A STUDY OF THE AETIOLOGICAL AND CLINICAL FEATURES OF INFECTED CORNEAL ULCERS AS STUDIED IN A RURAL POPULATION

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ABSTRACT

BACKGROUND

Corneal blindness is a major problem in India, which adds a substantial burden to the community in general and healthcare resources all over the world. In a rural population, corneal blindness is very common and in this study an effort is made to find out the aetiology and clinical features of a corneal ulcer to start the treatment at the earliest.

MATERIALS AND METHODS

Source of data is from the patients attending the Outpatient Department of Ophthalmology at M.V.J. Medical College and Research Centre, Hoskote, Bengaluru, during November 2010 to November 2012. Sample size - 60 patients. For all patients, a detailed history is taken and then a detailed examination under slit lamp biomicroscope is carried out. Local and general investigations are done wherever necessary.

RESULTS

Of the 60 patients, 24 (47%) had a history of corneal trauma caused by a variety of objects. The majority of ulcer patients were agricultural workers (51.6%) followed by labourers (20%), students (18.3%) and housewife (8.3%). Out of the 60 cases, 60% belonged to the lower class and 40% to middle class. Of the nontraumatic risk factors associated with the development of corneal ulcerations 38 (73.7%) of all 60 patients in the study had predisposing ocular or systemic conditions.

CONCLUSION

Corneal ulceration is a common problem in this part of Karnataka and most often occurs after a superficial corneal injury with organic material. In this study, majority of the cases were viral keratitis (48.3%), followed by bacterial (25%), fungal (25%) and protozoal (1.6%). Streptococcus Pneumoniae and Staphylococcus aureus accounted for majority of bacterial ulcers and Fusarium and Aspergillus species were responsible for most of fungal infections.

KEYWORDS

Bacterial Ulcer, Fungal Ulcer, Viral Ulcer, Corneal Blindness.

HOW TO CITE THIS ARTICLE: Subrahmanyam PM, Roche AL. A study of the aetiological and clinical features of infected corneal ulcers as studied in a rural population. J. Evid. Based Med. Healthc. 2017; 4(14), 789-794. DOI: 10.18410/jebmh/2017/152

BACKGROUND

The sense of sight is indeed the highest bodily privilege, the purest physical pleasure, which man has derived from his creator. Any defect in vision not only incapacitates and prevents one from indulging in normal day-to-day activities, but also causes a great loss to the society and nation by reducing human resources. Cornea is responsible for three quarters of dioptric power of the eye and hence any injury to it can cause considerable visual disturbances. Avascularity, while absolutely essential for optical purposes is a boon to the multiplying organisms.

Financial or Other, Competing Interest: None.
Submission 16-01-2017, Peer Review 21-01-2017,
Acceptance 06-02-2017, Published 14-02-2017.
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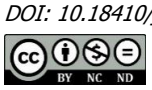
DOI: 10.18410/jebmh/2017/152



Corneal blindness is a major problem in India, which adds a substantial burden to the community in general and healthcare resources all over the world. Further, individuals with corneal blindness are usually of a younger age group compared with those suffering from cataract. Hence, in terms of total blind years, the impact of corneal blindness is greater.

The commonest cause of corneal blindness is infection made worse by malnutrition due to poverty and ignorance. Bacterial infections are quite frequently encountered and are an important preventable cause of monocular blindness. In the developing world, corneal ulcers appear to be occurring in epidemic proportions. Suppurative keratitis is the major cause of corneal blindness. While contact lens use is a major cause of corneal blindness in the developing world, a high prevalence of fungal infections, agriculture-related trauma[1] and use of traditional eye medicines is unique in the developing world.[2]

Although, a few bacteria namely Neisseria gonorrhoeae, Neisseria meningitides and Corynebacterium diphtheria can invade an intact cornea, most pathogens require a break in

the epithelial barrier to gain entry and adhere. Bacterial keratitis begins with the adhesion of bacteria to the damaged epithelium and stroma.

Because, the intact corneal epithelial barrier is an important first line of defense, development of an epithelial defect from corneal abrasions, foreign bodies or erosions may precipitate development of bacterial keratitis.

Trauma may breakdown the normal defense mechanism and allows the resident flora of the conjunctiva or those from the infected lacrimal sac to colonise the damaged corneal tissue or the pathogenic organisms are inoculated into the eye at the time of injury.

