ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

# Epidemiological Pattern and Risk Factors of Corneal Ulcers in Malabar Region of Coastal Kerala

**Kashinatha Shenoy**

Malabar Medical College& Research Centre, Calicut.673319 Kerala, India

## ABSTRACT

To study the association of various risk factors and epidemiologic factors of corneal ulcers in the patients attending a tertiary referral hospital at Malabar region of coastal Kerala. A retrospective analysis of all clinically diagnosed infective keratitis presenting over 2years between October 2008 to September 2010 was performed. A total of 96 corneal ulcer cases attending the outpatient department of Ophthalmology at Malabar Medical College Hospital and Research Centre ,Calicut, in Malabar region of coastal Kerala were studied. All corneal ulcer patients underwent detailed history, slit lamp examination, smears .and culture examination for etiological diagnosis. In 96 cases, 42.22 % fungal, 32.35 % bacterial, 12.5 % viral cases and 5.2 % undiagnosed infections were noted in the study. The commonest predisposing factor was ocular injury. In our study, we found that fungal corneal ulcer is the most common type of ulcer and ocular trauma is the most common positive factor for fungal corneal ulcers. Fungal ulcers are more common than bacterial ulcers. *Aspergillus spp*. and *Staphylococcus aureus* were the most common fungus and bacteria respectively. Suppurative keratitis and its complications constitute important causes of ocular morbidity; particularly in the developing world. These 'regional' findings have important public health implications for the treatment and prevention of suppurative corneal ulceration in this region of India.

**Key words:** mycotic keratitis, bacterial ulcer, *Aspergillus spp*, *Staphylococcus aureus,* keratitis.

***Corresponding author***

ISSN: 0975-8585

## INTRODUCTION

Corneal ulcer is a major cause of blindness in many developing countries[1]. Most microorganisms can invade the corneal stroma if the normal corneal defense mechanisms are compromised [1, 2]. A thorough understanding of the epidemiology, diagnosis and treatment of various forms of infectious keratitis is essential as well as important for the diagnosis and management of corneal ulcers [2]. Bacterial and fungal corneal ulcers are the commonest causes of corneal ulceration all over the world followed by viral keratitis and parasitic keratitis; the latter being usually seen in contact lens wearers due to acanthamoeba [3, 4, 5].

In general, the majority of the people are agriculturists in India and labour oriented workers [5]. These people are more vulnerable to corneal trauma and fungal infections. In the above context, the present study was undertaken to know the risk factors and epidemiological variables for corneal ulcer cases reporting to a tertiary referral hospital at Calicut.

## MATERIALS AND METHODS

A retrospective study was conducted from October 2008 to September 2010 at department of Ophthalmology at Malabar Medical College Hospital and Research Centre, Calicut in Malabar region of semi-urban coastal Kerala. The purpose of this study was to evaluate all types of keratitis seen at a tertiary care referral hospital over a period of two years. All these patients were reviewed for demographic features, predisposing factors, prior therapy, clinical features, microbiological findings, medical and surgical treatment and outcomes of therapy. In every case a detailed clinical history was taken with special note of any preceding ocular trauma. In patients who gave a history of trauma, details of the injuring agent as well as the mode of injury were taken. The time interval between injury, the onset of symptoms and the initiation of treatment was noted. History taking also included details of previous treatment, predisposing systemic conditions like diabetes, use of contact lenses [5, 6, 7].

All the patients underwent slit lamp examination and documentation of the ulcer – location, size, depth, nature of infiltrate, endothelial exudates and anterior chamber reaction or hypopyon were recorded [8]. Also, the patients underwent lacrimal sac syringing to rule out chronic dacrocystitis and best corrected visual acuity (BCVA) was measured using Snellen's distance visual acuity chart. Although clinical signs may be insufficient to confirm infection, a break in the continuity of the epithelium associated with underlying stromal infiltrate was considered infectious unless proved otherwise [5, 9, 10].

