

## Original Research Article

**Predisposing Factors & Microbiological profile of corneal ulcer**

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**Abstract:** Infectious keratitis is a leading cause of corneal blindness in developing countries. Corneal ulceration results in 1.5–2 million new cases of corneal blindness annually, posing a major public health problem according to the World Health Organization (WHO) reports. The aim is to determine the predisposing factors and to identify the specific microbial agents responsible for corneal infections. The study group comprised of 120 patients attending cornea clinic at Department of Ophthalmology, Govt. Rajaji Hospital, Madurai [tertiary care Hospital] and Aravind Eye hospital [A private sector hospital dedicated to ophthalmology], Madurai during the period from December 2010 to July 2011. Microorganisms were identified by using standard microbiological procedures. Out of 120 patients 75 cases were culture positive. Among 75 patients, 48 were males and 27 were female patients. The maximum incidence was seen in 3<sup>rd</sup> to 5<sup>th</sup> decade. Various predisposing factors such as trauma, Previous ocular surgery, Steroid application, Lid abnormalities and H/o prior anti-fungal use have been identified. The prevalence of bacterial isolates are *S. pneumoniae* [40%], *Pseudomonas* [31%], *Nocardia* [18%] and *S. viridans* [9.09%]. The prevalence of fungal spp was *Fusarium* [52%], *A. flavus* [30%], *A. fumigatus* [7.5%], *A. Niger* [5.6%] and *Bipolaris* [3.7%]. Keratitis is common in 3<sup>rd</sup> to 5<sup>th</sup> decade with male predominance with agricultural background. Trauma is the most common predisposing factor among the bacterial isolate, *S. pneumoniae* is the most common isolate and *Fusarium* is the most common fungal isolate to produce keratitis.

**Keywords:** keratitis, corneal ulcer

**INTRODUCTION:**

Keratitis is an inflammation of the cornea caused by infectious organisms or non-infectious agents. Microbial keratitis is potentially a vision threatening condition that can be caused by bacteria, viruses, fungi or parasites. Infectious keratitis is a significant public health problem. The reported incidence range from 11 per 1, 00,000 person years in the United States to 799 per 1, 00,000 person years in the developing nations like Nepal. In India the annual incidence is reported to be 11.3 per 10,000. Infectious keratitis requires prompt diagnosis and treatment to prevent blindness or even enucleation.

Few clinical signs distinguish infectious keratitis from corneal inflammation associated with trauma, hypersensitivity and immune mediated conditions. Microbiological tests are needed to establish aetiological agents and antimicrobial susceptibility. Presumptive treatment of the keratitis is often begun immediately after specimens are obtained for isolation.

The regimen may be changed based on reports of culture and antimicrobial susceptibility test. Generally, microbial agents do not cause keratitis in immunocompetent hosts or hosts without prior epithelial injury. There are exceptions however in which organisms such as *Neisseria gonorrhoea*, *Listeria monocytogenes*, *shigella* and *Corynebacterium* spp, may invade an intact epithelial surface.

**Corneal Ulcer:**

Is an inflammatory or more seriously infective condition of the cornea involving disruption of its epithelial layer with involvement of corneal stroma? Predisposing risk factors associated with microbial keratitis usually involve disruption of the corneal epithelium such as wearing of contact lenses, trauma (iatrogenic and traumatic), contaminated ocular medications, and altered structure of the corneal surface.

Ocular trauma other than corneal surgery

repeatedly account for 48% in some developing country. But such trauma was responsible for only 27% of corneal ulcer in U.S., whereas in India trauma accounts for 60% of the corneal ulceration. Contact lenses are the most common risk factor for microbial keratitis diagnosed in the US. The annual incidence of contact lens associated keratitis is estimated at 0.04% for individual with daily wear soft lenses and 0.21% for individuals with extended wear lenses. Most of the bacterial keratitis is caused by 5 major groups. *Staphylococcus* spp, *streptococcus* spp, (*streptococcus pneumoniae*, Group A through G. *Streptococci*) other Gram positive organisms (*Bacillus* and *Propionibacterium* spp) Gram negative organisms (eg *Pseudomonas*, *Haemophilus* and *Moroxella*) and the *Enterobacteriaceae*, (*Proteus*, *Klebsiella*, *Enterobacter* and *Citrobacter*).