Fungal keratitis is common in men above the age of 30 years because they contribute significantly to the agricultural force of the country and are commonly injured with the plant and other organic material. Acanthamoeba keratitis is common[3] in patients who are exposed to contaminated water and improper use of contact lens solution.

Prompt treatment is essential for all forms of corneal ulcer to prevent complications and permanent visual impairment. Usually, treatment consists of systemic and topical broad-spectrum antibiotics until culture results identify the causative organism. The goals of treatment are to eliminate the underlying cause of the ulcer and to relieve pain. Severe fungal keratitis on presentation and inadequate response to current antifungals, which are fungi static is a major cause for poor response to fungal keratitis, which may lead to perforation or panophthalmitis.

Corneal ulcers by Fusarium spp. one of the most virulent ocular pathogens, underscores the need for more effective methods of diagnosis and treatment to decrease the burden of avoidable blindness.

The present study is undertaken to evaluate the current concepts of the aetiology. Clinical characteristics, pathogenesis and microbiological workup of infective corneal ulcers.

Definition

Suppurative keratitis defined as a defect in the corneal epithelium within filtration of underlying and surrounding stroma associated with signs of inflammation (with or without hypopyon) with super added infection.[4]

Suppurative keratitis is the most common cause for corneal blindness in India. In India, there are about 12 million blind people. Incidence of cornel blindness 15.4% the corneal ulcer contributing 9.34% of this. Corneal infections are second most common cause of monocular blindness in developing countries.

Increase in incidence since past 3 decades due to-

- Greater diagnostic techniques.
- Better laboratory techniques.
- Greater awareness in ophthalmic community.
- A true increase due to widespread use of broad-spectrum antibiotics, corticosteroids and immunosuppressive drugs.

Risk Factors

Ocular risk factors- Abnormalities of tear components, tear volume or tear drainage system are principal causes of compromised ocular surface. Local factors include entropion, infections of eyelid margin, disorders of lacrimation such as chronic dacryocystitis and keratoconjunctivitis sicca. Corneal conditions- bullous corneal oedema from corneal injury or surgery, neurotrophic disease, bullous keratopathy, herpetic ulcerations[5] or corneal epithelial basement membrane dystrophy.[6] Ocular surface pathologies- Cicatricial pemphigoid, Stevens-Johnson syndrome, atopic keratoconjunctivitis, radiation and chemical injury and vitamin A deficiency leads to squamous metaplasia of ocular surface epithelium and cause an unstable tear film.

External Risk Factors

For the onset of suppurative keratitis, trauma is most frequent risk factor in 44% of patients. Use of contaminated ophthalmic solutions following corneal trauma, inappropriate use of topical antibiotics could eliminate natural protection by normal flora. Topical anaesthetic abuse and local immunosuppression from prolonged use of topical steroids associated with development and worsening of fungal keratitis.

Contact lens use has been identified as common risk factor for suppurative keratitis in developed countries. The most common isolate causing contact lens associated suppurative keratitis are pseudomonas sp. Filamentous fungi with cosmetic lens wear and yeast with therapeutic use. All types of contact lenses have been associated with Acanthamoeba keratitis particularly extended wear soft contact lenses. Continuous lens wear increases the risk of infectious keratitis by approximately ten fold.

Systemic conditions such as malnutrition, diabetes, collagen vascular diseases, chronic alcoholism, coma or immune deficiency and leprosy. HIV positive patients more likely to develop fungal keratitis.

Aetiology-

1. Bacterial.
   i. Gram-positive organisms.
      A. Aerobes.
         a. Micrococci- Staphylococcus aureus- Staphylococcus epidermidis.
         b. Streptococci- Alpha, Beta- Haemolytic streptococci, Non-haemolytic streptococci, Streptococcus pneumonia.
         c. Bacilli.
            - Spore forming- Bacillus and Clostridium.
            - Non-spore-forming-corynebacterium and Listeria.
      B. Anaerobes-
         a. Cocci-Peptostreptococcus, Peptococcus.
         b. Bacilli-Clostridium, Actinomyces.
         c. Acid-fast bacilli-Mycobacterium and no cardia.
   ii. Gram-negative organisms.

A. Aerobes.
   a. Diplococcic- Neisseria.
   b. Rods- E. coli, Klebsiella, Enterobacter, Proteus, Pseudomonas.
   c. Diplobacillus- Moraxella.
   d. Coccobacillus- Haemophilus.

