ORIGINAL ARTICLE
NORTH BENGAL MEDICAL COLLEGE JOURNAL [2024], VOL., 10, No. 1 : 03-09

Predisposing Risk Factors and Causative Organisms of Corneal Ulcer in a Tertiary Care Hospital of Bangladesh

*KM Shakila Sultana,[1] Md Mamunul Haque,[2] Mst Nigar Sultana,[3]
Jahangeer Alam Siddiki,[4] Md Enamul Hasan[5]

ARTICLE INFO

Article history:
Received: 12 April 2023
Accepted: 18 September 2023

Online:
www.nbmc.ac.bd

Keywords:
Corneal ulcer, Bacterial keratitis, Fungal keratitis

ABSTRACT

Introduction: *A corneal ulcer is a painful sore on the cornea that can cause loss of vision. Infective keratitis is the most common corneal pathology in developing countries, so updating knowledge is important for its control and proper management. The aim of this study was to find out the predisposing risk factors and causative organisms of corneal ulceration in Sirajganj District.* ***Methods:*** *This cross-sectional type of descriptive study was carried out in the Ophthalmology Department of North Bengal Medical College among the corneal ulcer patients over a period of 12 months from January to December 2022. A total of 60 corneal ulcer patients were enrolled purposively for this study. Pre-designed structured questionnaire was used to collect relevant data.* ***Results:*** *Out of 60 corneal ulcer patients, majority were adult (22, 36.67%), male (34, 56.67%) and came from rural backgroud (36, 60%). Most of the patients were illiterate (21, 35.00%) and farmers (23, 38.33%). Occupational variation is significantly (p-0.02) related with corneal ulcer. Among the patients, 33 (55%) had fungal and 27 (45%) had bacterial infection. Aspergillus fumigatus and Streptococcus pneumonae was common causative organism in fungal and bacterial keratitis respectively. Ocular trauma (agricultural and domestic) was the common predisposing factor of corneal ulcer.* ***Conclusion:*** *This findings would help in diagnosis and proper management of corneal ulcer patients.*

1. *Assistant Professor, Department of Ophthalmology, North Bengal Medical College, Sirajganj, Bangladesh*
2. *Assistant Professor, Department of Anaesthesiology, North Bengal Medical College, Sirajganj, Bangladesh*
3. *Assistant Registrar, Department of Ophthalmology, Shohid M Monsur Ali Medical College Hospital, Sirajganj, Bangladesh*
4. *Consultant, Prof M.A. Matin Memorial BNSB Base Eye Hospital, Sirajganj, Bangladesh*
5. *Junior Consultant, Prof M.A. Matin Memorial BNSB Base Eye Hospital, Sirajganj, Bangladesh*

***Corresponding author:** ✉shakilaboby12@gmail.com

INTRODUCTION

Corneal ulcer is a defect in the surface epithelium of the cornea that involves the underlying stroma and is a sight threatening ocular condition and the leading cause of monocular blindness.[1] It is a grey to white cloudy or translucent area on the normally transparent cornea. It sometimes may be too

small to see without sufficient magnification and lighting. Corneal ulcer presents in all age groups and both gender.[2] Infectious keratitis may occur by various pathogens i.e, bacteria, fungi, virus and parasites. Ocular trauma and corneal ulceration are significant causes of corneal blindness that are often underreported but may be responsible for 1.5-2.0 million new cases of monocular blindness every year.[3] It was estimated that six million corneal ulcers occur annually in the ten countries of South East Asia region.[4] A study conducted in Chittagong, Bangladesh, 53.5% bacteria and 39.9% fungi were found as microbial aetiology of corneal ulcer.[5] The incidence of fungal keratitis (42.86%) was higher than bacterial keratitis (25%) in Rajshahi, northern part of Bangladesh.[6] Etiologic and epidemiologic pattern of corneal ulceration varies with the population, geographic location and climate changes.[7] Infectious corneal ulcers are associated with some predisposing factors. Ocular trauma is a far more common predisposing factor of infectious keratitis in developing countries whereas pre-existing ocular disease and contact lens are common risk factors in developed countries.[8] Understanding of etiologic agents, epidemiologic features and risk factors are important for rapid diagnosis, optimal management and prevention of disease. In Bangladesh, 36% of all corneal ulcers are caused by fungi.[9] This high prevalence of fungal pathogens in Bangladesh is significantly greater than that found in similar studies in Nepal (17%)[10] and south Florida (35%).[11] The severity of these infections and the poor response to treatment of most fungal ulcers means that these eyes are invariably blinded or lost. Though corneal ulcer varies significantly from country to country and even from region to region in terms of the epidemiological characteristics, demography, predisposing factors, clinical and microbiological profile,[12] so it is necessary to develop a comprehensive strategy for the diagnosis, treatment and ultimately for the prevention of corneal infections.