With the advent of refractive surgery, especially Laser Assisted In situ Kerato Mileusis (LASIK), more unusual organisms such as *Nocardia* and *Mycobacterium* spp are also causing keratitis. The apparent change in the causal organisms could be the result of numerous factors such as improved isolation techniques, increased use of topical corticosteroid (ie. Refractive and cataract surgery) increased population of immuno deficient patients and an expansion in the use of soft contact lenses, especially extended wear and cosmetic lenses. Fungi are generally responsible for less than 10% of corneal infections in most clinical cases reported in the United States whereas in India, fungal keratitis accounts for more than 60% of the cases. Keratitides due to moulds occur more commonly in areas with a warmer and more humid environment. The fungi are usually inoculated into the cornea by trauma involving plant or vegetable matter. The incidence of fungal keratitis varies according to geographic location and ranges from 2% in New York to 35% in Florida are the most common cause of fungal corneal infection in the Southern US whereas *candida* and *Aspergillus* spp are more common in the Northern States. In India *Fusarium* species are the most common organisms followed by *Aspergillus* species.

#### MATERIALS & METHODS:

The study group comprised of 120 patients attending cornea clinic at Department of Ophthalmology, Govt. Rajaji Hospital, Madurai [tertiary care Hospital] and Aravind Eye hospital [A private sector hospital dedicated to ophthalmology], Madurai during the period from December 2010 to July 2011. Corneal scrapings were collected for investigations by the Ophthalmologist.

1. No.15 and Bard Parker blades were used to

scrap the ulcer. A new sterile blade was used for each patient.

2. The corneal scraping was inoculated in a C. Streak pattern on culture media (Blood agar, chocolate agar, potato dextrose agar, Sabouraud's agar).
3. Direct Gram's staining and 10% KOH wet mount were made on the direct scraping.
4. Blood agar and chocolate agar plates were incubated at 37°C in the presence of 5% CO<sub>2</sub> for 2-7 days.
5. Sabouraud's dextrose agar slant and potato dextrose agar slant were incubated at 25°C aerobically.
6. The culture plates and slants were looked for the growth of organisms.
7. If bacterial growth was observed, staining (Gram's and modified acid fast) was performed.
8. Biochemical tests were done to identify the pathogen.
9. If the fungal growth was observed, lactophenol cotton blue staining was performed and fungus was identified based on the spore morphology.

#### RESULTS:

A total of 120 patients with infectious corneal ulcer were selected for study. This study involves males and females of all age group. 75 cases were culture positive. Out of 120 cases 85 patients were male and 35 patients were female. (50/120) 41% cases were found to be in the age group between 30-60 years and 58.3 % (70/120) of cases were in the age group of > 60 years. This study shows that the maximum incidence of keratitis was seen in 3<sup>rd</sup> to 5<sup>th</sup> decade. This study showed increased prevalence of keratitis in rural population accounting for 70%. Numerous predisposing factors have been implicated, trauma alone contributed to 54.16% of the cases in the development of keratitis.

Numerous predisposing factors have been implicated, trauma alone contributed to 54.16% of the cases in the development of keratitis. Co-existing ocular diseases such as lid abnormalities, previous ocular surgery, steroid application and history of prior antifungal agents contribute to 3.63%, 18%, 12.7% and 16.36% respectively. In analyzing the contribution of different trauma lesions in corneal ulcer, trauma with vegetative matter like paddy, leaf and wood were responsible for 40% of cases. Among the bacterial isolates, *S. Pneumoniae* 9/22 (40%) was the Predominant organism followed by *Pseudomonas* 7/22 (31%), *Nocardia* 4/22 (18%) and *S. viridans* 2/22(9.09%). Among the fungal isolates, 28 out of 53

(52.83%) cases were due to *Fusarium* species and next common agent isolated was *Aspergillus flavus* 16/53

(30%), *Aspergillus fumigatus* 4/53 (7.5%), *Aspergillus niger* 3/53 (5.6%) and *Bipolaris* 2/53 (3.7%).