B. Anaerobes-
   a. Rods- Fusobacterium and Bacteroides.

2. Fungi- broadly classified into filamentous and non-filamentous depending on presence or absence of hyphae.
   a. Filamentous- Septate, non-septate.
      Blastomyces Rhizopus/Mucor.
      Non-pigmented and pigmented.
      Fusarium Curvularia, Aspergillus Alternaria, Penicillium.
   b. Non-filamentous-Yeasts. Dimorphic fungi. Candida Cryptococcus, Sporothrix.

3. Parasitic- Acanthamoeba.
4. Viral- Herpes simplex, Adenovirus, - Varicella- Zoster.

MATERIALS AND METHODS

Source of data for this clinical study of infective corneal ulcers in patients attending Outpatient Department of Ophthalmology in M.V.J. Medical College and Research Centre, Hoskote, during the period of November 2010 to November 2012. Sample size - 60.

Inclusion Criteria

All cases of keratitis due to ocular infections (viral, bacterial and fungal) confirmed of the cause either by clinical examination or by investigation.

Exclusion Criteria

All cases of keratitis due to noninfectious causes like nutritional (vitamin A deficiency), allergic keratitis (shields ulcer) confirmed of the cause by clinical examination or investigation.

METHODS

The socio demographic data is collected. A detailed history regarding the duration of ulcer, anything suggestive of local or general predisposing factors or any other treatment taken is asked. A Slit lamp biomicroscopic examination for the details of the ulcer is carried out. Ulcer is stained with 2% fluorescein. Lacrimal sac patency is checked.

Scraping is done under 4% lignocaine and inoculated directly into Blood agar, Chocolate agar and Saboraud's Dextrose agar.

Material from the corneal scrapping was also smeared on three separate glass slides, one for Gram stain, one for Giemsa stain and third for microscopic examination in the clinic as a 10% KOH wet mount. Microbial cultures were considered positive only if growth of the same was demonstrated on two or more solid media. The specific identification of bacterial pathogens was based on microscopic morphology, staining characteristics and biochemical properties using standard laboratory criteria. Fungi were identified by their colony character on SDA and by their microscopic appearance in KOH.

Laboratory investigations included urine examination for albumin, sugar, microscopy, blood for FBS/RBS. Treatment was begun with atropine 1% eye ointment/eye drops and a broad-spectrum antibiotic like fluoroquinolones 0.35% eye drops instilled every 30 minutes. Antibiotic ointments were used to treat bacterial corneal ulcers. Acyclovir 3% was used for viral keratitis. Systemic antibiotics, antifungals were given if the cornea perforates/extension to the sclera. Adjunct therapy with acetazolamide, vitamin C and A also instituted without delay.

RESULTS

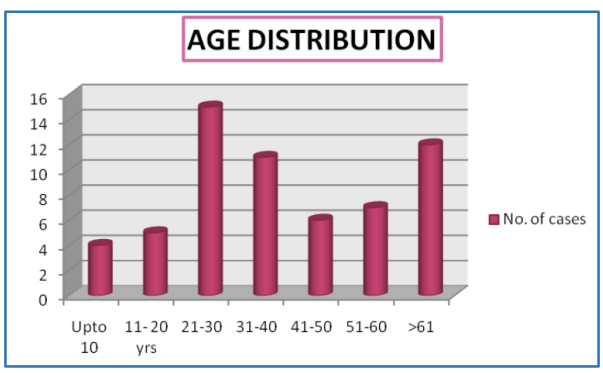


Figure 1. Age Distribution

From the above table, it is evident that the incidence of infective corneal ulcers is more common between second and third decade as well as above 60 years as they are more involved in outdoor and physical activities.

