Pattern of Keratitis: A Study of 500 Cases in Tertiary Hospital of Bangladesh

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ABSTRACT

Background: Keratitis is a potentially serious corneal infection and a major cause of visual impairment worldwide. Most common form of which is infectious variety; pathogens may be bacteria, viruses, fungi and parasites which varies with age and predisposing factors. Topical antimicrobials and cycloplegic agents are the mainstay of treatment. Pattern of causative organisms and drug sensitivity changes from time to time and differs from one to another geographic location.

Objective: To assess and evaluate the pattern of diagnosed patient of keratitis presented in a tertiary hospital.

Material and methods: This cross-sectional study was conducted on 500 diagnosed patients of keratitis in the department of cornea of National Institute of Ophthalmology & Hospital, a well-known tertiary care hospital with 500 beds for a period of 6 months. Patients were selected based on specific selection criteria. Detail history was taken, and thorough ocular examination was done in every patient. Corneal scrapings were taken for Gram's stain and 10% potassium hydroxide wet mount preparation. All the relevant data was recorded in a predesigned data collection sheet.

Results: The mean age of the study subjects was 38.49 years. Male (43.2%) and female (56.8%) ratio was almost equal. The prevalence was highest among lower economic class (56.8%) as usual, and lowest among affluent class (3.8%) but not sparing them. In terms of regional distribution, majority (42.6%) of the patients came from rural area, whereas 37% from urban non-slum area and 20.8% from urban slum area. The problem was mostly observed among day-laborers (24.8%) with gradually declining trend among students (20.6%), housewives (20%), service holders (14.2%), businessmen (3.2%) and unemployed (2.2%), surprisingly! Presentation of the cases were mostly in between 2nd-3rd week (55%), while 30% patients were presented within 1st week & 15% after 4 weeks of diagnosis. Among the cases, it was found that 28.8% patients had corneal injury, which were caused by vegetative trauma in 16% cases, 4% dust or sand trauma, 2.8% animal injury, 2.2% stick injury, 1% nail injury and 2.8% patients had history of other injury like stone, wooden materials, flying insects, dirty wire etc. Ocular diseases predispose to corneal ulcer were present in 9% patients. These were chronic dacriocystitis, entropion and trichiasis. 1.2% patients were diabetic, and 1% patients had history of inadvertent use of steroids. On the contrary, there were no specific predisposing factors in 71.2% cases. Among the cases, 96.6% experienced photophobia, 90% had foreign body sensation, 88.4% had reduced vision, 85.4% had eye pain, 78.8% suffered from watering, 73.6% had discharge, 48.8% had burning sensation, 12.2% had decreased corneal sensation and 11.2% patients noticed white spot in cornea in first stage. Slit lamp bio-microscopic examination of the patients shows 90% patients had conjunctival injection, 70% had epithelial defect, 28.6% patients had stromal infiltration, 18.4% patients had hypopyon, 14% patients had feathery pattern, 8.8% patients had suppuration, anterior chamber reaction was present in 4.4% cases and 2.2% patients had satellite lesion. The evaluation of etiology on the basis of clinical appearance reveals 61.4% of cases were presented with viral keratitis, 23.0% fungal corneal ulcer, 11.4% with bacterial corneal ulcer, 2.2% with marginal keratitis, 0.8% with exposure keratitis, 0.8% with filamentary keratitis and 0.4% cases with Acanthamoebic keratitis at the time of presentation. While assessing the depth of keratitis of the study subjects, 73.2% found superficial while 26.8% found deep. Assessment of area of corneal involvement in terms of punctate epithelial defect showed that in 46.8 % cases less than 3mm of cornea was involved, 3 to 6 mm of the cornea involved in 19.6 % cases and in 11.8 % corneal involvement was found in more than 6 mm area. Corneal scraping done in 118 (23.6%) out of 500 patients. Among them, Fungi were found in

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11.2% cases, mixed organism in 4%, Bacteria in 5.6% and Acanthamoeba found in 0.4% cases while 2.4% remains unidentified.

