ISSN 2091-2889 (Online)
ISSN 2091-2412 (Print)

Journal of Chitwan Medical College 2019;9(29):69-73
Available online at: www.jcmc.cmc.edu.np

ORIGINAL RESEARCH ARTICLE

EPIDEMIOLOGY OF BACTERIAL KERATITIS IN LUMBINI EYE INSTITUTE

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Received: 13 Aug, 2019
Accepted: 10 Sept, 2019
Published: 17 Sept, 2019

Key words: Bacterial; Epidemiology; Keratitis.

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DOI:https://doi.org/10.3126/jcmc.v9i3.25786

Citation

Gautam P, Dahal P, Patel S, Singh S. Epidemiology of bacterial keratitis in Lumbini eye institute. Journal of Chitwan Medical College. 2019; 9(29):69-73.

Peer Reviewed

ABSTRACT

Background: Bacterial keratitis is a common sight threatening condition. Untreated, it often leads to progressive tissue destruction with corneal perforation or extension of infection to adjacent tissue. The aim of the study was to study the epidemiological characteristics of bacterial keratitis seen at Lumbini eye institute in western part of Nepal.

Methods: A retrospective study was done from 1st November 2017 to 30th October 2018 in which records of all culture-positive bacterial keratitis over a 1 year period. Data regarding age of patient, occupation, type of injury, coexisting ocular disease was recorded. Clinical evaluation corneal scrapings were collected and subjected to culture and microscopy using standard protocols in all patients.

Results: Out of 800 corneal ulcer cases, 305(38.12%) were found to be of bacterial *aetiology*. A total of 100(32.78%) bacterial pathogens were isolated of which predominant bacterial species *Staphylococcus epidermidis* 56(56%) followed by *Staphylococcus aureus* 21(21%), *Pseudomonas aeruginosa* 12(12%), *Streptococcus viridans* 5(5%), *Nocardia* 4(4%) and *Streptococcus pneumonia* 2(2%) were isolated. Patients with age >45 years were 71(71%) and < 45 years were 29(29%). Among these, (55)55% of patients were non-agricultural workers and (45)45% were farmers; this difference was statistically not significant (p>0.0001). Co-existing ocular diseases predisposing to corneal ulceration were identified only in 19(19%), compared to other predisposing risk factors in 81(81%).

Conclusions: The epidemiological characteristic of bacterial keratitis varies geographically. This study describing the features of bacterial keratitis would greatly help the practicing ophthalmologist in the management of their patients.

INTRODUCTION

Infection of the cornea is a leading cause of ocular morbidity resulting in serious visual impairment and even in the loss of many eyes in Nepal. In view of the various patterns of infecting organism in different parts of the world, it is essential to identify the local microbial pattern causing corneal ulcers.[1] Bacterial keratitis rarely occurs in the normal eye because of the human cornea's natural host defense mechanism. However, predisposing factors such as corneal injury, contact lens wear, ocular adnexal dysfunction and other exogenous factors, systemic diseases and immunosuppression may alter the defense mechanisms of the outer eye and permit bacteria to invade the cornea.[2-3] The etiological and epidemiological patterns of corneal ulceration have been found to vary with the patient population, health of the cornea, geographic location and climate, and also tends to vary somewhat over time.[4] Since we encounter maximum number of corneal ulcers in our OPDs. Knowing the epidemiological features, risk factors and etiological agents that occur in our region are important in rapid recognition, timely treatment of

the disease. So this study aimed to determine the risk factors and epidemiological characteristics, and to identify specific bacterial pathogens causing bacterial keratitis in patients presenting in Lumbini eye institute at western region of Nepal which will help in treating patients and preventing the disease related complications.

METHODS

A retrospective analysis of all patients with culture-proven bacterial keratitis seen over a period of one year from 1st November 2017 to 30th October 2018 was done. Ulceration was defined as a loss of the corneal epithelium with underlying stromal infiltration and suppuration associated with signs of inflammation with or without hypopyon. Ulcers with typical features of viral infection, Mooren's ulcers, interstitial keratitis, sterile neurotropic ulcers, and any ulcer associated with autoimmune conditions and those not willing to participate were excluded from the study. After the ethical clearance from research and academic committee of Lumbini eye institute data related to demographic features, predisposing factors, history of corneal trauma, associated ocular conditions, other systemic diseases, pattern of bacterial growth and bacterial species were recorded. All patients had undergone thorough slit-lamp biomicroscopic examination by an ophthalmologist. After a detailed ocular examination, using standard techniques, corneal scrapings were taken under aseptic conditions from each ulcer by an ophthalmologist using a sterile Bard-Parker blade number 15.[5-7] Procedure was performed under the magnification of a slit-lamp after instillation of 4% lignocaine (lidocaine). The material scraped from the leading edge and the base of each ulcer was initially directly inoculated onto the surface of solid media such as Blood agar, Chocolate agar, MacConkey agar, Brain heart infusion broth and Sabouraud glucose agar in a row of C- shaped streaks The material obtained by scraping was also spread onto labeled slides in a thin, even manner to prepare a 10% potassium hydroxide (KOH) wet mount and to prepare smear for Gram stain and Giemsa stain