The purpose of this study was to find out the predisposing risk factors and causative organisms of corneal ulcer in a Tertiary Care Hospital of Bangladesh.

METHODS

This cross sectional type of descriptive study was conducted in ophthalmology outpatient department (OPD) of North Bengal Medical College Hospital, Sirajganj, Bangladesh, from January, 2022 to December, 2022. A total of 60 diagnosed patients of corneal ulcer due to bacterial and fungal infection were enrolled purposively for this study. Typical or suspected viral ulcers, Mooren's ulcer, marginal keratitis, interstitial keratitis, atheromatous ulcers, any ulcer associated with systemic/autoimmune diseases and neurotrophic corneal ulcers were excluded from this study. Ethical approval was taken from the Institutional Review Board (IRB) of North Bengal Medical College, Sirajganj. Prior to data collection informed written consent was taken from each study subject. Data were collected from the patients by an interviewer-administered semi-structured questionnaire. Baseline information of some selected socio-demographic characteristics of the respondents and information regarding predisposing risk factors and etiologic diagnosis of corneal ulceration were collected. After collecting data, data were analyzed by using the 'Statistical Package for Social Sciences (SPSS)' software, version-24.Chi-square test was applied to see the relationship between two categorical variables. A *p*-value <0.05 was considered statistically significant for all test.

RESULTS

Out of 60 corneal ulcer patients, majority (22, 36.67%) of the patients were in 31-40 years age group. Most (34, 56.67%) of the patients were male and came from rural area (36, 60%). (Table I).

Table I: Demographic distribution of the patients (n-60)

Variables	Frequency	Percentage (%)
Age (Years)		
≤ 30 years	14	23.33%
31-40 years	22	36.67%
41-50 years	11	18.33%
>50 years	13	21.67%
Total	**60**	**100%**
Sex		
Male	34	56.67%
Female	26	43.33%
Total	**60**	**100%**
Residence		
Rural	36	60.00%
Urban	16	26.67%
Semi-urban	8	13.33%
Total	**60**	**100%**

Regarding educational status of the patients, most (21, 35.00%) of the patients were illiterate. Among 60 patients, majorities were farmers (23, 38.33%) followed by day labourer. (Table II).

Table II: Distribution of the patients by their educational and occupational status (n-60)

Variables	Frequency	Percentage (%)
Educational status		
Illiterate	21	35.00%
Primary level education	20	33.33%
Secondary/Higher secondary level education	13	21.67%
Graduate & above	6	10.00%
Total	**60**	**100%**
Occupational status		
Farmer	23	38.33%
Day labour	16	26.67%
Housewife	6	10.00%
Govt. service	6	10.00%
Businessman	5	8.33%
NGO worker	4	6.67%
Total	**60**	**100%**

Out of 60 patients, 33 (55%) had fungal infection and 27 (45%) had bacterial infection (Figure 1)

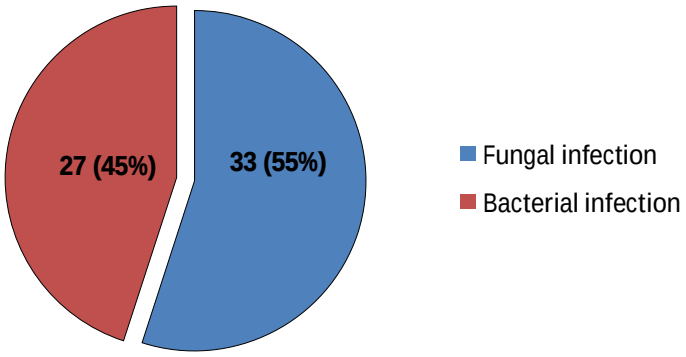

Figure 1: Distribution of the patients on the basis of isolated organism (n-60)

Among the fungal infected corneal ulcer patients (n-33), most of the patients (20, 60.61%) were infected by Aspergillus fumigatus (Figure 2).