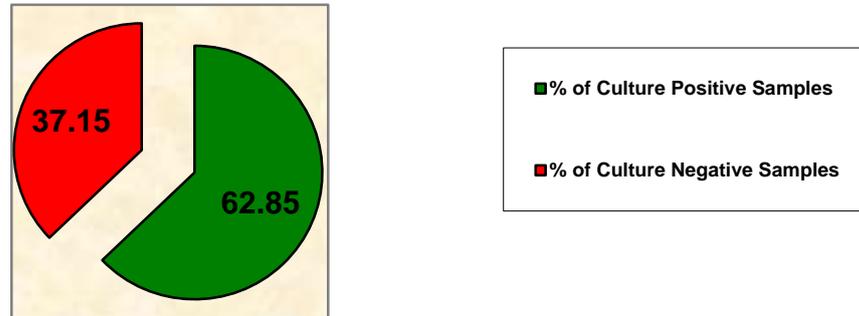


Fig-1: Culture Positivity in the Corneal Scraping Samples

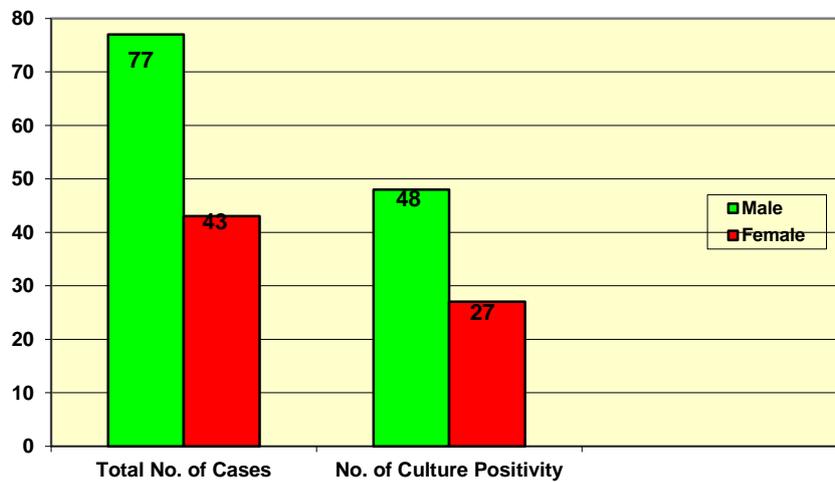


Fig 2: Gender distribution of infectious corneal ulcer

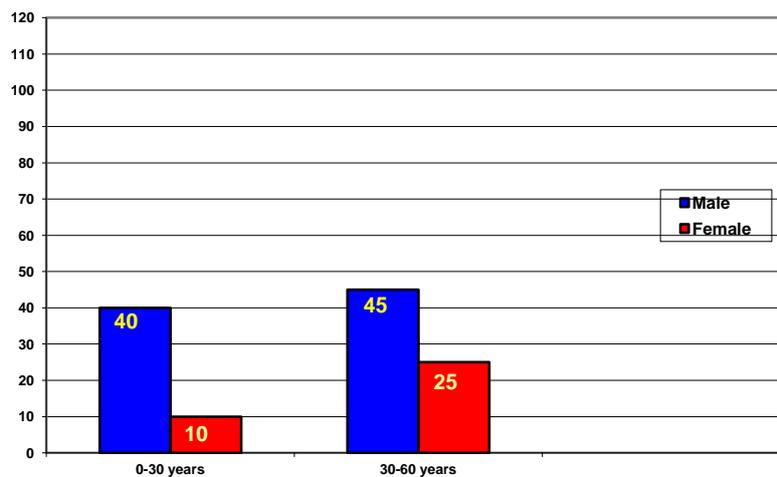


Fig 3: Age Distribution of Infectious Corneal Ulcer

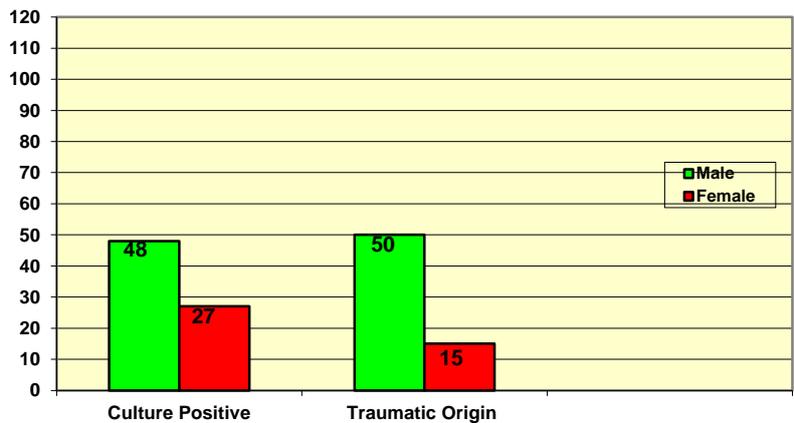


Fig 4: Distribution of predisposing factors causing corneal ulcer

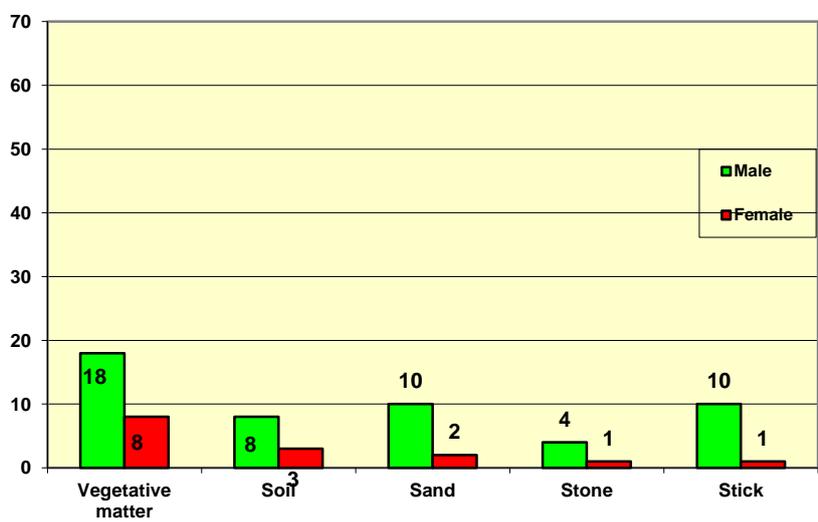