Conclusion: Analysis of the study findings shows diversity in the pattern, presentation, predisposing factors of different form of keratitis which may be helpful as basis of further study on this problem.

Keywords: Keratitis, Pattern, NIOH, Corneal, Scraping, Vegetative, Ocular, Photophobia, Filamentary, Acanthamoeba, Ulcer, Hypopyon, Satellite, Fungal, Marginal, Stromal, Slit Lamp.

I. BACKGROUND

The cornea, the clear part of the eye through which light passes, is subject to many infections and to injury from exposure to foreign objects. Infection and injury cause inflammation of the cornea and is called keratitis. Both infectious and immune mechanisms are important in the development of this sight threatening condition [1], [2]. Keratitis can progress rapidly with corneal destruction through pathological wound healing within 24-48 hours [3]-[5]. Any organism can invade the corneal stroma when protective mechanisms are compromised. Corneal ulcers may be classified according to anatomical position and their pathogenesis [6]. Anatomical corneal ulcers can either be peripheral or central. It is usually thought that most peripheral ulcers are non-infective in nature while central ones are infective [6]. Etiologically keratitis can be classified as either infectious or non-infectious. The infectious group includes bacterial, fungal, viral and parasitic while the non-infectious group includes Mooren's, marginal, phlyctenular, traumatic and nutritional. Bacterial keratitis usually develops when the ocular defenses have been compromised. However, some bacteria are able to penetrate a normal corneal epithelium. The most common agents for bacterial keratitis are *Staphylococcus aureus*, *Streptococcus pneumoniae* and gram-negative bacilli, especially *P. aeruginosa* [4]. Fungal keratitis is a fatal condition which needs early diagnosis and treatment to save the patient's eye. The two main types of fungi causing keratitis are Yeast and filamentous fungi. Fungal ulcers are typically seen after injury with vegetative matter such as a thorn or wooden stick and are characterized by a relatively indolent course. Superficial keratitis may result from a number of infections, most of which are viral. Of these, the most common are herpes simplex and adenoviruses. Superficial punctate epithelial keratitis is characterized by granular, opalescent, swollen epithelial cells with focal intraepithelial infiltrates. Numular keratitis is characterized by fine granular sub-epithelial deposits surrounded by a halo of stromal haze. Dendritic or geographic keratitis is associated with active Herpes virus replication. Disciform keratitis may be an active HSV infection of kerato-uveitis or endothelium or a hypersensitivity reaction to viral antigen in the cornea. It is less common in VZV infection. Interstitial keratitis or stromal keratitis is an inflammation of the corneal stroma without primary involvement of the epithelium or endothelium. Common causes are Syphilis, herpetic keratitis, other viral infections, tuberculosis, sarcoidosis, Cogan syndrome. Marginal keratitis is probably caused by a

hypersensitivity reaction against staphylococcal exotoxins and cell wall proteins with deposition of antigen-antibody complexes in the peripheral cornea with a secondary lymphocytic infiltration. Filamentary keratopathy is a common condition that can cause discomfort. In these cases, it is thought that a loose area of epithelium acts as a focus for deposition of mucous and cellular debris. Causes are aqueous deficiency, excessive contact lens wear, corneal epithelial instability, superior limbic kerato-conjunctivitis, bullous keratopathy, neurotrophic keratopathy. Exposure keratopathy is a result of incomplete lid closure causes drying of the cornea despite normal tear production. Common causes of incomplete lid closure are facial nerve palsy, coma or parkinsonism, eczema, solar keratosis, xeroderma pigmentosum, severe proptosis, severe enophthalmos.

