Original article

Epidemiology and etiological diagnosis of infective keratitis in eastern region of Nepal

Sitoula RP, Singh SK, Maheseth V, Sharma A, Labh RK
Biratnagar Eye Hospiatal, Atithi Marg 17, Biratnagar, Nepal

Abstract

Objective: This study aimed to determine the epidemiological characteristics and risk factors predisposing to corneal ulceration in patients presenting to Biratnagar Eye Hospital (Nepal). **Methods**: All patients presenting to Biratnagar Eye Hospital between January 1 and December 31, 2011 with corneal ulceration were retrospectively reviewed. Sociodemographic data and information pertaining to risk factors were recorded, all patients were examined and corneal scrapping and cultures were carried out. **Results**: Over one year period 1644 patients with corneal ulcer were evaluated, out of which 76.6% of patients were in the age range of 30 to 69 years and 65% of patients had presenting visual acuity < 3/60. Ocular trauma was the most common cause of keratitis accounting for 60.3% of corneal ulcer and majority of the patients (40%) presented after 2 weeks of symptoms. Among corneal scraping positive cases 1150 (70%) showed fungus, 73 (4.4%) showed bacteria and 20 (1.2%) showed both bacterial and fungus. **Conclusion:** Corneal ulcer continues to be one of the leading causes of preventable blindness in this region. Lack of awareness about gravity of this disease, financial constraints and geographic barriers remain the major reasons for delay in seeking proper medical help.

Keywords: Corneal ulcer, Suppurative keratitis, Corneal trauma, Fungal keratitis, Preventable blindness, Corneal opacification

Introduction

Corneal ulceration has been labeled as a "silent epidemic" in developing countries (Whitcher JP et al, 1997). Opacification of the cornea is the second major cause of blindness after cataract in developing regions like Asia, Africa and the Middle East (Upadhyay, 1991; Gonzales, 1996; Hagan, 1995; Whitcher, 2001). A regional variation in incidence has been observed for corneal ulceration with a reported rate of 11 per 100,000 persons/year in the United States (Liesegang et al, 1980), 113 per 100,000 persons/year in India (Gonzale et al, 1996) and as high as 799 per 100,000 population/ year in Nepal (Upadhyay et al, 1991). Extrapolating these numbers worldwide, we can estimate the number of corneal ulcer annually to be as high as 1.5 to 2 million or even higher (Whitcher et al, 2001). These alarmingly high numbers have made this disease a public health problem with an urgent need to identify the risk factors and the population at risk to avert this preventable cause of blindness.

The epidemiological pattern of corneal ulceration varies significantly from one region to another and more so from country to country. Studies have shown the prevalence of different

Received on: 27/02/14 Accepted on: 09/09/14
Address for Correspondence
Rakshya Panta Sitoula
Biratnagar Eye Hospital
Tel: 9842322600 Fax: 021-4363358
Email: rakshyasitoula@gmail.com

types of keratitis in different parts of the world (Leck et al, 2002). It is essential for any hospital to develop a comprehensive strategy for the diagnosis, treatment and, ultimately, for the prevention of corneal infections. In order to launch this strategy, the etiological factors predisposing to ulceration and the pathogenic organisms responsible must be determined. The aim of this study was to answer these questions for our center, which is a tertiary level ophthalmic center.

Materials and methods

A retrospective review of medical records of all patients presenting to Biratnagar Eye Hospital with the diagnosis of corneal ulcer over a period of one year from 1 January to 31 December 2011 was done. The diagnosis of corneal ulcer was made based on the loss of corneal epithelium with underlying stromal infiltration and suppuration associated with signs of inflammation with or without hypopyon. Ethical approval for this study was taken from the institutional review board.

From the patient records, the demographic data (age and gender) as well as the clinical information including duration of symptoms, cause of ulcer, history of trauma, previous treatment, predisposing ocular conditions and other associated risk factors, the time taken for them to come to the hospital for treatment and the cause for delay in seeking medical care were collected.

For simplicity, we classified the presenting distance visual acuity (VA) of these patients into four categories (as per WHO guidelines): those between 6/6 to 6/18 (acceptable), 6/24 to 6/60 (moderate visual impairment), < 6/60 to 3/60 (severe visual impairment) and < 3/60 (blind). Each patient underwent a slit-lamp biomicroscope (Haag-streit, Switzerland) examination. Corneal staining was done by placing the florescence strip in the lower conjuntival fornix and the cornea was then examined under red-free light. The size of the epithelial defect was measured with the bio-microscope and recorded in millimeters on a corneal ulcer form. A sketch of each ulcer was also drawn on the form on the frontal and cross-sectional diagrams, and the presence or absence of a hypopyon with its height in millimeters. The risk factors for the corneal ulcer were recorded. All the patients were subjected to a nasolacrimal duct syringing to evaluate patency of the duct. After a detailed ocular examination of the eyelids and cornea under a slit-lamp biomicroscope, corneal scrapings were taken under local anaesthesia (instillation of 4 % lignocaine) using a sterile Barde-Parker knife. The scrapings were taken from the leading edge and the base of each ulcer and the material obtained was inoculated directly into blood agar and chocolate agar media. Material from the corneal scraping was also smeared on two glass slides: one for Gram stain and the other for KOH wet mount.