Fig 5: Distribution of corneal ulcer among traumatic cases

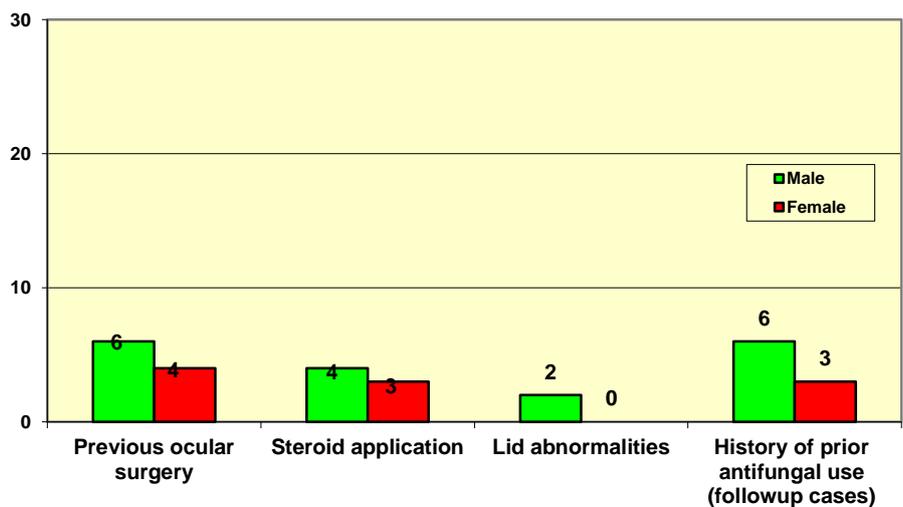


Fig 6: distribution of predisposing factors other than trauma

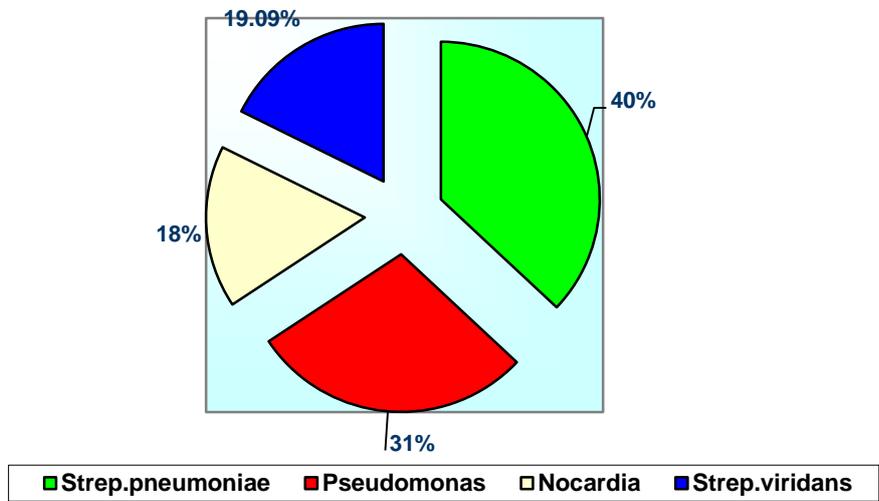


Fig 7: distribution of bacterial agents causing corneal ulcer

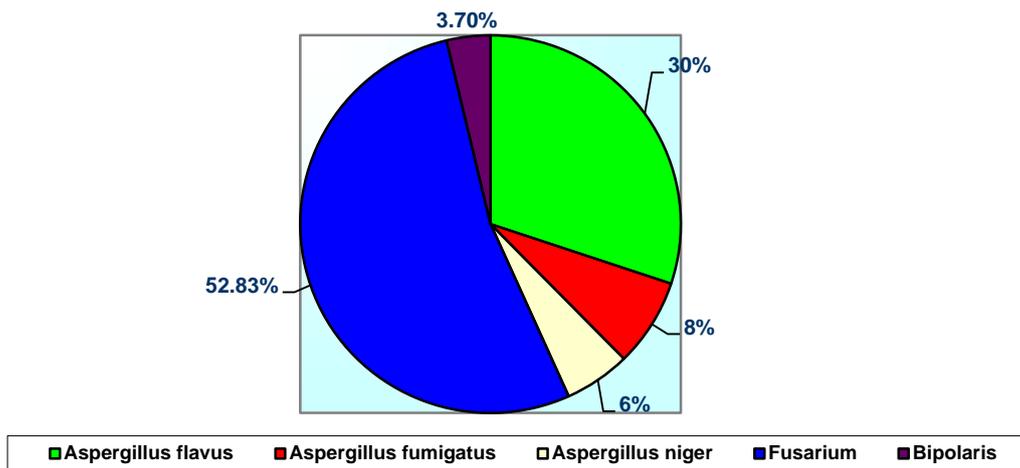


Fig 8: Distribution of fungal agents causing corneal ulcer

**DISCUSSION:**

Corneal ulcer is one of the most vision threatening ocular infection, which can cause significant morbidity. Patients can have poor clinical outcome including blindness if aggressive (or) prompt therapy is not initiated. There have been numerous studies both in India and abroad on infectious corneal ulcerations in the past 20 yrs. In all these studies it has been observed that there is a changing spectrum of agents involved and predisposing factors in different geographical regions.