II. MATERIALS AND METHODS

A hospital based, prospective, cross sectional study was conducted for a period of 6 months from 1 July 2018 to 31 December 2018 at corneal clinic of National Institute of Ophthalmology and Hospital, Dhaka, Bangladesh. Ethical approval was obtained from ethical review committee of NIOH. Informed written consent was obtained from patient or appropriate guardian. Through a non-randomized purposive sampling, a total of 500 diagnosed cases of keratitis were studied. Demographic data, detailed history of predisposing factors, previous treatment and duration of symptoms was noted by structured questionnaire. Presenting visual acuity was recorded by Snellen's chart at 6 (six) meter distance. Pattern of keratitis including size, depth, and location of ulcer along with examination of margins, floor and infiltrations were done by using slit lamp bio microscope. Presence or absence of hypopyon, ocular adnexa (eyelids, eyelashes, conjunctiva, and lacrimal sac area) was examined by naked eye examination. Patency of the lacrimal system was assessed by performing syringing in case of non-healing cases. Corneal surface scraping was performed gently in every subject of diagnosed corneal ulcer. For corneal scraping, informed verbal consent was obtained after explaining the procedure. The base and leading edges were scrapped from periphery to center. The material was smeared on two slides, one for 10% potassium hydroxide (KOH) wet mount preparation and another for Gram's stain. Collected data were reviewed, cleaned, and finally analyzed by SPSS 17 for Windows.

III. RESULTS

During this six-month study period, a total of 500 patients of keratitis attending in outpatient department of cornea were enrolled and went through the questionnaire and clinical examination and face to face interview. Results displayed in appropriate tables and graphs.

TABLE I: AGE DISTRIBUTION OF THE 500 STUDY SUBJECTS

Age group	Number	Percentage (%)
0-15 years	24	4.8
16-30 years	190	38.0
31-45 years	134	26.8
46-60 years	92	18.4
>60 years	60	12.0
Total	500	100%

TABLE II: SEX DISTRIBUTION OF 500 STUDY SUBJECTS

Gender	Number	Percentage (%)
Female	216	43.2%
Male	284	56.8%

TABLE III: DISTRIBUTION OF SOCIOECONOMIC STATUS

Socio-economic Class	Cases	Percentage
Upper class	19	3.8
Upper middle class	159	31.8
Lower middle class	218	43.6
Lower class	104	20.8

TABLE IV: DISTRIBUTION OF OCCUPATION

Occupation	Cases	Percentage (%)
Day Labor	124	24.8
Student	103	20.6
Housewife	100	20.0
Farmer	75	15.0
Service holder	71	14.2
Businessman	16	3.2
Unemployed	11	2.2

TABLE V: DISTRIBUTION OF THE PREDISPOSING FACTORS OF STUDY SUBJECTS

Predisposing factors	Number	Percentage (%)
Trauma	144	28.8
a. Vegetative trauma	80	16
b. Mud, dust, sand	20	4
c. Animal matters	14	2.8
d. Stick	11	2.2
e. Nail	5	1
f. Others	14	2.8
Co-existing ocular disorder	51	10.2
Inadvertent use of steroid	5	1
No specific history of trauma	365	71.2

In terms of predisposing factor, majority of cases (71.2%) had no specific history of any trauma. Only in 28.8% cases specific history of trauma was found, of which 16% were vegetative trauma, and others were from mud, dust, sand, animal matter, stick or nail etc. In 10.2% cases some co-existing ocular diseases were found (e.g., chronic dacryocystitis, entropion, trichiasis etc.). Inadvertent steroid use pertained only for 1% cases.

TABLE VI: DISTRIBUTION OF THE SYMPTOMS OF STUDY SUBJECTS

Characteristic	Number	Percentage (%)
Photophobia	483	96.6
Foreign body sensation	450	90
Reduced vision	442	88.4
Eye pain	426	85.4
Watering	394	78.8
Discharge	368	73.6
Burning sensation	244	48.8
Diminished corneal sensation	61	12.2
White spot	56	11.2

TABLE VII: DISTRIBUTION OF SIGNS ON SLIT-LAMP EXAMINATION

Signs	Number	Percentage (%)
Conjunctival injection	450	90
Epithelial defect	350	70
Stromal infiltration	143	28.6
Hypopyon	92	18.4
Feathery pattern	70	14.0
Suppuration	44	8.8
Anterior chamber reaction	22	4.4
Satellite lesion	11	2.2

