Epidemiological and Microbiological Profile of Suppurative Corneal Ulcer in a Tertiary Care Hospital in Eastern India

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ABSTRACT

BACKGROUND

Corneal ulcer is an open sore on cornea causing significant morbidity especially in developing countries. It is associated with redness, watering, photophobia, pain and decreased vision of that eye. It is a vision threatening emergency and may lead to corneal scarring and perforation. If left untreated it may progress to endophthalmitis. So, an early diagnosis with recognition of the causative agent is very much essential to preserve vision. We conducted this study to evaluate the risk factors, causative organisms, and patient demographics of microbial keratitis.

METHODS

All new patients with suspected suppurative keratitis presenting at the ophthalmology OPD of Calcutta National Medical College and Hospital for a period of 1 year were evaluated. Sociodemographic data, visual acuity at presentation, and information pertaining to the risk factors were recorded. After diagnosing infective corneal ulcer clinically, corneal scraping was performed. Microscopy and culture were performed on all corneal specimens obtained. From this data we tried to find out the epidemiological pattern and factors involved in suppurative corneal ulcer.

RESULTS

One hundred and fifty cases of suppurative keratitis were studied clinically and microbiologically. Study showed a male preponderance (73.33%) with cultivators constituting the major occupational group (29.33%). Trauma was the commonest pre-disposing factor (64%). Among the 114 (76%) culture positive cases, 62 (41.33%) patients had pure fungal infection, 33 (22%) patients had pure bacterial infections and 19 cases (12.67%) had mixed fungal and bacterial infections. *Aspergillus spp.* were the most common fungal isolate, while among the bacteria positive cases, the main isolates were *Staphylococcus aureus*, *Pseudomonas sp.* and *Pneumococcus*.

CONCLUSIONS

Suppurative corneal ulcer is an important cause of preventable blindness. Smear and culture is an essential tool in the diagnosis of these infections. Region based information about the causative organisms and risk factors helps in empirical management, and to formulate guidelines for prevention of suppurative keratitis in the population at risk.

KEYWORDS

Suppurative Keratitis, Epidemiology, Risk Factors

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BACKGROUND

Corneal blindness accounts for 20 - 30% of all blindness in the developing countries of the world and infective corneal disease is the leading cause of this problem in South Asia.[1] As such, the incidence of microbial keratitis has been found to vary from 11 per 100,000 persons/ year in United States to 799/ 100,000 persons / year in Nepal.[2]

Corneal ulceration is defined as loss of corneal epithelium with underlying stromal infiltrate and suppuration associated with signs of inflammation, with or without hypopyon.[3] A host of different aetiological factors through a common pathology of tissue destruction produce this ulcer. Also, the presentation, the rate of progress and severity vary widely. A key element in management of this sight – threatening condition is a proper understanding of the microbial organisms responsible for this disease entity as well as the current trend of various organisms causing microbial keratitis in a particular zone.

This study aims to establish the risk factors, causative organisms, patient demographics of microbial keratitis at a tertiary eye care centre in Eastern India so that timely, appropriate therapeutic strategies may be formulated.

METHODS

After obtaining permission from the institutional ethical committee, the study was performed at Calcutta National Medical College and Hospital, Kolkata. 150 consecutive new patients, who presented at the cornea clinic of the institution for the first time and were diagnosed clinically with suspected suppurative keratitis during the period of June 2012 to May 2013, were analysed in this study.

Inclusion Criteria

- Patients with suppurative keratitis.
- Patients who gave consent for study.

Exclusion Criteria

- Suspected or confirmed viral keratitis.
- Healing ulcers.
- Mooren's ulcer, marginal keratitis,
- Interstitial keratitis, atheromatous ulcer, neurotrophic keratitis.

A standardized form was maintained with the socio-demographic information of the patient along with visual acuity, presenting symptoms, duration, past treatment received, and any antecedent predisposing factor. History of injury was enquired about and when present, its type, the inflicting agent and the onset of the disease after the injury were noted. Each patient was examined thoroughly with the help of torch and slit lamp biomicroscopy. Presenting visual acuity (VA) of each eye was first recorded. In general ocular examination, any associated ocular condition was searched for. Intraocular pressure was recorded digitally and any regurgitation from the sac on pressure was noted. Syringing was done for any nasolacrimal passage obstruction.