Once a clinical diagnosis of corneal ulcer was made, corneal scrapings were taken ,before any commencing treatment, by applying topical anesthesia with a sterile bald parker blade number 15.Materials obtained were processed for direct 10 % Potassium hydroxide (KOH) mount examination, gram stain and for culture studies-blood agar, chocolate agar, Saboraud's dextrose agar( SDA) [11-16].

Cases where the ulcer could not be scraped either because the ulcer had already perforated or impending perforation and very young children were excluded from the study.

**Treatment** [19, 20, 28]

Microbiological investigations should always be done for all the cases and according to culture specific treatment should be started. In our opinion, empirical therapy (based on previous clinical experience) with one or more commercially available broad spectrum antimicrobial agents should not be started without microbiological confirmation.
Our patients were treated with a antibiotic that has a broad spectrum activity against gram-negative and gram-positive organisms, such as fluroquinolones like ciprofloxacin, ofloxacin, moxifloxacin, fortified eye drops and tobramycin [20].

Further,initial treatment in fungal keratitis was treated with natamycin (5%) suspension administered half hourly [22, 29]. If the ulcer showed no signs of healing, 0.15% Amphotericin freshly prepared were added [23]. In those ulcers which showed clinical feature of viral corneal ulcers, 3% acyclovir was instilled. Cycloplegic agents such as atropine sulphate 1%, homatropine 1% or cyclopentolate 1% instilled three times a day reduce ciliary spasm and produce mydriasis, thereby relieving pain and preventing synechiae formation. Anti-glaucoma agents were used when intraocular pressure is high. The role of topical corticosteroids in the management of suppurative keratitis is controversial and hence they are best avoided [21, 22].

Modification of therapy is primarily based on clinical response to initial therapy and is guided by the results of culture and sensitivity tests. Patients those who were having ulcers more than 3 mm in visual axis, hypopyon and iritis were admitted to the hospital for close monitoring. Initially the patients were reviewed daily; in cases of peripheral ulcers less than 2 mm and no hypopyon.And once the patient responded to the treatment, the patient was followed up on alternate days, then weekly, then once in 2 weeks. Once the ulcer healed completely the patient was followed up after 1 month and finally after 3 months, to assess the scar density and visual acuity [21].

## RESULTS AND DISCUSSION

In a total of 96 cases of corneal ulcer, the highest incidence of corneal ulceration was between 21 to 60 years with relatively higher incidence between 51 to 60 years followed by the age group between 31 to 40 years. This age pattern is because of agricultural as well as outdoor work, since above workers have a higher risk for eye injuries. It can be seen that our study had a bimodal distribution (20-29 years and 65-74 years) when compared to studies by Musch et al[5] in 1983. The mean age group affected in this study is 46 years. This is almost equal to the mean age group of 44.3 years in a 2001 study by Schaefer et al. We can also note that the peak age group detected in similar studies in India by Upadhyaya [10] et al in 1991 was in the 41-50 years which affirms our findings.

ISSN: 0975-8585

**Table-1: Age Incidence**

| Age | No.of cases | Percentage |
|---|---|---|
| 01-10 | 1 | 01.04 % |
| 11-20 | 9 | 09.37 % |
| 21-30 | 18 | 18.75 % |
| 31-40 | 21 | 21.75 % |
| 41-50 | 16 | 16.66 % |
| 51-60 | 22 | 22.91 % |
| 61-70 | 9 | 09.37 % |
| Total | 96 | 100 % |

## Sex Incidence

In this study showed a male preponderance, male 54 (56.25 %) and females 42 (43.75%). The male: female ratio is 1.5:1. This is almost similar to 1.6:1 ratio in studies by Sreenivasan M et al [7] in 1984. Liesegang et al (1980) also describe a male predominance, whereas in the study conducted by Upadhyaya [10] both sexes were equally affected and majority of the females were outdoor workers.

