

Original Article

CORNEAL ULCER AND ASSOCIATED RISK FACTORS IN BANGLADESH: A RURAL-URBAN COMPARISON

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**Abstract**

**Purpose:** In most developing countries, corneal infections are the most common cause of blindness after unoperated cataracts. We examined risk factors for corneal ulcers and made a comparison between rural and urban patients. **Methods:** This is a descriptive cross-sectional study and a total of 95 patients were recruited. **Results:** The majority (68%) of patients were males and adults. About 42% of patients had ocular trauma, 20% had corneal ulcers, and 1% had trachoma. About 40% had a bacterial infection, 64% had fungal infections, 15% had used traditional medicine, 1% had alcohol consumption and 9% had a viral infection history. Trachoma was found in 68% of rural patients and 32% of urban patients; bacterial infection was available in 71% of rural and 29% of urban patients. About 65% of rural and 35% of urban patients had developed fungal infection. About 85% of rural and 15% of urban patients used traditional medicine. Viral infection was found in 66% of rural and 34% of urban patients. The corneal ulcer incidence rates increased with age, sex, marital status, occupation, rural-urban location of the patients, positive history of trauma, and positive history of traditional eye medicine use. Patient's occupation, rural-urban location, and positive history of trauma are associated with corneal ulcer & rates are higher in patients with diabetes, obesity, and hypertension (cOR= 1.89; 95% CI = 1.005–2.69; P = 0.002). **Conclusion:** Health promotion activities and appropriate referral systems may improve corneal ulcers in rural settings.

**Keywords:** Corneal ulcer, fungal infections, Rural-Urban, IIEI & H, Bangladesh.

**1. Introduction**

Bacterial keratitis and fungal keratitis are common sight-threatening corneal ulcers worldwide [1]. About 1.5–2 million new cases of corneal ulcers are treated in developing countries each year which originated from microbial keratitis [2]. Corneal-related ulcers are the leading cause of

blindness and visual impairment globally, affecting around 6 million people, and this is responsible for 1.5-2 million new cases of monocular blindness per year worldwide [3]. Multiple predisposing factors and associated complications of corneal ulcers are still a big challenge for

physicians due to their varied presentation overlapping symptoms, and rapid progression [4]. Many risk factors including the uncontrolled use of antibiotics, ocular injuries, foreign body, postoperative complications, history of eye disease, socioeconomic status, use of traditional medicine, and geographical location are the predisposing factors to cause fungal corneal ulcers [5]. Fungal keratitis is particularly common in agricultural societies where trauma with vegetable matter or organic matter often leads to corneal ulceration [6]. The pattern of fungal keratitis is closely associated with the age and occupation of the patients. However, filamentous fungal keratitis may be observed after surgery in some cases [7]. The symptoms of corneal ulceration are the presence of pain, watering, redness, discharge, photophobia, decrease in visual acuity, and swelling of lids [8]. Poor socioeconomic conditions make the highest prevalence of blindness from corneal ulcers in South Asian and African countries [9]. The prevalence of corneal blindness varied from 0.5% to 0.9% in Bangladesh and the difference is higher in rural areas compared to urban areas. Some studies show that the incidence of fungal keratitis (42.86%) was higher than bacterial keratitis (25%) in Bangladesh in a rural setting

## 2. Methods

A cross-sectional study design was used to collect data from the semi-structured questionnaire from 18-year-old and above patients who attended a tertiary eye hospital. The study was conducted at Ispahani Islamia Eye Institute and Hospital, Dhaka, Bangladesh. The purposive sampling method was applied to recruit the patients. The sample size was finalized using a

### 2.1. Ethical consideration, quality control and quality assurance

Ethical clearance for the study has been obtained from Bangladesh Open Univ. (BOU) and Ispahani Islamia Eye Institute & Hospital (IIEI&H) (Reference No-3826/23). Written and verbal consent was