TABLE VIII: ETIOLOGY OF KERATITIS ON THE BASIS OF CLINICAL APPEARANCE

Name of Keratitis	Number	(%)Percentage
Viral Keratitis	307	61.4
Fungal corneal ulcer	115	23.0
Bacterial corneal ulcer	57	11.4
Marginal Keratitis	11	2.2
Exposure Keratitis	4	0.8
Filamentary Keratitis	4	0.8
Acanthamoeba	2	0.4

TABLE IX: DISTRIBUTION OF DEPTH OF KERATITIS ON SLIT LAMP EXAMINATION

Depth of Keratitis	Number	Percentage (%)
Superficial	366	73.2
Deep	134	26.8

TABLE X: TYPES OF KERATITIS ON THE BASIS OF LOCATION IN THE CORNEA

Location of lcer	Number	Percentage (%)
Central	384	76.8
Diffuse	101	20.2
Peripheral	15	3.0

TABLE XI: INTERPRETATION OF CORNEAL SCRAPPING

Organism found from Corneal Scrapping	Cases	Percentage (%)
Not done	382	76.4
Done	118	23.6
a. Fungus Present	56	11.2
b. Mixed	20	4
c. Bacteria	28	5.6
d. Not found	12	2.4
e. Acanthamoeba	2	0.4

IV. DISCUSSION

Keratitis is a major global cause of visual impairment and blindness. Most of the cases are infectious in nature and commonly affects the peoples of low socio-economic class. Infectious keratitis is a serious condition that could result in corneal scar, corneal perforation, and even blindness. Microbial keratitis is a common, potentially sight threatening ocular infection that may be caused by bacteria, fungi, or viruses. However, predisposing factors such as trauma, contact lens wear, dry eye, glaucoma, epithelial defect, systemic disease, and immunosuppressant may alter the defense mechanisms of the outer eye and permit bacteria to invade the cornea. The variables studied included demographic data, medical history, risk factors (history of ocular trauma, use of contact lenses, associated eye diseases, systemic diseases, previous ocular surgery), clinical presentation, initial and final visual acuity, medication used.

In this study, the mean age of the study subjects was 38.49±18.59 (SD) years. Laltanpuia et al. [7], found in their study within 2012-2014 that keratitis occurred most frequently 60 (78.9%) in the age group 21-65 years. In this

study, it was also found that people aged 16-60 years are more affected than people aged less than 15 years and above 60 years. As this age group (16-60 years) has more outdoor activities, they suffer more from ocular injury commonly. All the study findings show that most of the affected person of keratitis belongs to working group of peoples are affected by keratitis due to ocular injury, which have impact on our socio-economic status.

In his study, among 500 participants 216 (43.2%) were female and 284 (56.8%) were male. This study shows almost equal number of affected person in both genders. Possibly due to that female also involved house hold works as well as trends of female service holders increasing in Bangladesh. These findings also supported by several other studies in the different parts of the world. Laltanpuia et al [7], found almost similar result, where calculated odds are 1.37 times in males.

In the current study, among 500 patients 19 (3.8%) patients belong to upper class group, 159 (31.8%) patients belong to upper middle class group, 218 (43.6%) patients belong to lower middle class group, and 104 (20.8%) patients belong to lower class group.

In this study, among 500 patients 124 (24.8%) were day labor, 103 (20.6%) were student, 100 (20%) were housewives, 75 (15%) were farmer, 71 (14.2%) were service holder, 16 (3.2%) were businessman and 11 (2.2%) were unemployed. Laltanpuia et al [7] found almost same result, (53:69.7) were agricultural workers/daily wage earners (27:35.5%) or homemakers/housewives (26:34.2%). In our study housewives are more affected because they were also involved more in agricultural activities.