**Table – 2: Sex Incidence**

| Age | No.of cases | Percentage |
|---|---|---|
| Males | 54 | 56.25 % |
| Females | 42 | 43.75 % |
| Total | 96 | 100% |

Also, the highest incidence was seen in housewives, i.e. 31.25 % followed by manual labourers, i.e.17.7 % followed by agricultural workers (12.5 %). Corneal ulcer is more prone in those who work outdoors especially in agriculture workers and manual labourers. Housewives are prone to injury by cutting firehood or vegetable matter. Studies conducted by Upadhyaya M, Gonzales et al study conducted at Sarojini Devi eye hospital in 1968 showed a high incidence among agricultural workers [10] (SDE Hospital Study – 55.5%, Upadhyaya M et al study – 49.6%, Gonzales et al study – 56.4%). In the study by Upadhyaya masons consisted about 22.5%. However we found that mason consisted only 4.16 % while Students consisted about 6.25 % and industrial workers were only 5.20 % cases only because of less industrialization in this part of Karnataka.

**Table-3: Incidence in Relation with Occupation**

| Occupation | No.of cases | Percentage |
|---|---|---|
| Agriculture workers | 12 | 12.5 % |
| Manual labourer | 17 | 17.70 % |
| Mason | 4 | 04.16 % |
| Housewives | 30 | 31.25 % |
| Drivers | 8 | 8.33 % |
| Students | 6 | 6.25 % |
| Industrial workers | 5 | 5.20 % |
| Others | 14 | 14.58 % |
| Total | 96 | 100% |

ISSN: 0975-8585

**Incidence in relation to predisposing factors**

Of the 96 cases in this study, ocular trauma was seen in 71 cases (73.95 %). This almost correlates with 65.4% reported by Sreenivas M et al [17] in 1996 and 63% cases reported by Pahalkar et al in 1985. In the study by Kunimoto DY, Shaima et al in 1998, incidence of trauma was only 21.2% [12]. This is because their studies included only children less than 16 years who were mostly students.

**Table – 4: Incidence of Trauma**

| Trauma | No.of cases | Percentage |
|---|---|---|
| Present | 71 | 73.95 % |
| Absent | 25 | 26.05 % |
| Total | 96 | 100% |

Most of the trauma that occurred was with vegetative matter, 20 out of 71, i.e.20.83 %. In the study by Upadhyaya MP et al, [10] reported 52.8% of them had trauma with vegetative matter, the vegetative matter includes leaves, sticks, paddy, wood. In this study, there was a case of trauma of animate origin, i.e. cow's tail. Also, a higher incidence of trauma with vegetative matter can be noted in housewives and agricultural workers [24]. Next in the list was trauma with insects (10.41%) and most of these patients were hit by insects while driving two wheelers at night and few with four wheelers. This was followed by trauma with stone, sand and dry concrete material. The trauma due to stone could be because of quarry mining prevalent in this area. But we can still conclude that a less number were affected by stone injury.

**Table 5: Type of Trauma**

| Type of trauma | No of patient | Percentage |
|---|---|---|
| Veg.matter | 20 | 20.83 % |
| Stone | 10 | 10.41% |
| sand particle | 6 | 6.25 % |
| Dry concrete | 6 | 6.25 % |
| Insect | 10 | 10.41% |
| Finger nails | 7 | 7.29 % |
| Bow and arrow | 2 | 2.08% |
| Book and Pens | 7 | 7.29 % |
| Wood | 2 | 2.08 % |
| Animal tail | 1 | 1.04% |
| Total | 71 | 100 % |

**Incidence of Previous Treatment**

Of the 96 patients who came to the OPD, most of the patients were referred from various general practioners in nearby areas. Only 4 of them had not taken any form of treatment. We can see that 68. 75 % of them were on antibiotic drops, 9.37 % of them were on antibiotic plus steroid drops and those on antibiotic and antifungal drops were nearly 8.33 %. Another 4.16 % cases were on herbal medication.