[10]. Lack of awareness, delayed presentation, poor access to treatment, unavailability of anti-fungal drops, and quack/conventional treatment are the key issues for the high rate of corneal ulcers in developing countries, especially in rural and remote settings [11]. In some cases, these factors are responsible for progressive deep corneal ulceration and perforation in remote rural areas. Although there is geographical variation in corneal ulcers, fungal corneal ulcer prevalence is higher in developing countries whereas bacterial corneal ulcers are predominant in developed world like North America, Australia, Europe, and Singapore [12]. Some community-based studies suggested that the leading causes of corneal blindness in Bangladesh are fungal keratitis and ocular injuries [13]. There is no representative clinic-based data on the magnitude and etiologies of corneal diseases managed by ophthalmologists in Bangladesh. The identification of risk factors could lead to targeted improvements in clinical management and public health measures, such as the promotion of eye protection to prevent corneal ulcers. The study aims to identify risk factors for corneal ulcers and to find out the difference in rural-urban patterns of corneal ulcers risk factors in Bangladesh.

standard formula (Fisher, et al., 1991) [14], which was determined around 95. The study duration was six months from June 2023 to December 2023. The interview schedule was pretested, the results of which were analyzed to determine reliability. A research expert determined the validity of the questions.

obtained from each participant after explaining the purpose and nature of the research. Confidentiality of the information was assured by using an anonymous consent form. The researcher had a data

quality control mechanism following the submitted study protocol. Every day collected data was checked and edited if

## **2.2. Data analysis plan**

Collected data was edited and coded and then entered into the computer for analysis. The data was analyzed using the SPSS 26.0 version. A univariate logistic regression with adherence as the dependent variable was used to determine variables that are independently associated with adherence. Secondly, variables with significant univariate associations ( $p < 0.05$ ) were entered into a multivariate logistic regression model using backward elimination to identify variables that were significant pred-

## **3. Results**

The study collected data from patients who attended a tertiary eye hospital. The aged group (adult & older) was more vulnerable to corneal ulcers as nearly 73% of the patients were 31-60 years. It was observed that over 62% of male patients were 6 years older as against only 38% of females. The mean ages of male and female patients were 48 and 42 years, respectively but median ages were only 44 years for males and 37 years for females, which means a large number of patients were adults and few were younger. The average age of the respondents was  $50.28 \pm 16.69$  years and the minimum age was 18 years and the maximum was 81 years. The most interesting fact was that only 65% of the total corneal ulcer patients were in the active adult age group. The difference in age of corneal ulcer patients by sex was found statistically significant at the .001 level ( $\chi^2 = 32.90$ ,  $df = 11$ ; Cramer's  $V = .38$ ). This study found that about 30% of the respondents were farmers, 23% were housewives, 15% were day labour, about 14% were businessmen, 13% were service holders and 3% were students. Among the participants about 45% of the respondents were illiterate, 25% had primary level education, 8%

required. Necessary data clearance and consistency were checked and SPSS data was rechecked accordingly.

ictors of adherence to corneal ulcer screening. Potential predictors of adherence (such as age, gender, years with corneal ulcer, distance from the clinic, length of time between the most recent visit and the next scheduled visit, knowledge about the corneal ulcer, attitude towards treatment, etc.) were considered. Data analysis includes frequency distribution, cross tabulation, correlation and association, and statistically significant tests between variables

had SSC, 17% had JSC, .4% had HSC and only 3% had graduate and post-graduate degrees. The average income of the respondents was  $15305 \pm 5993$  (BDT). About 93% of the respondents were married, 5% were unmarried and 2% were divorced. The average family size of the respondents was 5.16 which was much higher compared to the national family size of 4.65. About 93% of respondents' religion was Islam and 7% was Hindu. In study showed that about 73% of patients attended hospitals from rural areas to receive treatment whereas 27% came from urban areas. The study also found that about 6.3% had 6/6 to 6/18 visual acuity, 2.5% had 6/60 to 3/60 and 5.1% had Perception of Light and Perception of Rays (PLPR) in the right eye of the patients (18-30 years). Among the 95 respondents, 11.4% of the patients had 6/6-6/18 visual acuity, 2.6% had <6/18-6/60, 1.3% had <6/60-3/60 visual acuity and 6.3% had PLPR (31-40 years). Of them 6.3% had 6/6-6/18 visual acuity, 3.8% had <6/18-6/60, 1.3% had <6/60-3/60, and 1.3% had PLPR (41-50 years). This study revealed that 12.7% had 6/6-6/18 visual acuity, 20% had <6/18 to 6/60, 2.5% had <3/60 visual acuity and 8.9% had PLPR