All inoculated media were incubated aerobically. The inoculated Sabouraud glucose agar were incubated at 27^{0}C, examined daily, and discarded at 3 weeks if no growth was seen. The inoculated plates of Blood agar, Chocolate agar, MacConkey agar, Brain heart infusion broth and Sabouraud glucose agar were incubated at 37^{0}C, examined daily, and discarded at 48 hours if growth was not seen. All laboratory methods followed standard protocols.[5-7] Microbial cultures were considered significant if growth of the same organism was demonstrated on more than one solid phase medium, and/or if there was confluent growth at the site of inoculation on one solid medium, and/or if growth of one medium was consistent with direct microscopy findings (i.e., appropriate staining and morphology with Gram stain) and/or if the same organism was grown from repeated scraping. Data analysis was done using Statistical package for social science (SPSS) 11.0 versions. p-value was calculated wherever required. p-value <0.05% was considered statistically significant.

RESULTS

Out of 100 bacterial keratitis patients, there were 59(59%) males and 41(41%) females, with M: F ratio of 1.4:1. Patients above the age of 45 years 71(71%) were significantly (p<0.0001) more than patients below 45 years 29(29%). Non –agriculture workers 55(55%) and farmers 45(45%) were clinically not significant (p>0.0001). Co-existing ocular diseases predisposing to corneal ulceration were identified in 19(19%) patients, compared to other predisposing risk factors in 81(81%) patients (p< 0.0001). The demographic data and co-existing ocular diseases are shown in (Table 1 and 2).

Table 1: Demographic characteristics of culture positive bacterial keratitis

Demographics	Particulars	Frequency (%)
Gender	Male	59(59%)
	Female	41(41%)
Age	<45 years	29(29%)
	> 45 years	71(71%)
Occupation	Farmer	45(45%)
	House wife	35(35%)
	Students	6(6%)
	Day labour	8(8%)
	Industrial worker	4(4%)
	Business man	2(2%)
Season	Winter	30(30%)
	Spring	27(27%)
	Summer	23(23%)
	Autumn	20(20%)

Table 2: Predisposing factors of culture positive bacterial keratitis

Predisposing Factors	Percentage(%)
Corneal Trauma	49(49%)
Chronic Dacryocystitis(CDC)	8(8%)
Dry eye	6(6%)
Entropion	5(5%)
Systemic Diseases:	
Diabetic Mellitus	6(6%)
Leprosy	1(1%)
Others	25(25%)
Total	100%

A history of corneal injury was recorded in 49(49%) patients, of which 20 (20%) had corneal injury with vegetative materials and 29 (29%) had injury due to other materials. The percentage of patients who reported a history of corneal injury with vegetative materials was significantly lower than the percentage reporting injury due to other traumatizing agents. Over a period of one year, our data revealed that, there was lower incidence of bacterial keratitis during autumn and summer season than other seasons.

Table 3: Pattern of Growth

Growth pattern	Total
Bacteria	305(38.13%)
Fungus	400(50%)
Mixed Growth (Bacteria+Fungus	95(11.87%)
Total	800

Out of evaluated 800 corneal ulcers, 305(38.12%) were found to be bacterial etiology among them total 100 (32.78%) bacterial pathogens were isolated. Of those 100, 29(29%) were gram *positive cocci,* 11(11%) were gram negative bacilli, 4(4%) were aerobic *Actinomycetes* (*Nocardia spp*.) and whereas 56 (56%) shows no organisms in gram stain. The predominant bacterial species isolated were *Streptococcus epidermidis* 56(56%) followed by staphylococcus *aureus* 21(21%), *Pseudomonas aeruginosa* 12(12%), *Streptococcus viridans* 5(5%), *Nocardia* 4(4%) and *Streptococcu pneumonia* 2(2%). Pattern of Bacterial growth, stain and species are shown in (Table 3, 4 and 5).