ISSN: 0975-8585

**Table – 6: Incidence regarding previous Treatment Taken**

| Previous Treatment | No. of cases | Percentage |
|---|---|---|
| Antibiotics | 66 | 68. 75 % |
| Herbal medicine | 4 | 4.16 % |
| antibiotics+ Antifungal | 8 | 8.33 % |
| Antibiotic plus steriods | 09 | 9.37 % |
| Antiviral | 5 | 5.20 % |
| No Treatment | 4 | 4.16 % |
| Total | 96 | 100% |

Out of our 4 patients, who had instilled herbal medicines, all 4 were positive for fungal growth. In a previous study by Puttana et al [18], the authors have noted 28% growth of fungus in herbal eye applications. We found that right eye was involved in 46.88 % cases and left eye was affected in 53.12 % of cases. No cases were reported which involved both the eyes.

**Table–7: Percentage of Patients with and without hypopyon**

| | With hypopyon | Without hypopyon |
|---|---|---|
| No. Of patients | 28 | 68 |
| Percentage | 29.16 | 70.83 |

**Table – 8: Percentage of fungal ulcer with and without hypopyon**

| | With hypopyon | Without hypopyon | Total |
|---|---|---|---|
| No.of patients | 19 | 26 | 45 |
| Percentage | 42.22% | 57.78% | 100% |

**Table – 9: Percentage of bacterial ulcer with and without hypopyon**

| | With hypopyon | Without hypopyon | Total |
|---|---|---|---|
| No.of patients | 11 | 23 | 34 |
| Percentage | 32.35 % | 67.64 % | 100% |

Of the 45 fungal ulcers, 42.22% of the fungal ulcers had hypopyon.
Of the 34 cases of bacterial corneal ulcer, 32.35 % of them were with hypopyon.

## Incidence of Microbial Ulcer

Fungal corneal ulcers had typical feathery edges, dry raised surface with endothelial plaque and immune ring with satellite lesions in almost all 45 cases. Bacterial corneal ulcers had depressed surface with moist appearance and stromal infiltration. Symptoms in these were more than signs with lid edema in 34 cases [12]. cases of viral ulcers gave typical clinical features of decreased corneal sensation. Typical dendritic pattern which when stained with Flourescein and seen under cobalt green filter. Among the other ulcers, [5] of them were unidentifiable. In this study, there was not a single case of protozoal corneal ulcer.

ISSN: 0975-8585

**Table – 10: Microbiological pattern of corneal ulcer**

| | No.of cases | Percentage |
|---|---|---|
| Fungus | 45 | 46.87 |
| Bacteria | 34 | 35.41 |
| Viral | 12 | 12.50 |
| Protozoal | 0 | 0 |
| Others | 5 | 5.20 |
| Total | 96 | 100 |

## Incidence of the Organisms

Of the 96 cases, 44.12% were fungal ulcers. 22.54% of them were bacterial ulcers. 3.92% of them were viral ulcers. Not a single case of acanthamoeba was seen in this study. This study in contrast to the study conducted by Upadhayaya et al in the year 1999 had 63.2% of bacterial ulcers and only 6.2% of fungal [10] In the study conducted by Sreenivas M et al in 1996 showed equal incidence of bacterial and fungal ulcers [17].

**Table – 11: Organisms grown from bacterial corneal ulcers**

| Organisms | No.of cases | Percentage |
|---|---|---|
| Staph.aureus | 18 | 52.94 |
| Pseudomonas | 7 | 20.58 |
| Klebsiella | 3 | 8.82 |
| E.Coli | 2 | 5.88 |
| Enterococci | 1 | 2.94 |
| Gram +ve culture –ve | 3 | 8.8 |
| Total | 34 | 100 |

*Staph.aureus* consists of majority of the cause of bacterial corneal ulcer in this study. This tallies with the study conducted at Sales Gonia Eye Hospital in 2001. In the study conducted by Upadhyaya 31.1% of the 256 bacterial ulcers [10] *pneumococcus* was the common isolate, this was same with studies conducted at Vellore in 1985 by Carmichael et al in 1985 and in Madurai in 1996. This study is similar to the study by Musch et al [5] in 1983 reported *pseudomonas* and *Staph.aureus* as the common isolate. In this study 43.47% of the isolates were *staph.aureus* and 17.39% of them were pseudomonas. 13.05% of them were *Klebsiella* followed by *E.coli* 8.7% and *Entercocci* 4.34%. 13.05% of them were gram's positive with culture negative. Foster et al suggested negative culture could be due to sterile ulcers, previous antibiotic treatment and improper selection of media.