In this study, male predominated females in all forms of keratitis. In this study, 77/120 (64%) were males and 43/120 (35.8%) were females. This study

correlates well with the study of sadia sethi *et al.*; [3] in 2010 from Peshawar who reported 67% males and 33% females with corneal ulcer and Reema nath *et al.*; [4] in 2011 from upper Assam revealed increased incidence of corneal ulcer in male patients (67.6%). Corneal infection among males could be attributed to their greater involvement in outdoor activities, thus being prone to corneal injuries with external agents. The distribution of corneal ulcer cases in rural and urban area revealed high prevalence of infected corneal ulcers in rural area 70%. This study is concordant with study by Basak Samar *et al.*; [11] in 2005 from West Bengal who reported that 78.5% of the patients were from rural areas.

In this study a very high percentage of the patients with history of corneal injury were recorded in patients with fungal keratitis 61%, where as in bacterial keratitis, corneal injury was found to be very low 16%. This study correlates with the study of Reema Nath *et al.*; [4] in 2011 from Assam which revealed (74.5%) of keratitis due to trauma, but the study conducted by sadia sethi *et al.*; [3] in 2010 from Peshawar reported trauma contributed to 39% of keratitis cases. In South India, paddy (or) rice stalks in the fields, thorns and tree branches was the most common cause of corneal injuries. In this study, corneal injury with vegetative matter contributes to 40%. This study correlates with the study concluded by Basak Samar *et al.*; [11] in 2005 West Bengal who reported (59.6%) traumatic cases due to vegetative matter. But, M. Srinivasan *et al.*; [1] in 1997 from Madurai, South India reported that the contribution of vegetative matter in causing corneal infection was 25.2%.

This difference in pattern of risk factors may be due to the variation in the occupational profile of the patients who live in those regions. Agricultural related works are common in developing countries. Butler *et al.*; [5] in 2005 from Philadelphia reported that chronic ocular surface disease (25%), contact lens wear (20%) and use of topical corticosteroids (14% were common risk factors among non-traumatic causes). But in this study, 16.36% of cases gave history of prior topical antifungal use, history of steroid application in 12.7%, history of prior ocular surgery in 18% of the patients. This study correlates with the study by Wong *et al.*; [6] in 2003 from Newzealand who reported 29.6% of cases due to previous ocular surgery and history of steroid application in 15% of the patients. In this study, bacteria and fungi were isolated in 60.8% samples out of this 64.38% were fungal isolates and 35.62% were bacterial isolates. Whereas the study conducted by MR. Kursiah *et al.*; [7] in 2008 from Malaysia reported that 36% of fungi and 64% of bacteria were positive in culture. But the study concluded by M. Srinivasan *et al.*; [1] in 1997 from Madurai reported 47.1% of bacterial isolates and 46.8% of fungal isolates.

Among the bacterial isolates in this study 9(40%) were *S. pneumoniae*, followed by *Pseudomonas* 7(31%) and *Nocardia* 4(18%) and *S. viridans* 2(9.09%). Among the Fungal, isolates, in this study *Fusarium* spp were 28/53 (52.8%), followed by *A. flavus* 16/53 (30.1%), *A. fumigatus* 4/53 (7.5%), *A.niger* 3/53 (5.6%) and *Bipolaris* 2/53 (3.7%). This study correlates with the study by M. Srinivasan *et al.*; [1] from Madurai in 1997 who has reported that *S. Pneumoniae* (44.3%)

was the most common bacteria followed by *Pseudomonas* spp (14.4%) and the most common fungal pathogen isolated was *Fusarium* spp (47.1%) followed by *Aspergillus* spp (16.1%). Feilmeier *et al.*; [8] from Nepal in 2010 has reported that among the fungi, *Aspergillus* was the most common organism and *S. pneumoniae* was the most common bacteria identified. Samar K Basak *et al.*; [11] from West Bengal in 2005 reported that *Aspergillus* spp (60%) and *Staphylococcus aureus* (46%) were the most common fungus and bacteria respectively. In this study, *S. pneumoniae* was the most common organism and among the fungal isolate, *Fusarium* was the most common organism to produce keratitis. Among the various predisposing factors, trauma in agriculturist plays an important role in producing corneal ulceration.