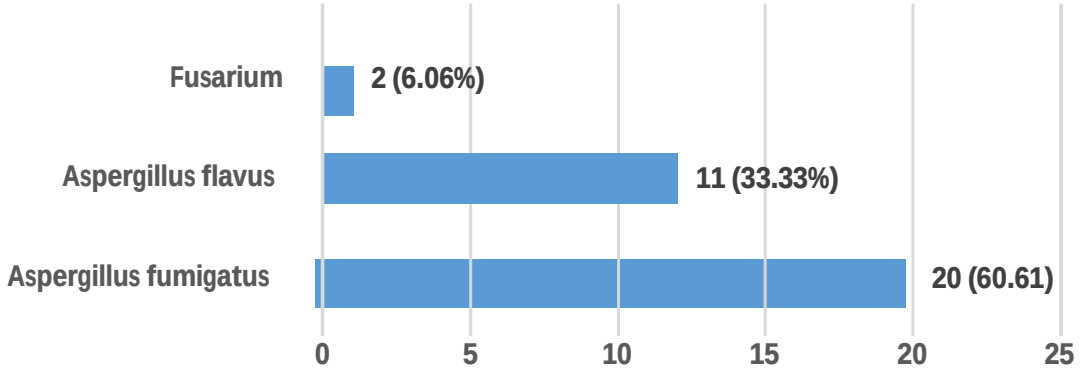

Figure 2: Isolated fungi among the corneal ulcer patients (n-33)

The patients who were infected with bacteria (n-27), main causative organism were Streptococcus pneumonae (13, 48.15%) and Staphylococcus aureus (8, 29.63%) (Figure 3).

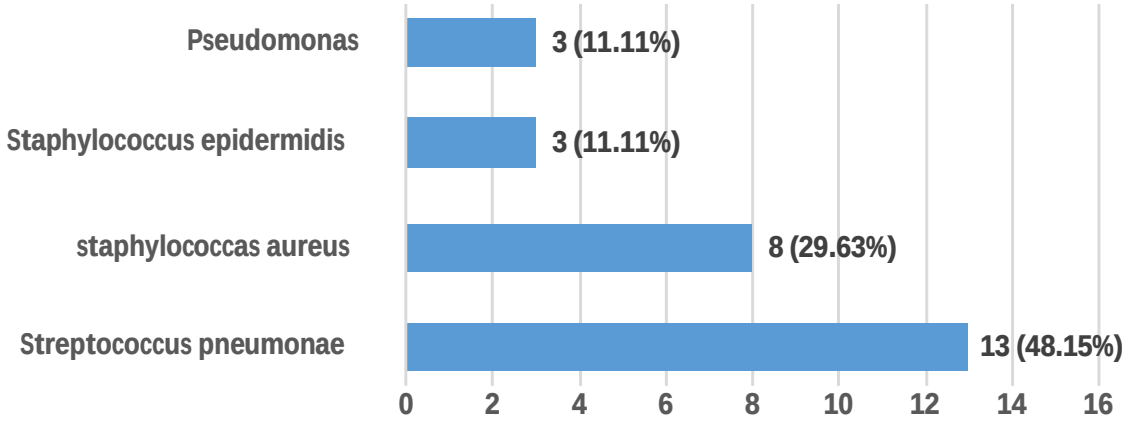

Figure 3: Isolated bacteria among the corneal ulcer patients (n-27)

Ocular trauma was the common predisposing factor of corneal ulcer. Among them, fungal and bacterial keratitis was frequently caused by agricultural and domestic trauma respectively. Dacryocystitis was another important cause of corneal ulcer. (Table III)

Table III: Predisposing factors associated with fungal and bacterial corneal ulcer (n-60)

Predisposing factors	Bacterial keratitis (%) (n-27)	Fungal keratitis (%) (n-33)	Total (%) (n-60)
Ocular trauma			
Agricultural	5 (18.52%)	24 (72.73%)	29 (48.33%)
Domestic	12 (44.44%)	7 (21.21%)	19 (31.67%)
Dust injury	8 (29.63%)	3 (9.09%)	11 (18.33%)
Others			
Dacryocystitis	15 (55.55%)	7 (21.21%)	22 (36.67%)
Systemic diseases like DM & HTN	7 (25.93%)	9 (27.27%)	16 (26.67%)
Topical steroids	4 (14.81%)	0 (0.00%)	4 (6.67%)
Contact lens	1 (3.70%)	0 (0.00%)	1 (1.67%)

*Multiple responses; DM: Diabetes Mellitus, HTN: Hypertension

Both the fungal and bacterial keratitis was common among farmer and day labourer. Occupational variation is significantly related with corneal ulcer (Table IV).