(51-60 years). About 2.6% of patients had 6/6 to 6/18 visual acuity, 1.3% had <6/60 visual acuity and 2.5% of the patients had PLPR (61 years & above). Table (1) shows that the visual acuity of the right eye by age of the corneal ulcer patients was statistically significant ( $\chi^2=42.22$ ,  $df = 19$ ,  $Sig; P < .02$ ,  $\Gamma V=0.38$ ,  $\lambda = .75$ ). We assessed the unaided visual acuity of patients in the left eye and found that about 7.5% of the patients had 6/6 to 6/18 visual acuity, 6.65% of the patients had <6/18 to 6/60, 3.7% had <6/60 to 3/60 and 4.1% had PLPR (18-30 years). This study found that 10.4% of the patients had 6/6-6/18 visual acuity, 3.6% had <6/18 to 6/60, 2.3% had <6/60 to 3/60 visual acuity and 5.3% had PLPR (31-40 years). The study revealed that 8.5% of the patients had 6/6 to 6/18 visual acuity, 2.4% had <6/18 to 6/60 and 1.3% had <6/60 to 3/60 vision and 2.3% had PLPR (41-50 years). This study found that 10.4% of the patients had 6/6 to 6/18 visual acuity, 10.3% had <6/18 to 6/60, and 8.9% of the patients had PLPR (51-60 years). Of the respondents, 2.6% of the patients had 6/6 to 6/18 vision, about 10.25% had <6/60 vision, 1.3% had <3/60 and 2.5% had PLPR (61 years & above). Table (2) shows that the visual acuity of the left eye by age of the corneal ulcer patients was statistically significant ( $\chi^2=49.80$ ,  $\Gamma V=0.45$ ,  $\lambda =0.77$   $df = 17$ ;  $Sig, P < .004$ ). Among the respondents, this study found that 50.5% of the patients' size of the ulcer was 2-4 mm, 31.5% of the patient's ulcer size was 1-2 mm, 14.5% of ulcer size were 4-6 mm and 3.4% of ulcer size were 3.4%. This study found that 88.90% of corneal ulcer patients had a history of diseases. About 35.3% of the patients had a history of watering, 30.2% had pain, 22.8% had redness, 7% had DV and 4.7% had a history of FBS. This study also found that 23% of the patients have a positive history of discharge

in the right eye and 19% had discharge in the left eye. Among the respondents 8% had discharge around 1-5 days, 37% had a 6-10 days history of discharge, 12% of the patients had an 11-15 days discharge history, 8% had 16-20 days discharge, 12% had 21-25 days discharge history and 22% had 26-30 days long discharge history in their eyes. Among the 95 respondents, 42% of patients had ocular trauma, 20% had corneal ulcers, 1% had trachoma, 40% had a bacterial infection, 64% had fungal infections, 15% had traditional medicine, 1% had alcohol consumption and 9% had a viral infection. The study showed that 73% of corneal ulcer patients came from rural areas and 27% from urban areas. The risk factors for corneal patients varied according to the residence of the patient, such as in case of corneal ulcer, rural (68%), urban (32%), trachoma rural (100%), bacterial infection, rural (71%), urban (29%), fungal infection, rural (65%), urban (35%), traditional medicine, rural (85%), urban (15%) and viral infection, rural (66%) and urban (34%). Table 3 stated that the corneal ulcer incidence rates increased according to the risk factors: age (the risk factor increased 1.004 times with the increase of age of the patient) and same for sex, marital status, occupation, rural-urban location of the patients, positive history of trauma and positive history of TEM use. In particular, the study observed that in patients' occupation, rural-urban location, and positive history of trauma corneal ulcer rate was higher in patients with diabetes, obesity, and hypertension than in age-matched controls ( $cOR=1.89$ ; 95%  $CI=1.005-2.69$ ;  $P=0.002$ ). The  $cOR$  for corneal ulcers in other comorbidities did not indicate a statistically greater risk than in the corresponding gender group. Moreover, the Kaplan–Meier subgroup analysis showed a higher cumulative risk rate of corneal ulcers for rural patients than urban patients; the finding was also statistically significant ( $P < 0.002$ ).