We performed summary statistics for both continuous (mean and SD) and categorical variables (frequency and percentage). All tests were two-tailed and the significance level was <0.05. We used STATA version 12.0 (STATACorp. College Station, TX) to analyze the data.

Results

There were 1,644 documented corneal ulcer patients out of the168,229 OPD patients during the study period. There were 957 (58 %) males and 687 (42 %) females. We had to exclude about 32 patients due to incomplete data and many peadiatric patients with corneal ulceration were not documented as they directly presented to the peadiatric ophthalmology OPD. The mean age was 44 ± 16 years. Corneal ulcer was found to be more common between the third and sixth decades of life with 77 % of patients being in this age group. The monthly pattern of patient presenting with corneal ulcer is shown in Figure 1. More patients presented with corneal ulcer during the harvesting season.

Table 1: Duration of symptoms at presentation

Duration Of symptoms	Frequency	Percentage
<4 Days	45	3
4-7 Days	350	21
1-2 Weeks	469	28
>2 Weeks	671	41
Unspecified	109	7

Table 2: Reasons for delayed presentation

Reasons	Frequency	Percentage
Distance	353	22
Money	365	22
No person to accompany	171	10
Unawareness	439	27
Unspecified	316	19

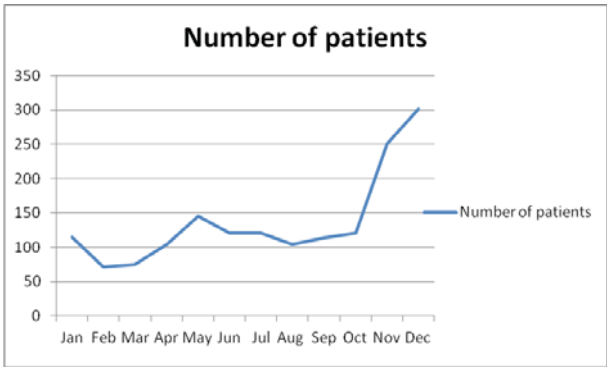

Figure 1: Distribution of Patients by Months

Table 3: Prior consultation before presenting to Biratnagar Eye Hospital

Prior consultations	Frequency	Percentage
Eye care Paramedical	204	12
Eye Doctor	38	2
Medical Doctor	334	20
Medical Shopkeeper	431	26
Traditional Healer	594	36
Relatives	28	2
None	15	1

Table 4: Predisposing factors for corneal ulceration in 1048 of 1644 patients

Predisposing factors	Frequency	Percentage
Trauma - vegetative	629	38
Trauma non-vegetative	361	22
Dacrocystitis	80	5
Other ocular disease	17	1

Table 5: Etiological agents

Etiology	Frequency	Percentage
Bacteria	73	4.5
Fungus	1150	70
Mixed	20	1
No Organism	393	24
Not Done	8	0.5

Only 45 (3 %) patients presented within four days of being symptomatic. The reasons for delayed presentation included: being unaware of the serious nature of this condition - 439 (27 %) patients, financial constraints - 365 (22 %) patients and geographic constraints with long distances to travel to reach an eye center - 353 (22 %) patients (Table 2).

Almost all patients sought some form of help elsewhere before presenting to our center. These included initial visits to: (1) a village faith healer by 594 (36 %) patients, (2) a village pharmacist by 431 (26 %) patients, (3) a medical doctor by 334 (20 %), (4) an eye-care paramedic by 204 patients (12 %) and (5) an ophthalmologist by 38 (2 %) patients (Table 3).

Of all the corneal ulcer patients that presented to this center, about 85 % were already on some form of medications for corneal ulcer: 42 (3 %) patients were on antifungal drops, 168 (10 %) were on antibiotic drops, 308 (19 %) were on both antifungal and antibacterial drops and 27 (2 %) patients were using steroid drops.

A history of eye trauma was reported in 990 (60 %) patients. Ocular trauma with vegetative material such as paddy leaf, leaf, hay, grass and sugarcane accounted for 629 (38 %) patients and non-vegetative material accounted for 361 (22 %) patients (Table 4). The VA at the time of the first visit was less than 3/60 in 1,072 (65 %) patients. Only 204 (12 %) patients had a VA between 6/6 and 6/18 at presentation. Hypopyon with corneal ulcer was present in 688 patients (42 %)

Corneal scrapings were positive in 1,243 patients (76 %). KOH mount was positive for fungus in 1,150 patients (70 %), Gram stain

was positive for bacteria in 73 patients (4.5 %) and 20 patients (1 %) showed both fungus and bacteria. In 393 patients (24 %), no organisms were seen. In eight patients (0.5 %), corneal scraping was not done due to risk of perforation (Table 5).