**Table –12: Fungal Organism grown from corneal ulcer In SDA**

| Organisms | No.of cases | Percentage |
|---|---|---|
| Fusarium | 15 | 33.33 % |
| Aspergillus | 7 | 15.55 % |
| Pencillium | 6 | 13.33 % |
| Curvularia | 3 | 6.66% |

| | | |
|---|---|---|
| Candida | 4 | 8.88 % |
| KOH +ve, Culture –ve | 10 | 22.22 % |
| Total | 45 | 100% |

Of the fungi, commonest isolate was *fusarium* species, i.e.37.78% [26, 27, 29]. Next in this study were *Aspergillus* and *pencillium* species with 11.11% each followed by curvularia and *aurobasidium* species which was 6.67% followed by *candidia* which was 4.44%. This can be comparable to the study by Sreenivasan M et al at Madurai where *fusarium* species was 47% and *Aspergillus* was 16.1%. In the study conducted by Alexander TT et al in 1995, both these organisms were equally represented. In the Dunlop AA et al study conducted in Bangladesh in 1995, *aspergillus* was found to be more than *fusarium*. Studies at Sarojini Devi Eye hospital in 1968 also showed similar report. Upadhyaya MP [10] et al also reported *aspergillus* as the most frequent organism isolated. In this study, there was 10 cases of KOH positive and culture negative, this shows that simple test like KOH can be done to detect a case of fungal corneal ulcer.

In this part of Karnataka, the commonest organism isolated was *staphylococcus aureus* among the bacterial corneal ulcer and *fusarium* was the most common fungal isolates seen among the fungal corneal ulcer, which is similar to other studies conducted in South India.

**Treatment Response**

Of the 96cases of corneal ulcers, 97% of them had healed with either a macular, or a leucomatous scar and the visual outcome was good in cases which had a peripheral corneal ulcer. Most of the central corneal ulcers healed with improvement in vision depending on the corneal opacity. 4 persons had complications like perforated corneal ulcer which did not respond to the conventional treatment as they were patients with poor compliance and they had to undergo therapeutic keratoplasty. One person was lost to follow up.

**Table – 13: Treatment Response**

| | Healed with Rx | Rx for complication | Lost to follow up | Total |
|---|---|---|---|---|
| No.of patients | 91 | 4 | 1 | 96 |
| Percentage | 94.79% | 4.16% | 0.98% | 100 |

## DISCUSSION

Commonest predisposing factor is trauma with vegetable matter .The incidence of bacterial and fungal corneal ulcers is high in the forty one to fifty years old age group. The mean age is 46.Males are more commonly affected than females. The bacterial and fungal corneal ulcers are seen more commonly among those who work out doors. Almost all the bacterial and fungal ulcers presented with the typical clinical presentation. Fungal corneal ulcers are more common in this study .Among the fungi, Fusarium is more common. Among the bacteria Staph aureus topped the list. We found that 5 % Natamycin is an ideal drug of choice for most of the

filamentous fungi. Most bacterial ulcers responded to commercially available topical antibiotics. Viral corneal ulcer healed well with Acyclovir 3% eye ointment. In this study no case of Acanthamoeba was seen. We can safely conclude that with early diagnosis and appropriate treatment blindness due to the disease can be prevented in a vast populous agricultural country like India.

## CONCLUSIONS

Suppurative keratitis due to trauma in all occupations is a sight-threatening disorder. Early clinical suspicion, rational use of laboratory diagnostic procedures and appropriate therapy can go a long way towards reducing ocular damage from this disorder in India and elsewhere. Our study highlights the relative importance of ocular trauma and corresponding high incidence of fungal ulcers. Early recognition and institution of appropriate therapy by community ophthalmic workers or ophthalmologists could prevent corneal blindness. Prompt referral of advanced cases to tertiary eye care centres can be a vision-saving measure. Community awareness of risk factors and the use of contaminated traditional herbal eye preparations need to be screened by health workers across the communities.