The corneal ulcers were examined in great detail, before and after staining with 2% fluorescein. Location and size of ulcer, its extent, depth of stromal infiltration, margin of ulcer and any satellite lesions were recorded. Any perforation of the ulcer or vascularisation of the cornea and condition of the surrounding cornea was noted. Hypopyon, when present, was examined carefully, noting its extent, colour and whether it was fixed or mobile.

A general systemic examination was done in all cases, including blood pressure, blood glucose concentration to rule out any relevant systemic disorder.

Corneal scrapings were collected aseptically. A drop of local anaesthetic without preservative (4% Lignocaine hydrochloride or 0.5% Proparacaine hydrochloride) was instilled, and with the help of the slit lamp or operating microscope, the edge and base of the ulcer was firmly scraped using Bard Parker blade No. 15 after removal of debris or discharge in the vicinity, taking care not to touch the lashes or lids. Material obtained from scraping was inoculated in the media and smeared onto two slides, one stained with Gram stain and the other with 10% Potassium hydroxide (KOH) for direct microscopic evaluation.

Initially, scraped material was inoculated directly in 'C' curve fashion and cultured in Blood agar, Chocolate agar, and Sabouraud's dextrose agar (SDA), followed by microbiological analysis by subculture in relevant media and other tests.

Cultures on blood agar and chocolate agar was evaluated at 24 hours and 48 hours, and then discarded if there was no growth. For fungal cultures the materials were inoculated on to Sabouraud dextrose agar (SDA) and incubated at room temperature, examined daily, and discarded after 2 weeks if there was no growth. A non-nutrient agar plate with an overlay of Escherichia coli was inoculated if Acanthamoeba keratitis was suspected and an additional slide was prepared for microscopy.

An isolate was considered as significant when it was consistent with the clinical signs and direct smear results, and if the same organism was grown in more than one media, or if the same organism was grown from repeated scrapings.

Statistical Analysis

Data was presented as actual numbers and percentages.

RESULTS

One hundred and fifty patients with the clinical diagnosis of corneal ulcer with or without hypopyon were enrolled for this study. Mean age of study population was 45.12 ± 17.14 yrs. Ranging from 7 yrs. to 76 yrs., 45 yrs. being the median age.

Majority of the patients in this series (127; 84.67%) were within the range of 21 to 70 years of age. Of these, 110 (73.33%) were male and 40 (26.67%) were female.

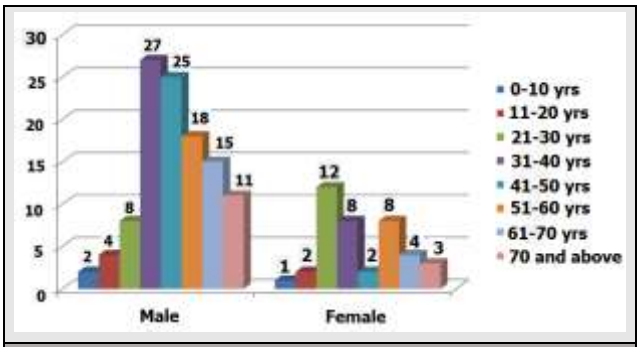

Figure 1. Age and Sex Distribution of Corneal Ulcer Cases

Of the study population 11.34% patients were with visual acuity between 6/6 to 6/9, 19.33% were having visual acuity between 6/12 to 6/24, 47.33% and 14% population had visual acuity between 6/36 to 6/60 and 3/60 to HMCF (hand movement close to face) respectively while only 8% had PL (perception of light) and NO PL as their acuity of vision.

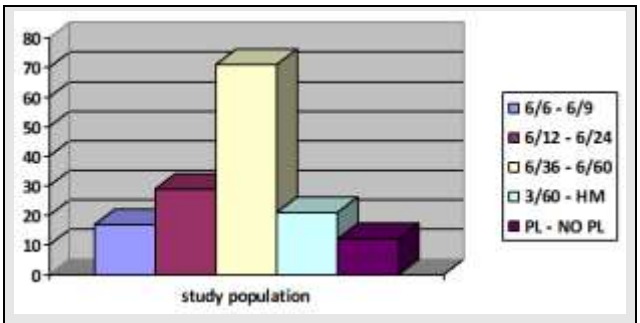

Figure 2. Distribution of Visual Acuity at Presentation among Study Population

Of the 150 cases studied in this series, 87 (58%) were from rural areas and 63 (42%) were from urban localities. The cultivators (44) constituted the commonest occupational group (29.33%), followed by skilled /unskilled workers (35 cases; 23.33%).