Biratnagar Eye Hospital being a referral center in the region, we intended to report the number of cases presenting to this center with the diagnosis of corneal ulcer in one year. The corneal ulcer was found to be more prevalent in the working age group between the third to sixth decades of life who are physically active and hence more predisposed to ocular trauma. These were more males than females (58 to 42 %) in the present series. The majority of our cohort presented only two weeks after being symptomatic and most of them had already sought some form of medical help and were on some form of treatment for corneal ulcer from elsewhere. A fungus was the causative agent for the corneal ulceration for two to thirds of our cohort.

In our study, 77 % of corneal ulcer patients were between the third and sixth decades of life. Morbidity in this productive age group causes a huge economic burden to the family and to the society as a whole. Srinivasan et al (Srinivasan et al, 1997) also reported a higher prevalence in the middle age groups and attributed it to work-related ocular trauma. In our study, there were more male patients than female, with the ratio being 1.4:1, which could be due to more men working in the fields in our agriculture-based society. Similarly, a study from South India also showed the male to female ratio as 1.6:1 (Srinivasan et al, 2007).

Ocular trauma has been found to be the major predisposing factor for corneal ulcers. Farmers are particularly prone to eye injuries while working in their fields. As the majority of patients in the present series were farmers, a history of ocular injury was elicited in 60 % of our cohort, and specifically with vegetative material in 38 %. Srinivasan et al (Srinivasan et al, 1997) from South India reported ocular trauma in 65.4 % of their cohort, and Basak et al (Basak et al, 2005) reported trauma in 82.9 % of their patients with suppurative keratitis in their study from Northeast India. In contrast, a study from the US (Tanure et al, 2000) reported a history of trauma in only 8.3 %.

Lack of awareness, financial constraints and geographic barriers are the three main reasons for delayed presentation following corneal ulcer in developing countries like ours. In the present series, 395 (24 %) patients presented within two weeks after being symptomatic. This is in contrast to a previous study from Nepal by Upadhyay et al (Upadhyay et al, 1991) who reported 43.7 % of their cohort presenting within seven days of being symptomatic. This study was from the capital, Kathmandu where patients have better access to transport and hospitals. Similarly, in a study from South India, Srinivasan et al (Srinivasan et al, 1997) reported that 60 % of their cohorts had presented within a week.

Nearly all patients had sought some kind of medical help before presenting to our center. The majority of patients (36 %) had gone to village faith healers and pharmacists had seen quarter of the present cohort. Pharmacists and village faith healers still play a vital role in the primary management of corneal ulcers in our rural community. Including these primary points of contact in the treatment chain by educating them for timely referral might reduce the number of patients presenting late to hospitals. Only 2.3 % of our cohort had initially consulted an ophthalmologist. This is in contrast to the study by Srinivasan et al (Srinivasan et al, 1997) where 65 % of the patients had primary evaluation by an ophthalmologist. All ophthalmic medications in Nepal are sold over the counter; therefore 85 % of patients were on some kind of topical eye drops at presentation.

A fungus was identified as the causative agent in 70 % of patients in the present series. However, two other studies from the same region have mentioned fungal infection as the etiology in 44 % and 40.65 % of their cohort (Khanal et al, 2001 Amatya et al, 2012). Similarly, a study from Kathmandu valley (Central Nepal) reported fungal growth in 61% out of 40% of culture positive patients (Feilmeier et al, 2010). Basak (Basak et al, 2005) reported fungal corneal ulcer in 62.7 % of their cohort from eastern India. The reported prevalence of fungal keratitis from other developing countries ranges from 33 % to 56 % (Dunlop, 1994; Gonawardena, 1994; Hagan, 1995; Srinivasan, 1997; Furlanetto et al, 2010). In contrast, the prevalence of fungal corneal ulcer in studies from developed countries was as low as 20 % in Florida, USA (Liesegang et al, 1980) and 3 % in the UK (Coster et al, 1981). The current series has the highest percentage of fungal keratitis reported so far. This high incidence may be due to the agriculture-based lifestyle of the population of this region, which predisposes them to ocular trauma. The tropical climate of plains may also have contributed to this high prevalence.

These alarmingly high numbers of corneal ulcer in this region reflect a need for designing public health programs targeting the population at risk for providing diagnosis, primary treatment and subsequent referral. Upadhyay et al. (Upadhyay et al, 2001) have shown that corneal ulceration can be prevented by the application of 1 % chloramphenicol ophthalmic ointment in the eyes following corneal abrasion in rural settings, especially within 18 hours of injury.

