92)

In Table 7, the incidence of keratomycosis reported by various authors of different countries have been shown.

Incidence in Relation to Age

In the present series, the highest incidence of mycotic corneal ulcer observed in the age group from 30 to 50 years. Reddy *et al.*[22] reported similar finding in his study. Hammeke and Ellis[17] reported a higher incidence in adult (10.3%) than in young one below 16 years (4.8%). Naumann *et al.*[23] observed higher incidence among the patients above 50 years. Williamson *et al.*[3] observed no significant variation of incidence about age. Jones *et al.*[24] reported a maximum number of keratomycosis in young persons.

It has been observed that the higher incidence in 30–50 years age group might be because these people spend most of their time in agricultural fields and hence they are frequently exposed to fungal infection following even minor trauma.

Table 5: Agents causing injury in fungal corneal ulcer cases

Agents causing injury	Total number of cases	Fungus positive cases
		Number of cases (%)
Paddy leaf	16	8 (27.58)
Wooden piece	8	2 (6.89)
Vegetable matter	10	4 (13.79)
Other tree leaves	8	3 (10.34)
Straw	10	3 (10.34)
Bamboo stick	13	4 (13.79)
Mud or soil	7	1 (3.44)
Miscellaneous	10	3 (10.34)
Without H/o Trauma	18	1 (3.44)
Total	100	29 (99.95)

Table 6: Fungal species identified in the present series

Types of Fungus	Total number of fungus positive cases
	Number of cases (%)
Aspergillus fumigatus	12 (41.37)
Aspergillus niger	7 (24.13)
Candida	4 (13.79)
Penicillium	4 (13.79)
Fusarium	2 (6.89)
Total	29 (99.97)

Incidence in Relation to Sex

The present study shows that males (62.06%) are more prone to fungal infection than female (37.93%) and the ration of male-to-female is 3:2. The higher incidence in the male can be attributed to the fact that males are more vulnerable to injury than females.

The higher incidence of fungal corneal ulcer among the male cases was also reported by Naumann *et al.*[23], Reddy *et al.*,[24] Rao and Rao,[21] Dutta *et al.*[13] (1981), and Maria *et al.*[25] On the other hand, Puttanna[12] and Saxena and Goswami[20] reported the higher incidence in the female. They attributed this to the focal sepsis, for example, fungal vaginitis and cosmetics and beauty aids etc.

Incidence in Relation to Occupation

In the present series, fungal keratitis was found in a patient with various occupations. It has been observed that mycotic keratitis is more prevalent among the cultivators. Out of 29 culture positive cases, 14 cases (48.27%) were cultivators. Most of the people in this region are agriculturists and farmers. During the fieldwork, they received an injury to their eyes by paddy leaves or other vegetable matters which might be the precipitating factor of the high incidence of keratomycosis among the cultivators in this region.

The next higher incidence in this series has been observed in housewife (27.58%) which might be due to similar reason as

Table 7: Incidence of isolation of fungus from corneal ulcer

Authors	Total number of eyes	Fungus positive *n* (%)	Region
Fazakas[14]	993	253 (25.4)	Central Europe
Mitsui and Hanabusa[15]	65	12 (18.4)	Japan
Fazakas[16]	160	39 (24.3)	Central Europe
Hammeke and Ellis[17]	356	32 (10.3)	Arkansas
Aiteye and Smith[18]	43	12 (27.9)	England
Nema *et al.*[19]	180	40 (22.22)	India
Williamson *et al.*[3]	1160	32 (2.9)	Great Britain
Saxena and Goswami[20]	614	54 (8.7)	India
Rao and Rao[21]	115	28 (24.3)	India
Dutta *et al* (1981)[13]	100	32 (32.0)	India
Present Series (2003)	100	29 (29.0)	India

these women are also frequently exposed injury caused by paddy leaves and cows tail during milking.

Balakrishnan,[10] Duke-Elder,[26] Reddy *et al.*[22] and Dutta *et al.* (1981)[13] reported high incidence of keratomycosis among the cultivators. The incidence of keratomycosis among the cultivators observed in the present series is almost coincides with the observations of Reddy *et al.*[22] who recorded 55.5% of mycotic keratitis among the agricultural workers.

Incidence in Relation to Seasonal Variation

In the present study, it has been observed that the incidence of keratomycosis is highest during the period from December to February. 17 cases (58.6%) out of 29 culture positive cases were found during this period. The harvesting season which falls within this period might be the cause of high incidence of keratomycosis in this region. The same impression was given by Rao and RamaKrishnan.[11] Rao and Rao[21] reported high incidence of keratomycosis during November to March. Naumann *et al.*[23] observed high incidence of keratomycosis during summer season. Srivastava *et al*[27] reported high incidence of keratomycosis during rainy season.