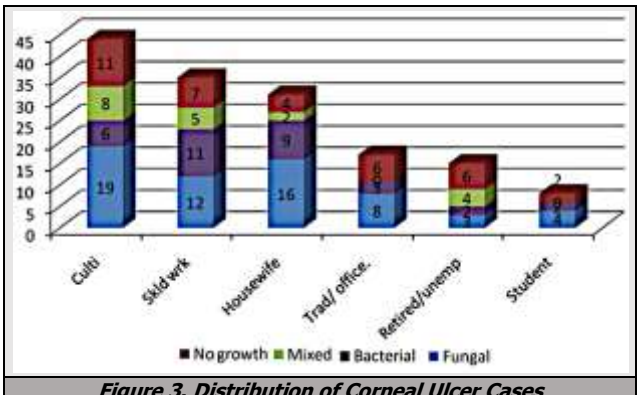

Figure 3. Distribution of Corneal Ulcer Cases with Respect to Occupation

History of trauma was found in 96 cases out of the 150 patients (64%). Commonest type of trauma was with vegetative matter (31 cases; 32.29%) followed by wood chip or stick. This group yielded the maximum number of fungus positive cases (24 out of 31 cases i.e., 77.42%).

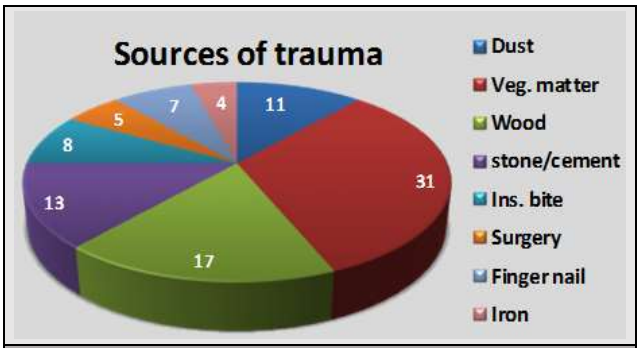

Figure 4. Distribution of Corneal Ulcer Cases According to Sources of Injury

Chronic dacryocystis, blepharitis, trichiasis, conjunctivitis and lagophthalmos were among the other co-existing ocular diseases. There were 2 cases with history of contact lens usage; both showing bacterial growth in culture. Twenty one patients (14%) had a history of use of topical steroid-antibiotic drops. Among the systemic illness, Diabetes mellitus was found to be a common associated condition. Among the 150 patients, 101 (67.33%) were treated with antimicrobial agents, corticosteroids or some form of medication topically elsewhere, prior to their presentation.

Type of Microbe	No. of Culture Positive Cases	Total	% (of 114 Cases)
Fungi (Only)			
Aspergillus fumigatus	12		
Aspergillus flavus	11		
Aspergillus niger	9	62	54.39
Fusarium sp.	11		
Others	19		
Bacteria (Only)			
Staphylococcus aureus	13		
Pseudomonas sp.	9		
Pneumococcus	5	33	28.94
Others	6		
Mixed Cases (Both Bacteria & Fungi)		19	16.67
Total no. of culture positive cases		114 (76%)	
Total no. of culture negative cases		36 (24%)	

Table 1. Fungi and Bacteria Isolated in Corneal Ulcer Cases

Microorganisms were isolated in 76% of the 150 cases of presumed microbial keratitis. Culture positive fungi were identified as the principal aetiological agent in 62 patients i.e., 54.39% of all culture positive cases. Among the 62 fungus positive cases, *Aspergillus spp.* topped the table with 32 cases (51.61%). This group included *Aspergillus fumigates*, *Aspergillus flavus*, *Aspergillus niger*. Eleven cases yielded *Fusarium sp.* in culture.

Corneal scraping yielded only bacteria in 33 clinical specimens (28.94% of the positive cultures). Among the 33 bacteria positive cases, the main isolates were of *Staphylococcus aureus*, *Pseudomonas sp.*, *Pneumococcus*.

Total mixed cases	19
Fungi	
Aspergillus fumigatus	6
Aspergillus flavus	4
Aspergillus niger	2
Fusarium sp.	5
Others	2
Bacteria	
Staphylococcus aureus	10
Staphylococcus epidermidis	4
Pseudomonas sp.	3
Pneumococcus	1
Others	1

Table 2. Distribution of Bacteria and Fungi Isolates in Mixed Corneal Ulcer Cases

Mixed isolate of bacteria and fungi was found in 19 cases (16.67%). Among them, *Aspergillus fumigates*, *Aspergillus flavus*, *Aspergillus niger*, *Fusarium sp.* were the common fungi detected; *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Pseudomonas sp.*, *Pneumococcus* were the common bacteria present.