This study has a number of limitations. First, this is a retrospective study with its inherent biases. Second, Biratnagar Eye Hospital being a tertiary level regional referral center, there could be an element of Berkesonian bias.

Corneal ulcer seems to be a major issue among eye patients coming to this institute. A lack of awareness about the gravity of this disease, financial constraints and geographic barriers remain the major reasons for the delay in seeking proper medical help. Identifying the population at risk and the points of first contact of the corneal ulcer patients in the population to initiate awareness programs on primary management and subsequent referral to eye centers may help to address this public health problem.

References

Amatya R, Shrestha S, Khanal B et al (2012). Etiological agents of corneal ulcer: five years prospective study in eastern Nepal. Nepal Med Coll Journal ;14(3):219-22.

Basak SK, Basak S, Mohanta A, Bhowmick A (2005). Epidemiological and microbiological diagnosis of suppurative keratitis in Gangetic West Bengal, eastern India. Indian J Ophthalmol; 53(1):17-22.

Carmichael TR, Wolpert M, Koornhob HJ (1985). Corneal ulceration at an urban African hospital. Br J Ophthalmol; 69: 920-6.

Coster DJ, Wilhelmus J, Peacock J, et al (1981). Suppurative keratitis in London. The cornea in health and disease. VI Congress of the European Society of Ophthalmology; 40:395-8.

Dunlop AAs, Wright ED, Howlader SA, Nazrul I, Husain R, McClellan K, et al (1994). Suppurative corneal ulceration in Bangladesh. A study of 142 cases examining the microbiological diagnosis, clinical and epidemiological features of bacterial and fungal keratitis. Aust NZ J Ophthalmol; 22:105-10.

Erie JC, Nevitt MP, Hodge DO, Ballard DJ (1993). Incidence of ulcerative keratitis in a defined population from 1950 through 1988. Arch Ophthalmol;111:1665-71.

Feilmeier MR, Sivaraman KR, Oliva M, Tabin GC, Gurung R (2010). Etiologic diagnosis of corneal ulceration at a tertiary eye center in Kathmandu, Nepal. Cornea; 29(12):1380-5.

Furlanetto RL, Andreo EG, Finotti IG, Arcieri ES, Ferreira MA, Rocha FJ (2010). Epidemiology and etiologic diagnosis of infectious keratitis in Uberlandia, Brazil. Eur J Ophthalmol; 20(3):498-503.

Gonawardena SA, Ranasinghe KP, Arseculeratne SN, et al (1994). Survey of mycotic and bacterial keratitis in Sri Lanka. Mycopathologia;127:77-81.

Gonzales CA, Srinivasan M, Whitcher JP, Smolin G (1996). Incidence of corneal ulceration in Madurai District, South India. Ophthalmic Epidemiol;3:159-66.

Hagan M, Wright E, Newman M, Dolin P, Johnson G (1995). Causes of suppurative keratitis in Ghana. Br J Ophthalmol;79:1024–8.

Khanal B, Kaini KR, Deb M, Badhu B, Thakur SK (2001). Microbial keratitis in eastern Nepal. Tropical Doctor;31:168-9.

Leck AK, Thomas PA, Hagan M, et al. Aetiology of suppurative corneal ulcers in Ghana and south India, and epidemiology of fungal keratitis. Br J Ophthalmol 2002;86:1211–1215.

Liesegang TJ, Forster RK (1980). Spectrum of microbial keratitis in south Florida. Am J Ophthalmol; 90:38-47.

Srinivasan M, Gonzales CA, George C, et al (1997). Epidemiology and etiological diagnoses of corneal ulceration in Madurai, south India. Br J Ophthalmol;81:965-71.

Tanure MA, Cohen EJ, Sudesh S, Rapuano CJ, Laibson PR (2000). Spectrum of fungal keratitis at Wills Eye Hospital Philadelphia, Pennsylvania. Cornea; 19:307-12.

Upadhyay MP, Karmacharya PC, Koirala S, et al (1991). Epidemiologic characteristics, predisposing factors, and etiologic diagnosis of corneal ulceration in Nepal. Am J Ophthalmol;111:92-9.

Upadhyay MP, Karmacharya PC, Koirala S et al (2001). The Bhaktapur eye study: Ocular trauma and antibiotic prophylaxis for the prevention of corneal ulceration in Nepal. Br J Ophthalmol; 85:388-392.

Whitcher JP, Srinivasan M (1997). Corneal ulceration in developing world – a silent epidemic. Br J Ophthalmol; 81:622-623.

Whitcher JP, Srinivasan M, Upadhyay MP (2001). Corneal blindness: a global perspective. Bull World Health Organ;79:214-21.

Source of support: nil. Conflict of interest: none