Incidence in Relation to Trauma

In the present series, among the 29 culture positive cases of keratomycosis, 25 cases (86.2%) had history of trauma to the cornea. It has been observed that trauma was inflicted mostly by vegetative materials such as paddy leaves, straw, tea leaves, and branches of tree during agricultural field work. Balakrishnan[10] noticed in his series that all the culture positive fungal corneal ulcer cases were farmers who received injury to the cornea during fieldwork. Similar observations were made by Chick and Conant,[28] Puttanna,[12] Polack *et al*.,[9] Reddy *et al*.[22] and Dutta *et al.*[13] (1981).

Clinical Picture

Conjunctival and circumcorneal congestion

All the 29 fungus positive cases had conjunctival and circumcorneal congestions which might be due to the reactionary iridocyclitis or due to the secondary bacterial infection. Naumann *et al.*[23] and Puttanna[12] stated that reaction of the fungal keratitis is less than that of bacterial corneal ulcer. However, it was observed by Duke-Elder[26] that fungal keratitis became more violent when it was superinfected by pathogenic organisms such as Staphylococcus, etc.

Conjunctival Swab Culture from the Normal Eye

Sabouraud's dextrose agar media

In the present series, conjunctival sac swab culture was done by collecting from 10 clinically healthy individuals. In one case, the culture was positive and the fungus isolated in the culture was *Aspergillus* species. It has been observed that the occupation of that individual was cultivation which might be a contributing factor for the presence of fungus in normal conjunctival sac. Nema *et al.*[19] reported that rural people (25.04%) harbor fungus in their conjunctival sac more than that of urban population (18.48%). They explained it to be due to exposure of rural people to the agriculture environment. Williamson *et al*.;[3] Saxena and Goswami;[20] Rao and Rao[21] (1972) also observed the presence of fungal flora in normal conjunctival sac.

Conjunctival Swab Culture from the Mycotic Corneal Ulcer Cases

Sabouraud's dextrose agar media

In the present study, conjunctival swabs from 22 cases (75.86%) out of 29 fungus positive cases showed growth of fungi in Sabouraud's dextrose agar media. The other 7 cases (24.13%) failed to show any such growth. This can be explained by the fact that fungi usually live in the deeper layers of the cornea as observed by Naumann *et al.*[23] and hence, superficial swabs from conjunctival sac failed to show any evidence to fungus present in it.

Examination of corneal scrapings

In the present series, all the 29 fungus positive cases showed the presence of fungal elements on staining with either KOH solution or Gram stain. By these examinations, the fungal species could not be identified as only spores of fungus were visualized. The same difficulty was faced by Rao and Rama Krishnan.[11]

Culture of the scraping materials in Sabouraud's dextrose agar

In the present series, the media used for fungal culture was Sabouraud's dextrose agar media. In this media, the growth of fungus is more and identification of fungal colony by the naked eye is easier. It has been observed in the present study that almost all fungal colonies grew during the 1st week of inoculation. Sabouraud's dextrose agar media is the best because it inhibits bacterial growth by lower pH (5.5) and enhances fungal growth by the higher sugar content.

Table 8: Fungi isolated by various workers

Authors	Number of cases	Number of fungus positive cases (%)	Species of fungi isolated	
Nauman *et al.* [23]	73	11 (15%)	*Aspergillus*	2
			Cephalosporium	3
			Allesheria boydii	2
			Fusarium	3
			Candida	1
Puttanna[12]	303	34 (11.2%)	*Aspergillus*	16
			Cephalosporium	3
			Fusarium	2
			Rhizopus	2
			Candida	4
			Penicillium	3
			Lasio diplodia	2
Polack *et al.*[9] (selective study)	33	32 (9.6%)	*Aspergillus*	2
			Candida	2
			Cephalosporium	11
			Tetraploa	1
			Curubularia	1
Kulshrestha *et al.*[30]	52	23 (44%)	*Aspergillus*	8
			Candida	3
			Dermatophytes	4
			Penicillium	2
			Mucos	1
			Rhizopus	3
			Yeast	2
Grover *et al.*[31] (selective study)	17	14 (82%)	*Aspergillus*	7
			Candida	1
			Penicillium	2
			Curvularia	1
			Fusarium	1
			Trichosporum	1
			Scopuloriopsis	1

Types of Fungus

In the present series, the different types of fungus isolated were *Aspergillus* 19 (65.51%), *Candida* 4 (13.79%), *Penicillium* 4 (13.79%), and *Fusarium* 2 (6.89%).