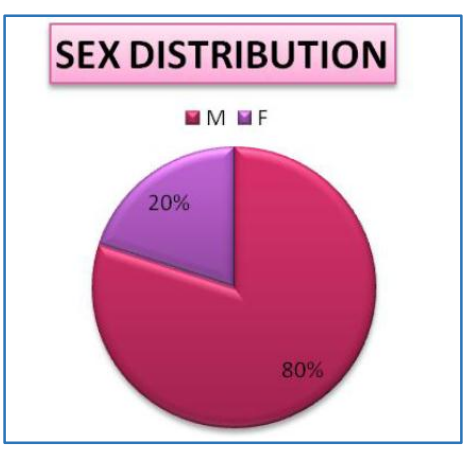


Figure 2. Sex Distribution

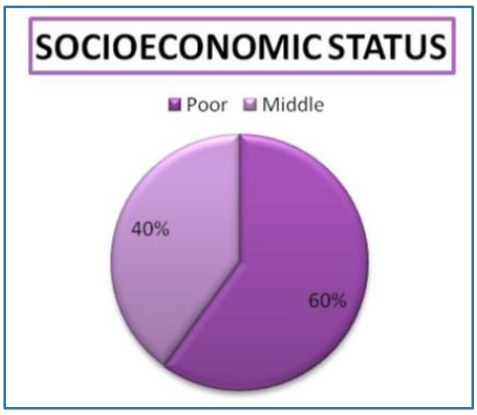


Figure 3. Socioeconomic Status

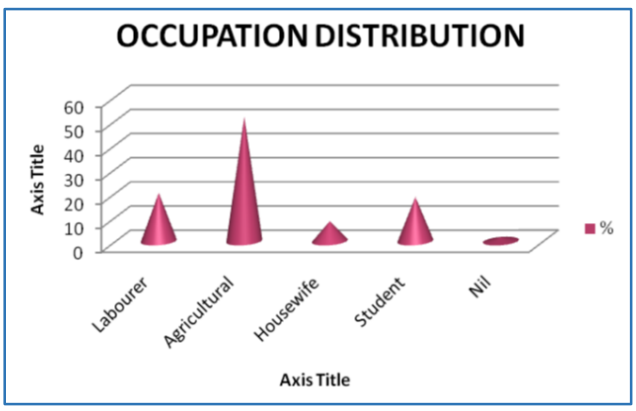


Figure 4. Occupation Distribution

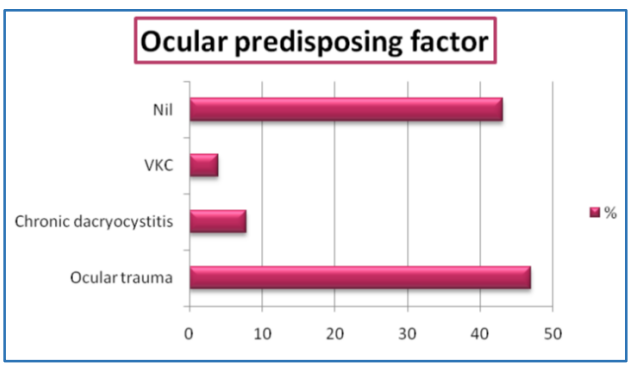


Figure 5. Ocular Predisposing Factor

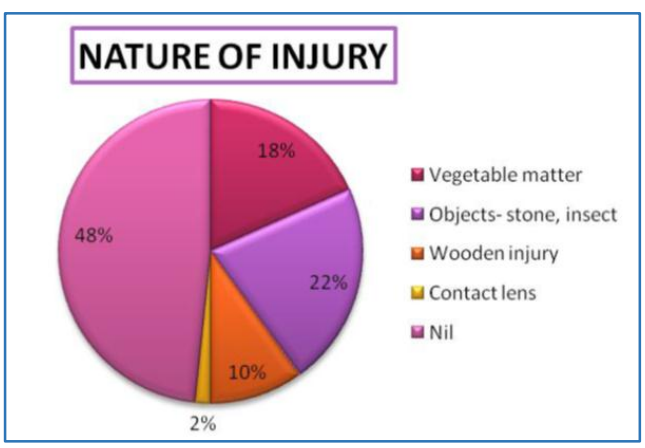


Figure 6. Nature of Injury

SI.NO	HYPOPYON	NO. OF CASES	%
1	Present	17	28
2	Absent	43	72
	Total	60	100

SI.NO	CORNEAL SENSATION	Bacterial	Fungal	Viral	Acanthamoeba
1	Normal	9	9	19	
2	Decreased	6	6	10	1
	Total	15	15	29	1

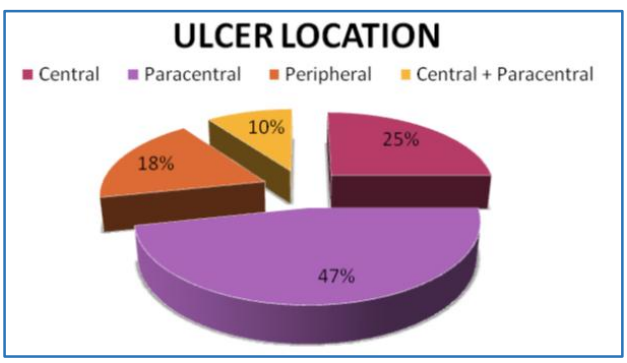


Figure 7. Ulcer Location

Visual acuity on presentation ranged from 6/6 to no light perception. Out of the 60 cases, 5 cases (8.3%) presented with perception of light and hand movements.