Table IV: Relationship between occupational status and keratitis among corneal ulcer patients (n-60)

Occupational status	Bacterial keratitis (%) (n-27)	Fungal keratitis (%) (n-33)	Total (n-60)
Farmer	9 (33.33%)	14 (42.43%)	23 (38.33%)
Day labourer	6 (22.22%)	10 (30.30%)	16 (26.67%)
Housewives	4 (14.82%)	2 (6.06%)	6 (10.00%)
Govt. serviceholder	3 (11.11%)	3 (9.09%)	6 (10.00%)
Businessman	3 (11.11%)	2 (6.06%)	5 (8.33%)
NGO worker	2 (7.41%)	2 (6.06%)	4 (6.67%)
Total	**27 (100%)**	**33 (100%)**	**60 (100.00%)**

X^2=13.87, df=5, *p*-0.02

Both fungal and bacterial keratitis was common in rural people (Table V).

Table V: Relationship between residence and keratitis among corneal ulcer patients (n-60)

Residence	Bacterial keratitis (n-27)	Fungal keratitis (n-33)	Total (n-60)
	Frequency (%)		
Rural	13 (48.15%)	23 (69.70%)	36 (60.00%)
Urban	9 (33.33%)	7 (21.21%)	16 (26.67%)
Semi-urban	5 (18.52%)	3 (9.09%)	8 (13.33%)
Total	27 (100%)	33 (100%)	60 (100.00%)

X^2=2.95, df=2, p-0.227

DISCUSSION

Corneal ulcer is a major ocular problem in developing countries causing prolonged ocular morbidity and loss of vision. Even with appropriate treatment, there is a high incidence of visual loss due to the development of dense corneal scar. The burden of corneal ulceration, risk factors, microorganisms and susceptible antibiotics vary from region to region and time to time.

Out of 60 corneal ulcer patients, majority (22, 36.67%) were 31-40 years of age group. Pant et al.[2] and Baruah et al.[13]observed middle age group are more affected by corneal ulcer. Middle age group are exposed to risk factors more frequently due to involved in outdoor and physical activities. In this study, 34 (56.67%) patients were male while 26 (43.33%) patients were females with a male: female ratio of 1.3:1. This ratio is near to that reported by Srinivasan et al.[14] (1.6:1). Male are commonly affected due to more exposure to risk factors. Similar findings were also found with the studies done by Pant et al.[2],Basak et al.[9], Srinivasan et al.[14] and Kumari et al.[15]

Maximum (36, 60%) patients in this study belonged to the rural area. A similar propensity of rural patients was found in a study conducted in India by Gupta et al.[16] where 65% patients came from a rural background. Pant et al.[2] reported majority (75%) of affected people were from rural areas. The most common cause of a corneal ulcer is traumatic corneal abrasion, which is often caused during agricultural work or other manual labour. Rural people usually involved with agricultural and various domestic activities. As a result corneal ulcer is more common in rural area than urban area. In this study, maximum patients of corneal ulcer were farmer (23, 38.33%) and day labourer (16, 26.67%). Corneal ulcer was common in farmers reported by Pant et al.[2] (38.0%), Deorukhkar et al.[17] (52.32%). Farmers are worst victim of corneal ulcer due to occupational exposure.

Corneal ulcer due to fungal infection (33, 55.0%) was common than bacterial infection (27, 45.0%). This finding was consistent with the study conducted by Srinivasan et al.[14] (47.1%) and Deorukhkar et al.[17] (57.91%). Majority of the patients were farmer who is usually infected with fungal keratitis after a corneal injury involving plant material. Among the fungal keratitis, most common isolates was Aspergillus fumigatus (20, 60.61%) followed by aspergillus favus (11, 33.33%). Similar findings were found in a study done by Ahmed et al.[18] where Aspergillus species (48, 50.53%) were the most common fungal isolates followed by Fusarium species (25, 26.32%). But Srinivasan et al.[14] reported that the most common fungal isolates was Fusarium spp (47.1%) followed by Aspergillus spp (16.1%).

This study revealed Streptococcus pneumonae (13. 48.15%) was common causative organism of bacterial keratitis followed by Staphylococcus aureus (8, 29.63%). Deorukhkar et al.[17] found that Streptococcus pneumoniae was the predominant bacterial isolates (32.74%) followed by Staphylococcus spp. (17.25%). Srinivasan et al.[14] showed that the most common bacterial pathogen was Streptococcus pneumoniae (44.3%) of all positive bacterial cultures followed by Pseudomonas spp. (14.4%) which was not similar with this study.