Table 4: Microbiological Characteristics of culture positive bacterial keratitis

Microbiology	Particular	Percentage
Gram stain	*Gram positive.cocci*	29%
	Gram negative. bacilli	11%
	Norcardia	4%
	No organism	56%
Total		100%

Table 5: Microbiological Characteristics of culture positive bacterial keratits

Microbiology	Bacterial species	Percentage
Species	*Staph. aureus*	21%
	Staphy.epidermidis	56%
	Strepto.pneumoniae	2%
	Strepto.vairidance	5%
	Pseudo.aeruginosa	12%
Total		100%

DISCUSSION

Corneal infection is a leading cause of ocular morbidity and blindness worldwide. At birth the eyes are sterile but they soon become invaded by various bacteria and other microorganisms. The bacteria that are normally present can be arranged in two groups; the resident bacteria which are constantly present in the eye and which if disturbed, promptly re-establish themselves (*Corynebacterium spp.*) the transient bacteria which consist of non-pathogenic or potentially pathogenic bacteria that inhabit the eye for short periods. Almost any species of bacteria can infect the cornea if the integrity of the natural anatomic barriers or defense mechanisms is compromised.[8-9] Present study describes features of 100 culture-proven cases of bacterial keratitis diagnosed at Lumbini eye institute.

In this study, bacterial keratitis accounted for 32.78% out of 305 corneal ulcers evaluated. Bacterial keratitis has been reported to account for 32.3% of all cases of corneal ulcer evaluated in Madurai (South India) [6] In marked contrast, a study performed in Nepal documented the occurrence of a bacterial etiology in 63.2% of all corneal ulcers.[10] Bacteria are responsible for a larger proportion of corneal ulceration in temperate climates such as Britain[11] and northern United States[12] than in tropical regions such a south India, but in the sub-tropical urban climates

of Nepal bacteria are a predominant cause for microbial keratitis.[10] *Streptococcus epidermidis* (56%) was the predominant bacterial species in this study. But unlike our study, *Streptococcus pneumoniae* was predominant in South India [5] and central part of the Nepal [10], *Pseudomonas aeruginosa* in Ghana and Hong Kong.[13-14] Male preponderance (59%) was seen in our study, but it was not statistically significant (p> 0.001). There was significantly higher incidence of bacterial keratitis among patients other than agricultural workers 55%. Our study shows that there is significant association between occupation and bacterial keratitis, in other study 71% bacterial Keratitis has been reported among farmers. [15] Bacterial keratitis is significantly higher (71%) among those aged >45 years in our present study (p<0.0001) but this study is in contrast to fungal keratitis, which affects more of younger age group (21-50 years.[6] In this study Corneal trauma (49%) is the leading cause of microbial keratitis. Similarly another study done by Thylefors B *et al* showed that corneal trauma is the leading cause of microbial keratitis.[16] Different from ours study, Bharathi *et al*. State that the most common risk factors identified for the development of bacterial keratitis was co-existing ocular diseases in south India.[5] Gopinath et al [17] reported higher incidence of fungal keratitis due to corneal injuries in Hyderabad. In our study Chronic dacryocystitis 8(8%) was the most common ocular risk factor followed by dry eye 6(6%) and entropion 5 (5%). Dhakhwa K et al[18] reported 17 of 414(41%) patients had history of using topical steroid and 3(0.7%) patients used goat's milk and seeds of plants but none of our patients had history of using steroid and traditional medicine. In addition, 7(7%) patients had systemic disease, in the study incidence of which 1(1%) had leprosy and 6(6%) had Diabetes mellitus syndrome. In this study, the bacterial keratitis was less during the summer and autumn. In comparison, the incidence of fungal keratitis was seen higher during the month of June, July, August and September because of more agricultural works like harvesting paddy during these months.

The limitation of the study was we could not cover all the micro-organism the cause bacterial keratitis due to the lack of good laboratory facility, irrelevant history and delay reach to the hospital.

CONCLUSION

Bacterial keratitis is rare in the absence of predisposing factors and it is frequently encountered in patients with co-existing ocular disease. The epidemiology and etiology of bacterial keratitis is specific to the region. Screening patients for predisposing factors, treating the co-existing ocular diseases and educating them about proper eye care and the risk of infection may reduce the occurrence of bacterial keratitis. It is necessary for all of us to be aware of its risk factors, and any suspicion of its presence, a good microbiology workup for establishing timely institution of therapy in order to preserve vision.

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