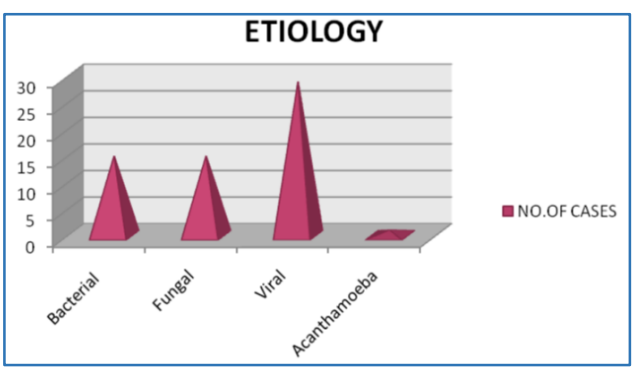


Figure 8. Aetiology

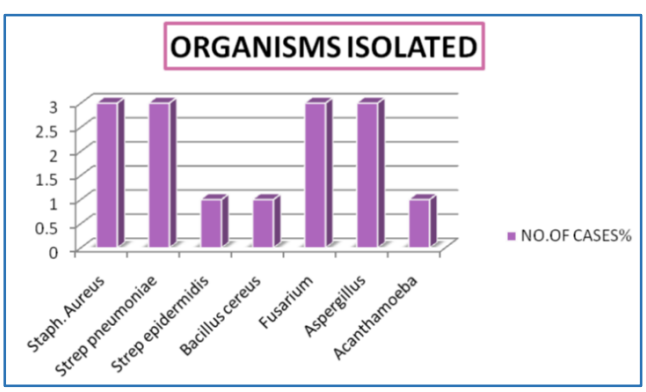


Figure 9. Organisms Isolated

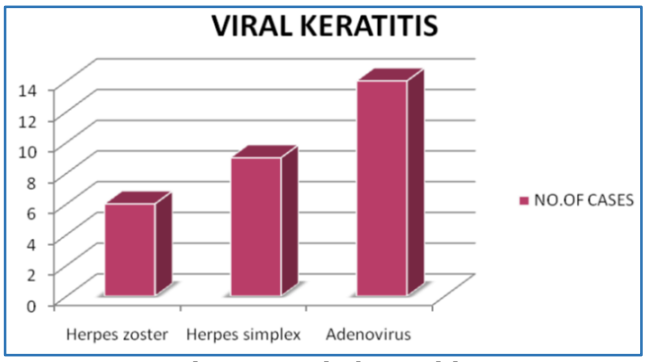
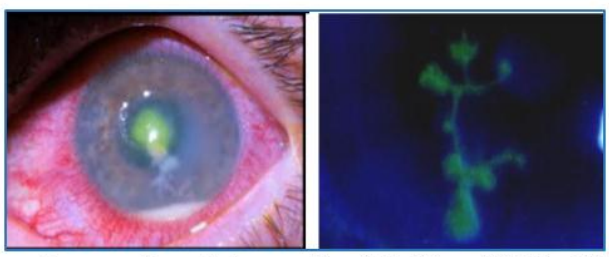


Figure 10. Viral Keratitis



Hypopyon Fungal ulcer ***Dendritic Ulcer- HSV Keratitis***

DISCUSSION

In South India, statistics documenting the prevalence of blindness from corneal scarring are not available, but the incidence of corneal ulceration is more than 10 times higher (11.3/10,000) than in a comparable population in USA.[4,7]

In this study, incidence of microbial keratitis was higher in males (80%) than females. Both sexes tend to develop corneal ulcers in the middle decade of life when presumably they are physically active and at a higher risk of corneal injuries.

Most ulcer patients were agricultural workers (51.6%)[8] followed by labourers (20%), students (18.3%) and housewife (8.3%). Out of the 60 cases, 60% belonged to the low class and 40% to middle class. Of the nontraumatic risk factors associated with the development of corneal ulcerations, 38 (73.7%) of all 60 patients in the study had predisposing ocular or systemic conditions.