#### SUMMARY:

A Total of 120 cases of infectious keratitis were included in the study. Aetiological organisms were isolated in 75 (62.85%) of the cases. 70.66% of them were fungi and 29.33% of them were bacteria. Majority of the organisms were fungi belonging to the genus *Fusarium* (52.83%) followed by *Aspergillus* spp (*A. flavus* 30%), (*A. fumigatus* 7.5%) and (*A. Niger* 5.6%). Male predominance was seen in this study (64.38%). The age group most commonly affected between 30-60 years constituted 58.3% of cases. The incidence of infectious keratitis was more in rural area than in urban area 70%. Among the predisposing factors, trauma with vegetative matter 40% was found to be more important in the development of infectious fungal corneal ulcers. Fungal keratitis (70.6%) was more common than bacterial keratitis (29.3%). Among the fungal isolates, *Fusarium* species were the most common fungal isolate and it accounts for 52.83%. Among the bacteria, *S. pneumoniae* was the most common organism followed by *Pseudomonas* (31%), *Nocardia* (18%) and *S. viridans* (9.09%)

#### REFERENCES:

1. Srinivasan M, Gonzales CA, George C, Cevallos V, Mascarenhas JM, Asokan B, Wilkins J, Smolin G, Whitcher JP. Epidemiology and aetiological diagnosis of corneal ulceration in Madurai, south India. *British Journal of Ophthalmology*. 1997 Nov 1; 81(11):965-71.
2. Abraham D, Vitale S, West S, Isseme I. Epidemiology of eye injuries in rural Tanzania. *Ophthalmic epidemiology*. 1999 Jan 1;6(2):85-94.
3. Sethi S, Sethi MJ, Iqbal R. Causes of microbial keratitis in patients attending an eye clinic at Peshawar. *Gomal Journal of Medical Sciences*. 2010 Jun 1; 8(1).

4. Nath R, Baruah S, Saikia L, Devi B, Borthakur AK, Mahanta J. Mycotic corneal ulcers in upper Assam. *Indian journal of ophthalmology*. 2011 Sep 1; 59(5):367.
5. Bharathi MJ, Ramakrishnan R, Meenakshi R, Mittal S, Shivakumar C, Srinivasan M. Microbiological diagnosis of infective keratitis: comparative evaluation of direct microscopy and culture results. *British Journal of Ophthalmology*. 2006 Oct 1;90(10):1271-6.
6. Wong et al. Microbial keratitis *British J Ophthalmol*. 2003; 18: 108-120.
7. Kursiah MR, Sharif FM, Balaravi P. Retrospective review of corneal ulcers in Ipoh Hospital. *The Medical journal of Malaysia*. 2008 Dec; 63(5):391-4.
8. Feilmeier MR, Sivaraman KR, Oliva M, Tabin GC, Gurung R. Etiologic diagnosis of corneal ulceration at a tertiary eye center in Kathmandu, Nepal. *Cornea*. 2010 Dec 1; 29(12):1380-5.
9. Arora U, Gill PK, Chalotra S. Fungal profile of keratomycosis. *Bombay Hospital Journal*. 2009; 51(3):325-7.
10. Bharathi MJ, Ramakrishnan R, Meenakshi R, Mittal S, Shivakumar C, Srinivasan M. Microbiological diagnosis of infective keratitis: comparative evaluation of direct microscopy and culture results. *British Journal of Ophthalmology*. 2006 Oct 1; 90(10):1271-6.
11. Basak SK, Basak S, Mohanta A, Bhowmick A. Epidemiological and microbiological diagnosis of suppurative keratitis in Gangetic West Bengal, eastern India. *Indian journal of ophthalmology*. 2005 Jan 1;53(1):17.