Aspergillus

It was the most common causative organism of mycotic corneal ulcer in the present study. Both *Aspergillus fumigatus* 12 (41.37%), and *Aspergillus niger* 7 (24.13%) constituted the highest number of fungi isolated from the ulcer and it might be due to the favorable climatic condition for growing of *Aspergillus* in the region. Puttanna[12] reported 16 (47.05%) cases of *Aspergillus* out of 34 fungus positive corneal ulcer cases in his study. He emphasized that *Aspergillus* thrives in tropics and claimed that *Aspergillus* was one of the most common mycotic organism that invade cornea, tear duct, and orbit. Ainley and Smith[18] reported that *Aspergillus* species is the common inhabitants of the healthy conjunctival sac. Rao and RamaKrishnan [11] stated that epithelial erosion of cornea favors fungal growth. Agarwal *et al.*[29] and Puttanna[12] revealed that indiscriminate use of broad-spectrum antibiotics and/or corticosteroids may turn the non-pathogenic fungi to become pathogenic. By considering from all these points of view, the high incidence of *Aspergillus* keratitis of the present series is an acceptable one. Because in the present series, out of all the fungus positive cases, 25 (86.20%) cases had history of trauma to their eyes and 10 (34.48%) cases had the history of application of antibiotics or corticosteroids and native medicine before coming to the hospital. The highest incidence of *Aspergillus* in the present series simulated with the observations of Puttanna[12] 47.05%; Kulshrestha *et al.*[30] 34.74%; Grover *et al.*[31] 50%, and Dutta *et al.*[13](1981) 68.75%.

In the present series, out of 19 cases of *Aspergillus* keratitis, 3 cases resulted in corneal perforation with panophthalmitis. This might be due to the entry of the organism into the deeper layers of the cornea, due to low resistance of the patient or following application of corticosteroids or/an broad-spectrum antibiotics. Castroviejo *et al.*[32] observed perforation in cases of *Aspergillus* keratitis.

Candida

Candida was isolated from 4 (13.79%) cases out of 29 fungus positive cases. This incidence simulates the report of Kulshrestha *et al.*[30] who got 13.04% in their series. Polack *et al.*[9] reported the lowest incidence of *Candida* keratitis was 6.36% in their series. Naumann *et al.*,[23] Puttanna;[12] Grover *et al.*[31] reported the incidences of keratomycosis due to *Candida* as 9.09%, 11.76%, and 7.14%, respectively. Heavy rainfall of this region which favors growing of *Candida* spores might be the cause of high incidence of *Candida* keratitis in the present series.

Penicillium

In the present series, *Penicillium* was isolated from 4 (13.79%) cases of keratomycosis. This incidence is almost coincide with the reports of Reddy *et al*.[22] (1972) and Grover *et al*.[31] who got *Penicillium* as the causative organism in 13.8% and 14.2%, respectively, in their series. Puttanna[12] found *Penicillium* in 8.85 cases of keratomycosis which is lower than that of the present study. Dutta *et al*.[13] (1981) found in 18.7% of cases. This incidence is slightly higher than the present series. Out of 4 cases of *Penicillium* keratitis, 3 cases came in December and January. It has been observed from the present study that the incidence of keratomycosis due to *Penicillium* increases during winter season. Srivastava *et al*.[27] (1978) observed that *Penicillium* species was more frequently isolated during cool and dry winter months.

Fusarium

Out of 29 cases of culture-positive keratomycosis, *Fusarium* species was isolated from 2 (6.89%) cases only. This incidence simulates the report of Grover *et al*.[31] who got 7.1% in their series. Naumann *et al*.[23] and Polack *et al*.[9] found *Fusarium* keratitis 27.2% and 46.8%, respectively, in their series. These incidences are quite high in comparison to the result of the present series; but Puttanna[12] reported 5.8% of *Fusarium* keratitis which is lower than the result of the present study. Dutta *et al*.[13] (1981) isolated *Fusarium* species in 9.3% of cases which is almost coincide with the present study [Table 8].

CONCLUSION

This study comprises 100 clinically suspected mycotic keratitis cases, who were admitted to the Department of Ophthalmology, M.G.M. Medical College & L.S.K. Hospital, Kishanganj, during the period from June 2011 to November 2013. The incidence of mycotic keratitis in this series was 29%. The maximum incidence of keratomycosis was observed in the age group from 30 to 50 years. This is attributed to trauma to the eye in agricultural fields.

The disease is more in males than in females, and the ratio is 3:2. About occupation, the incidence was more common among the cultivators (48.27%); housewives 927.58%), students 910.34%), tea garden laborers (6.89%), carpenter (3.44%), and service holder (3.44%). The incidence of keratomycosis was found to be the highest during the period from December to February (58.60%) which is a harvesting season of this region. Circumcorneal congestion was present in all the proved mycotic keratitis cases.

Culture positive cases showed growth of fungus within 2 weeks of incubation in Sabouraud's glucose agar media at room temperature. The incidence of *Aspergillus* keratitis was the highest (65.50%), *Candida* (13.79%), *Penicillium* (13.79%) and *Fusarium* 96.89%). The fungal etiology in the causation of corneal ulcer varies about age, sex, and occupation of the population and climatic condition of the region. Keratomycosis occurs more frequently during the harvesting season of the year. *Aspergillus* is the most common variety among the species of fungus from the mycotic corneal ulcer.

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How to cite this Article: Nandi P, Nandi P, Sukul S, Adhikari S, Pradhan RP, Deb RK. Spectrum of mycotic corneal ulcers in a tertiary care hospital in Eastern India. Asian Pac. J. Health Sci., 2018; 5(2)157-164.

Source of Support: Nil, **Conflict of Interest:** None declared.