**Table 1:** Percentage distribution of visual acuity (unaided) of the patients' Right Eye by age

Description	Visual Acuity of the Right Eye of the Patient					
	6/6-6/18	<6/18-6/60	<6/60-3/60	<3/60	PLPR	Total
18-30 years	6.3%	-	2.5%	-	5.1%	13.9%
31-40 years	11.4%	2.6%	1.3%	-	6.3%	21.6%
41-50 years	6.3%	3.8%	1.3%	-	1.3%	12.7%
51-60 years	12.7%	20.0%	2.5%	1.3%	8.9%	45.4%
61 & above years	2.6%	-	-	1.3%	2.5%	6.4%
x <sup>2</sup> = 42.22, df = 19, Sig; P< .02 Gamma V= .38, Lamda λ = .75						100.00

**Table 2:** Percentage distribution of visual acuity (unaided) of the patient's Left Eye by age

Description	Visual Acuity of the Right Eye of the Patient					
	6/6-6/18	<6/18-6/60	<6/60-3/60	<3/60	PLPR	Total
18-30 years	7.5%	6.65%	3.7%	-	4.1%	21.95%
31-40 years	10.4%	3.6%	2.3%	-	5.3%	21.5%
41-50 years	8.5%	2.4%	1.3%	-	2.3%	14.5%
51-60 years	10.4%	10.3%	3.8%	-	8.9%	25.4%
61 & above years	2.6%	10.25%	-	1.3%	2.5%	16.65%

**Table 3:** Factors associated with the risk of Corneal Ulcer patients

Variables	Univariate analysis			Multivariate analysis		
	cOR	(95% CI)	p-value	cOR	(95% CI)	p-value
Age	1.004	(0.888–1.058)	0.515	1.489	(0.658–1.050)	0.050
Sex	1.454	(0.987–1.822)	0.505	1.224	(0.487–.822)	0.566
Marital status	.840	(0.886–1.800)	0.576	.740	(0.819–1.001)	0.514
Respondent occupation	2.051	(0.987–1.022)	0.030	2.051	(0.995–1.872)	0.020
Household head occupation	1.080	(0.787–.922)	0.690	1.087	(0.887–.998)	0.540
Distance to the hospital	1.055	(0.987–1.750)	0.501	1.085	(0.977–1.580)	0.501
Education	1.097	(0.919–1.092)	0.645	1.007	(0.719–1.002)	0.645
Rural-urban location	.904	(0.887–1.780)	0.002	.884	(0.897–1.580)	0.002
Positive history of trauma	2.684	(0.987–1.582)	0.011	2.014	(0.978–1.442)	0.001
Positive history of TEM Use	.354	(0.877–1.560)	0.020	.454	(0.887–1.260)	0.022

#### 4. Discussions

Corneal ulcers represent a severe ocular emergency with potential vision-threatening complications for both rural and urban settings in Bangladesh. Corneal ulcers result from bacterial, protozoal, viral, or fungal infections. The spectrum of etiologic agents varies based on the geographic and socio-economic status of the community people. This study collected data from eye hospital patients and the study period was 6 months from June 2023 through December 2023. The majority of the patients were 31-60 years old. The mean ages of male and female patients were 48 and 42 years, respectively. The most interesting fact is that only 65% of the total corneal ulcer patients were in the active adult age group. The difference in age of corneal ulcer patients by sex was found statistically significant at the 0.001 level. Our