## ACKNOWLEDGEMENT

All authors would like to thank all the patients and the department staff and managements of their respective institutions who cooperated in the above study. Authors wish to clarify that they have not received any financial support or funding from any commercial sources.

## REFERENCES

[1] Reed WP, Williams RC. IJ Chronic Dis 1978; 31: 67.
[2] Ormerod LD, Hertzmark E, Gomez DS et al. Ophthalmology 1987; 94: 1322.
[3] Albert DM, Jakobeic FA, Azar DT, Gragoudas ES. Principles and practice of Ophthalmology, Second Edition, WB Saunders Company. 2000, 1994; Vol.II, 906-914, Vol.2; 893-905.
[4] Arfa RC. Infectious ulcerative keratitis. In -Grayson's diseases of the cornea. 1991, pp.163-164. CV Mosby, St.Louis.
[5] Musch DC, Alan Sugar et al. Arch Ophthalmol 1983; 101: 154-158.
[6] Frederic S Schaefer, Olivier Bruttin, Leonidas Zografos et al. Brit J Ophthalmol 2001; 85: 842-847.
[7] Jones DB. Ophthalmology 1981; 88: 814
[8] Ostler HB. Diseases of the external eye and adnexa. Text book of Ophthalmology. Baltimore, 1993; Williams and Wilkins
[9] Carmichael TR, Wolpert M et al. Brit J Ophthalmol 1985; 69: 920-926.
[10] Upadhyaya MP, Karmacharya PC, Koirala S et al. Am J Ophthalmol 1991; 111(1): 92-99.
[11] Reddy S, Satyendran OM et al. Am J Ophthalmol 1972; 20(3): 101-107.
[12] Pahalkar S, Thomas A. Alexander TA and Koshi G. Indian J Ophthalmol 1985; 3: 289.

[13] Jones DB, Liesegang TJ and Robinsons NM. Lab diagnosis of ocular infections. Cumulative techniques and proceedings in Clinical Microbiology.
[14] Epley KD, Katz HR et al. Cornea 1998; 17(1): 74-78.
[15] Ishibashi Y; Hommura S, Matsumoto Y. Am J Ophthalmol 1987; 103: 636.
[16] Vajpayee RB et al. Ann Ophthalmol 1993; 25(2): 68-71.
[17] Srinivasan M. Keratomycosis in South India. The transactions of the world congress on the cornea III, edited by Dwight Cannangh 1984.
[18] Puttanna ST. Primary fungus keratitis after instillation of herbal juice as a part of native treatment. Trans. 2nd Cong. Asia-Pacific Acad. Ophth. 1964.
[19] Jones DB. Strategy for the initial management of suspected microbial keratitis. In -New Orleans Academy of Ophthalmology. Symposium on Medical and Surgical Diseases on the Cornea. St. Louis, 1980; Mosby Year Book.
[20] The Ofloxacin Study group. Ophthalmology 1997; 104(11): 1902-1909.
[21] Kupferman A, Leibowitz HM. Arch Ophthalmol 1976; 94: 1981-1984.
[22] Arora I, Kulshrestha OP, Upadhyay S. Indian J Ophthalmol 1983; 31(Suppl): 1019-1021.
[23] Thomas PA et al. Mycoses, 1988; 31: 278.
[24] Gopinathan V et al. Cornea 2002; 21: 555-559.
[25] Bharathi MJ, Ramakrishnan et al. IJO 2003; 51: 315-321.
[26] Chowdhary A et al. Cornea 2005; 2: 69-76.
[27] Srinivas M et al. IJO 2007; 55: 1.
[28] Shah A, Sachdev A, Coggon D, Hossain P. Br J Ophthalmol 2011; 95:762-767.
[29] Said DG , Otri M, Miri A, Kailasanathan A, Khatib T, Dua HS. Br J Ophthalmol 2011;95:1623-1624.