By far, the most common predisposing factor for corneal ulceration in South India was a history of corneal injury. Of the 60 patients, 24 (47%) had a history of corneal trauma caused by a variety of objects. Therefore, it is observed that in developing countries, superficial corneal trauma during agricultural work often lends to rapidly progressing corneal ulceration and visual loss.

In South India, paddy and rice stalk in the field was the most common cause of superficial corneal trauma.[5] However, in this study, the most common cause of superficial corneal trauma was by stone piece (21.6%), followed by vegetable matter (11%) and wooden injury (10%).

In this study, common clinical characteristics of fungal corneal ulcer were long duration of history, dry, raised necrotic slough in 80% of cases and satellite lesions in 60% of cases. While bacterial keratitis features were short duration of history, greyish white with purulent slough in 70% cases. Viral keratitis was identified on vesicular lesions on face and lids for Herpes zoster, punctate keratitis in herpes simplex and adenovirus.[6]

Hypopyon was more frequently observed in bacterial (59%) than in fungal (41%) keratitis. This figure is similar to South Indian study.[9]

Corneal sensations were reduced in 10% (6) of bacterial ulcers, 10% (6) in fungal ulcers, 16% (10) in viral keratitis and 1.6% in acanthamoebic ulcer.

In the present study, the Gram stain report correlated with culture report in 80% of the cases, whereas in the study conducted by Galentine and Williams, it was found to be about 63%. Therefore, the Gram stain report can be used as a guide for initial therapy that can be modified later according to the culture reports.

In the present study, KOH stain correlated with culture report in all cases suggesting the wet mount is rapid, reliable and superior technique for diagnosing mycotic keratitis. In a similar study conducted by Vajpayee RB in Delhi,[10] it was observed that KOH sensitivity was found to be 94%. Therefore, KOH is particularly important for the early initiations of antifungal treatment in mycotic keratitis.

Foster reported that the use of multiple media will give the highest yield of positive cultures. Blood and chocolate agar were highly specific to isolate bacteria, but also sensitive in identifying fungal organisms. In our study, blood and chocolate agar were positive in 8 cases.

Microorganisms were isolated from 15 (50%) of the 30 cases that were cultured. This figure compares favourably with a recent study in Ghana where (57.8%) of all cultures were positive. Another study by M. Srinivasan in South India showed 68.4% of growth.

Out of 15 (50%) patients, 8 (16%) were pure bacterial growth, 6 (12%) were fungal growth. In one patient, acanthamoeba was isolated. In this study, the most common bacterial pathogens isolated were staphylococcus 3 (18%) and Streptococcus pneumonia 3 (18%) followed by Streptococcus epidermidis and Bacillus cereus. In the developing world, Streptococcus pneumonia should always be considered as the most likely cause of bacterial corneal ulceration until proved otherwise.

Of the 6 fungal isolates cultures from 15 corneal ulcers, 3 were Fusarium species and rest 3 were Aspergillus species.[10] This pattern of fungal organisms dominated by Fusarium species is similar to the spectrum of microbial keratitis reported from South Florida by Leisegang and Forster and Hagan from Ghana.

Of the 29 (48.3%) cases of viral keratitis, 11 (10%) cases were Herpes zoster virus, 9 (15%) were Herpes simplex virus and commonest 14 (23.3%) were adenovirus.

CONCLUSION

This study was developed primarily to determine the risk factors, specific pathogens responsible for corneal ulceration in Hoskote Taluk, Bengaluru District, Karnataka. Corneal ulceration is a common problem in this part of Karnataka and most often occurs after a superficial corneal injury with organic material. In this study, majority of the cases were viral keratitis (48.3%), followed by bacterial (25%), fungal

(25%) and protozoal (1.6%). Streptococcus pneumoniae and Staphylococcus aureus accounted for majority of bacterial ulcers and Fusarium and Aspergillus species were responsible for most of fungal infections. A presumptive diagnosis of viral keratitis was done based on the clinical features due to lack of laboratory facilities.

Most commonly acquired suppurative ulcers resolve with appropriate treatment. Delay in initiating the treatment probably contributes to poorer outcome from therapeutic measures.

These findings have important public health importance for the treatment, rapid referral, diagnosis and prevention of corneal ulceration in the developing world.

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