study revealed that the majority of patients were adults and males. Does this mean adult males receive corneal ulcers far more than females of the same age? The probable explanation could be that males possibly were more involved with risky professional or occupational activities at the working age while females get involved with less hazardous activities at the same age at home. Infectious corneal ulcers are important causes of ocular morbidity and this leads to severe visual loss if not diagnosed and treated properly determine the actual ratio of males and females with corneal ulcers a large community survey is required. This study showed that the majority of respondents were farmers, housewives, and day laborers. Such statistics reveal that corneal ulcer patients come from poor socio-economic groups and they

are not aware of their eye health. Community-based occupational-based awareness programs would be an effective way to prevent corneal ulcers in rural and urban settings. About 45% of the respondents had no education and we found that a poor level of education is associated with delayed presentation of cases and attending hospital for treatment purposes. The average income of the respondents was 15305±5993 (BDT) revealing that poverty was a strong indicator of access to treatment of corneal ulcer patients in rural and urban settings of Bangladesh. An early appropriate diagnosis and regular follow-up are essential to ensure good visual outcomes for corneal patients. However, the depth and dimensions of infectious corneal infiltrate, risk factors, and the size of the epithelial defect mostly depend on the positive outcome of treatment. Our study data reveals that the patient's size of the ulcer hurts the corneal ulcer. It also revealed that the majority patients of corneal ulcer patients had a history of diseases. One-third of the patients had a history of watering or pain, the remaining had redness, DV, and a history of FBS. One study conducted by Aftab et al., (2023) [15] concluded that watering, pain, and history of FBS were major history of corneal ulcer patients attending in hospital setting. This study stated that one-fifth of the patients have a positive history of discharge in both eyes. The duration of discharge varies among rural (16±5.65 days) and urban patients (13±4.55 days). Lack of awareness, socio demographic status, and access to eye care may be negative factors for high discharge duration among rural patients. Ocular trauma, trachoma, bacterial infection, fungal infections, traditional medicine, alcohol consumption, and viral infection are the common risk factors for corneal ulcers in our study patients. The majority (73%) of corneal ulcer patients came from rural areas and a few (27%) from urban areas. The study collected data from a tertiary eye hospital which is a famous referral hospital in Bangladesh and this hospital provides

low-cost high-quality service for rural people. For this reason, the study observed a high number of corneal ulcer patients from rural areas. Another possible reason may be in rural areas there were few cornea experts or some cases not available. Study found that the risk factors for corneal patients varied according to the residence of the patient, such as in case of corneal ulcer, rural (68%), urban (32%), trachoma rural (100%), bacterial infection, rural (71%), urban (29%), fungal infection, rural (65%), urban (35%), traditional medicine, rural (85%), urban (15%) and viral infection, rural (66%) and urban (34%). According to the distribution pattern, the vast majority of patients were of working age. Low incidence in patients at extremes of ages is attributable to their minimal involvement in the occupation. Malnutrition, xerophthalmia, and measles are the predisposing factors for the incidence of corneal ulcers in children in developing countries but due to study protocol, it did not include children in our study. This study found that the corneal ulcer incidence rates increased according to the risk factors: age, sex, marital status, occupation, rural-urban location of the patients, positive history of trauma, and positive history of TEM use. Few studies reveal that the highest incidence between the ages of 31-60 is due to their greater involvement in their agricultural fields, industries, factories, use of contact lenses, corticosteroids, and other occupational hazards [16,17]. The multivariate regression analysis shows that in patients' occupation, rural-urban location, and positive history of trauma corneal ulcer rate is higher in patients with DM, obesity, and hypertension than in age-matched. However, the cOR for corneal ulcers in other comorbidities did not indicate a statistically greater risk than in the corresponding gender and different age group. Moreover, the study found a higher cumulative risk rate of corneal ulcers for rural patients than the urban patients; the finding was also statistically significant ( $P < 0.002$ ).

## 5. Conclusion

Study findings suggested and concluded that the majority of patients had ocular trauma, corneal ulcers, Trachoma, Bacterial Infection, fungal infections, traditional medicine, alcohol consumption, and viral infection history. The prevalence of corneal ulcers might be reduced through health promotion activities and treatment outcomes might be improved with increased community-based awareness programs and effective referral systems.

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