DISCUSSION

Majority of the patients in this series (127; 84.67%) were within the range of 21 to 70 years of age. The youngest patient was 7 years old while the oldest was a 75 year old man. The most affected group was between 31 -40 years (35; 23.33%) followed by 41-50 years (27; 18%). Earlier workers namely Dasgupta et al (1973), Srivastava et al (1976) and Dutta et al (1981) reported corneal ulcers mostly within 50 years with a range of 40-60 years.[4,5,6]

Among the 150 patients studied, 110 (73.33%) were male and 40 (26.67%) were female. Though both sexes develop corneal ulcers more commonly in the middle decades of life, a significant male preponderance has been reported by most previous studies including those in children and elderly patients.[7] As adult patients and specially the males are the most active group of the general population, they are more exposed to injuries and thereby more susceptible to corneal ulcers.

In this series, of the 150 cases studied, 87 (58%) were from rural areas and 63 (42%) were from urban localities. This is similar to the findings in several other studies.[8] Srivastava et al (1976) however reported the incidence more in the urban population.

Cultivators /agricultural workers were the major sufferers of corneal ulcers (29.33%) and 19 out of 44 cases (43.18%) were positive for fungus. They constituted the majority of the fungus positive cases (30.65%). Persons engaged in various types of agricultural works were found to be the main group of patients of fungal corneal ulcers in various other studies too with a range of 29 – 78%.[9,10] Skilled/unskilled workers constitute the next affected group (23.33%). Outdoor activities may be responsible for the corneal ulcers in these two groups as the nature of their work predisposes them to injury. Any preventive programme taken must address this occupation related corneal trauma.

As in our study, trauma as a predisposing factor for fungal corneal ulcers were reported by Dasgupta et al and that by vegetable matters as the prime source was reported by Dutta et al. Tabatabaee A et al reported that major cause of entrance of fungal inoculum into corneal stroma was ocular trauma in firm land spillage of vegetative material in eye.[11] Overall, patients with ocular trauma were found to be 5.33 times at a greater risk of developing microbial keratitis.[12]

There were 2 cases with history of contact lens usage; both showing bacterial growth in culture. Wearing contact lenses was found to be the most important risk factor for infectious corneal ulcers in several studies.[13, 14]

Among the 150 patients, 101 (67.33%) were treated with antimicrobial agents, corticosteroids or some form of medication topically elsewhere, prior to their presentation. Antibiotic- corticosteroid combinations favour fungal growth in the cornea. Among the 62 fungus positive cases in this study, 20 used only antibiotic and 11 cases gave a history of antibiotic-steroid use. It is similar to findings of Basak et al who found 19.3% patients were on topical corticosteroids for variable duration prior to first presentation.

Among the associated systemic illness, 8 cases had Diabetes mellitus of which 3 cases were associated with trichiasis, blepharitis or lagophthalmos. Jones et al (1969) observed that Diabetes was the commonest systemic association with corneal ulcer and it corroborated with the present study.[15]

Microorganisms were isolated in 76% of the 150 cases of presumed microbial keratitis and culture positive fungi were identified as the principal aetiological agent in 62 (41.33%) patients of all corneal ulcers. Several authors such as Lack et al, Dunlop AAS et al has reported more or less similar findings.[16]

In the present study, among the 62 fungus positive cases, *Aspergillus spp.* topped the table with 32 cases (51.61%). As in this study, *Aspergillus spp.* have been found to be in their study by Dunlop AAS et al.[17] Other studies in south India have reported *Fusarium sp.* to be more common than *Aspergillus spp.*[18,19]

Of the 33 bacterial isolates, most common was *Staphylococcus aureus* (39.39%) which was similar to study by Al-Almujaini A et al.[20] A predominance of *Pseudomonas* species has been reported in Paraguay and Hong Kong with common association with contact lens wear.[21,22]

CONCLUSIONS

Corneal scarring due to suppurative keratitis is an important cause of preventable blindness. Moreover, microbial keratitis itself is an ocular emergency as it can progress rapidly leading to visual loss and corneal perforation. Knowledge of the common aetiological agents in a locality is very helpful in this effort. Proper public health initiative, early detection coupled with timely and appropriate aggressive clinical treatment is essential for preventing the sight threatening corneal infection and minimize the incidence of post-infective corneal scars.

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