In this study, 144 (28.8%) patients had corneal injury, among them 16% patients had vegetative trauma, 4% patients had dust, sand trauma, 2.8% patients had animal injury, 2.2% patients had stick injury, 1% patients had nail injury, 2.8% patients had history of other injury like stone, wooden materials, flying insects, dirty wire etc. Ocular diseases predispose to corneal ulcer, such as chronic dacryocystitis, entropion and trichiasis were present in 10.2% patients. History of inadvertent use of steroids found in 1% patient. There were no specific predisposing factors in 71.2% of patients. Kaliyamurthy, et al [8] also found the main cause as injury with vegetative matter which is 337(31.6%). As an agricultural country, this is quite natural to be affected by vegetative matter. Not only male, females are also involved in agriculture dependent works in rural areas. This may be the reason behind high incidence of agricultural trauma, as well as high incidence in rural areas.

In this study, among 500 patients 96.6% had photophobia, 90% patients had foreign body sensation 88.4% had reduced vision, 85.4% had eye pain, 78.8% suffered from watering, 73.6% of them had discharge, 48.8% of them had burning sensation, 12.2% patients suffered from decreased corneal sensation and 11.2% patients noticed white spot in cornea first.

In the present study, slit lamp bio-microscopic examination of the patients shows, 450 (90%) patients had conjunctival injection, 350 (70%) patients had epithelial defect, 143 (28.6%) patients had stromal infiltration, 92 (18.4%) patients had hypopyon, 70 (14%) patients had feathery pattern, 44 (8.8%) patients had suppuration, anterior

chamber reaction was present in 22 (4.4%) patients and 11 (2.2%) patients had satellite lesion.

The above mentioned symptoms and signs are established clinical features of keratitis, although severity and intensity varies in different environmental and socio-demographic perspective and also causative organisms.

In the current study, the evaluation of etiology on the basis of clinical appearance. 307 (61.4%) patients were presented with viral keratitis, 115 (23.0%) presented with fungal corneal ulcer, 57 (11.4%) patients presented with bacterial corneal ulcer, 11(2.2%) patients had marginal keratitis, 4 (0.8%) patients had exposure keratitis, 4 (0.8%) patients had filamentary keratitis and 2 (0.4%) patients had acanthamoebic keratitis at the time of presentation (which was diagnosed elsewhere). Most common causative factors for keratitis are similar to this study finding. Incidence of the causative agents differs in different season. Age group and residing area also contributes the variation of causative agents.

In this study, assessment of the depth of keratitis of study subjects shows it was superficial up to anterior stroma 366 (73.2%) patients and deep up to deep stroma in 134 (26.8%) patients. According to this study finding most of the cases were diagnosed as viral keratitis and it usually spreads up to superficial stroma. This factor supports the predominant finding of superficial keratitis in this study.

In this study, assessment of area of corneal involvement shows, 234 patients had punctate epithelial defect, less than 3 mm of the cornea involved in 109 patients, 3 to 6 mm of the cornea involved in 98 patients and 59 patients had corneal involvement more than 6 mm. As mentioned earlier that most of the cases in this study was viral keratitis and punctate epithelial defect is the earliest form of viral keratitis, so the cases of punctate epithelial defect are more in this study.

In the present study, pure fungal infection was noted in 56 (11.2%) subjects and fungal infection associated with bacterial infection in 20 (4%) subjects, bacteria found in 28 (5.6%) patients, acanthamoeba found in 2 (0.4%) patients and no organism found in 12 (2.4%) patients. Puri LR et al. [9], also found the high incidence of fungal infection and low incidence of bacterial infection in their study. One reason could be due to large populations are belonging to agricultural background and rural community. The sensitivity and specificity of bacterial detection in Gram's stain is inferior to that of detecting fungal filaments by 10% KOH preparation. [10] [11].

Based on the above mentioned clinical patterns newer strategies may be adopted to reduce the morbidity associated with this condition are likely going to have to be multidimensional, involving corneal ulcer prevention, improved early and accurate diagnostics techniques such as next-generation sequencing, and novel antimicrobial agents to address the development of drug resistance. Adjuvant therapies that focus on modifying the immune response to the infection, thereby reducing the corneal melting and scarring that ultimately lead to poor vision, may have the greatest potential to improve clinical outcomes