Ocular trauma was the common predisposing factor of corneal ulcer in this study. Agricultural and domestic trauma was major causes of ocular trauma. Similar findings were reported by Pant et al.[2] and Deorukhkar et al.[17]. Occupational variation is responsible for this type of ocular trauma. Farmers and day labourer were commonly affected by fungal and bacterial keratitis. Occupational variation is significantly (*p*-0.02) related with corneal ulcer. Pant et al.[2], Deorukhkar et al.[17] and Ahmed et al.[18] were observed similar findings.

There were several limitations such as sample size was only 60, purposive sampling technique was used and data were taken from only one centre.

CONCLUSION

Study concluded that, ocular trauma is the common predisposing factor of corneal ulcer in farmer and day labourer. Development of awareness and using of personal protective measures during working period would reduce the incidence of corneal ulcer.

Acknowledgements: Authors are highly thankful to management and supporting staff of North Bengal Medical College Hospital for providing the necessary information.

Conflict of interest: None

REFERENCES

1. Ahmed F, House RJ, Feldman BH. Corneal abrasions and corneal foreign bodies. Prim Care Clin Off Pract. 2015; 42(3): 363-375.
2. Pant B, Mathur P, Joshi Y. Assessment of prevalence, predisposing factors, etiology and treatment of corneal ulcer patients. J Drug Delivery Ther. 2019; 9(4-A): 355–357.
3. Whitcher JP, Srinivasan M, Upadhyay MP. Corneal blindness: a global perspective. Bull World Health Organ. 2001; 79(3): 214-221. PMID: 11285665; PMCID: PMC2566379.
4. Srinivasan M. Prevention of traumatic corneal ulcer in South East Asia. Community Eye Health J. 2017; 30(99): S15–S17.
5. Akter L, Salam MA, Hasan B, Begum N. Etiological agents of suppurative corneal ulcer: Study of 56 cases. Banglad J Med Microbiol. 2009; 03(01): 33-36.
6. Akter L, Simon MA, Hasana B, Banu N. Etiological agents of suppurative corneal ulcer in Bangladesh. J Opthalmol. 2019; 05 (2): 1-5.
7. Shrestha R, Nayak N, Gurung B, Gokhale S. Infectious Keratitis in Western Nepal: An Experience from a Tertiary Care Hospital. Res Sq. 2018; 21(4): 288-293. doi: https:// doi.org/10.21203/rs.2.125/v1
8. Leck AK, Thomas PA, Hagan M, Kaliamurthy J, Ackuaku E, John M, et al. Aetiology of suppurative corneal ulcers in Ghana and south India, and epidemiology of fungal keratitis. Br J Ophthalmol. 2002; 86(11): 1211–1215.
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(1): 17–22.
10. Upadhyay MP, Karmacharya PC, Koirala S. Epidemiologic charactercluster and phase variation in Staphylococcus epidermidis blood culture strains and mucosal isolates. Infect Immun. 1991; 65(3): 890-896.
11. Liesegang TJ, Forster RK. Spectrum of microbial keratitis in South Florida. Am J Ophthalmol. 1980; 90(1): 38–47.
12. Keshav BR, Zacheria G, Ideculla T, Bhat V, Joseph M. Epidemiological characteristics of corneal ulcers in South sharqiya region. Oman Med J. 2008; 23(1): 34–39.
13. Baruah M, Das RK, Agarwalla V, Basyach P. Corneal ulcer: an epidemiological, microbiological and clinical study of cases attending Assam medical college and hospital, Dibrugarh, India. Int J Res Med Sci. 2020; 8(3): 1076-1080.
14. 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): 965–971.
15. Kumari N, Xess A, Shahi SK. A study of keratomycosis: our experience. Indian J pathol Microbiol. 2002; 45(3): 299-302.
16. Gupta R, Singh C, Mahajan B, Khurana AK. Microbiological regional profile of infective keratitis. Indian J Clinic Experimen Ophthalmol.2015; 1(4): 264-272.
17. Deorukhkar S, Katiyar R, Saini S. Epidemiological features and laboratory results of bacterial and fungal keratitis: a five-year study at a rural tertiary-care hospital in western Maharashtra, India. Singapore Med J. 2012; 53(4): 264–267.
18. Ahmed S, Ghosh A, Hassan SA, Tarafder S, Amin Miah MR. Predisposing factors and aetiologic diagnosis of infectious corneal ulcer. Bangladesh J Med Microbiol. 1970; 4(1): 28–31.