Section: Ophthalmology

Original Research Article

CORNEAL ULCERS – A SEASONAL

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Abstract

Background: In India and other developing countries, superficial injury causing corneal abrasion in agriculture worker is a major risk factor for causation of microbial keratitis. We present the results of an investigation of seasonal trends in infectious keratitis in southern India. This study analyzed data from the microbiology laboratory of the Regional Institute of Ophthalmology, Chennai, a large volume referral center with a catchment area covering much of southeast India. **Materials and Methods:** A retrospective analysis of the microbiological laboratory database at the Regional Institute of Ophthalmology, Chennai, India, was conducted on all patients seen from 1 January 2019 to 31 December 2022. The data was collected in respect to mode of injury, symptoms, time of presentation, management and outcome. Initial visual acuity was taken in all the patients and underwent Slit lamp examination with documentation of corneal lesion after staining with fluorescent strip. Site, shape, size, margin and floor of the ulcer were recorded regularly. Anterior chamber reaction, hypopyon, hyphaema was measured and recorded. All patients underwent empirical antimicrobial therapy and related medication. Final visual acuity (BCVA) was taken before discharge of the patients. Management was classified into conservative (medical) and interventional (surgical). **Result:** A total of 1379 patients were included in this study. Male (M) was more common than female (F), male and female ratio was 1.4:1. Most common age group was 50-60 years, which was 42% . Most common mode of ocular injury was due to vegetable matter injury, ¬¬(52.8%). The most common residence district of the patients was Chennai followed by Tiruvallur. A majority of patients (64.75%) with fungal keratitis were agricultural workers, whereas bacterial keratitis occurred more commonly (57.62%) in non-agricultural workers ($p < 0.0001$) . Corneal injury was identified in (93.54%) patients, and it accounted for 96.15% in fungal keratitis ($p < 0.0001$) and 100% in Acanthamoeba keratitis. The predominant bacterial and fungal organisms isolated during the study period was staphylococcus(30.9%) and fusarium(26.12%) respectively. **Conclusion:** Climate and the environment in which the person lives influences the type of infection that develops. Corneal injury is the principal risk factor for the development of fungal keratitis, but coexisting ocular diseases are the main risk factors for bacterial keratitis. There was a seasonal increase in the incidence of fungal keratitis and the reported cases of microbial keratitis during windy and dry weather, whereas the incidence of bacterial keratitis is consistently the same throughout the year.

INTRODUCTION

In India and other developing countries, superficial injury causing corneal abrasion in agriculture worker is a major risk factor for causation of microbial keratitis.[1] It is seen that ocular injuries are most common in farmers and the risk of developing fungal corneal ulcer seems to be very high frequently associated with a minor trauma of vegetable matters. Regional variation of ocular injury is well known. Previous studies have reported an association between climate and keratitis. Bharathi et al reported that fungal keratitis predominated in the hot and windy environment of southeast India.[2] A longitudinal study of keratitis in Australia found hot summer months conducive to infection by

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Pseudomonas aeruginosa, whereas winter months favoured Streptococcus pneumoniae.[3]

A closer understanding of the seasonal patterns of infectious keratitis is theorized to lead to improved treatment or prevention for 2 reasons.[4-6] Firstly, in areas with limited access to ophthalmologic care, practitioners often start empiric treatment for keratitis without the benefit of culture data. Tailoring empiric treatment to cover the most common pathogens may improve clinical outcomes. Secondly, intensifying screening efforts during periods of higher infectious keratitis incidence supports frontline health care providers who often are not ophthalmologists and have minimal training in eye disease.

We present the results of an investigation of seasonal trends in infectious keratitis in southern India. This study analyzed data from the microbiology laboratory of the Regional Institute of Ophthalmology, Chennai, a large volume referral center with a catchment area covering much of southeast India.

MATERIALS AND METHODS

A retrospective analysis of the microbiological laboratory database at the Regional Institute of Ophthalmology, Chennai, India, was conducted on all patients seen from 1 January 2019 to 31 December 2022. The study included cases with a clinical diagnosis of a corneal ulcer, defined as an epithelial defect with stromal infiltration and suppuration associated with signs of inflammation. For inclusion, cases must have had a smear and/or culture performed. Marginal ulcers, Mooren's ulcers, interstitial keratitis, sterile neurotrophic ulcers, and peripheral ulcerative keratitis were excluded. The data was collected in respect to mode of injury, symptoms, time of presentation, management and outcome. Initial visual acuity was taken in all the patients and underwent Slit lamp examination with documentation of corneal lesion after staining with fluorescent strip. Site, shape, size, margin and floor of the ulcer were recorded regularly. Anterior chamber reaction, hypopyon, hyphaema was measured and recorded. All patients underwent empirical antimicrobial therapy and related medication. Final visual acuity (BCVA) was taken before discharge of the patients. Management was classified into conservative (medical) and interventional (surgical).

RESULTS

A total of 1379 patients were included in this study. Male (M) was more common than female (F), male and female ratio was 1.4:1. Most common age group was 50-60 years, which was 42%.

Most common mode of ocular injury was due to vegetable matter injury, (52.8%). [Figure 1]

The most common residence district of the patients was Chennai followed by Tiruvallur. A majority of patients (64.75%) with fungal keratitis were agricultural workers, whereas bacterial keratitis occurred more commonly (57.62%) in non-agricultural workers ($p < 0.0001$). Corneal injury was identified in (93.54%) patients, and it accounted for 96.15% in fungal keratitis ($p < 0.0001$) and 100% in Acanthamoeba keratitis.

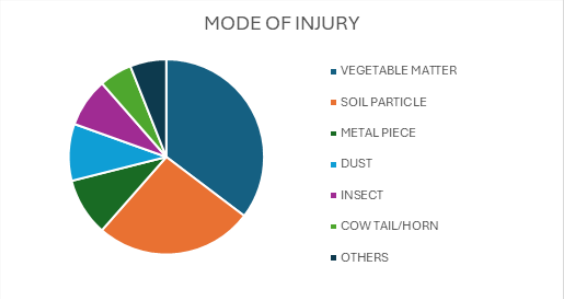

Figure 1: Chart showing the most common mode of injuries predisposing to microbial keratitis

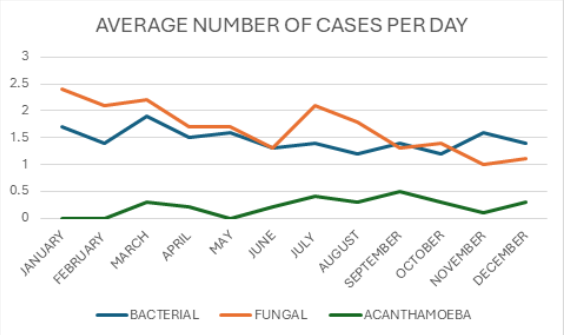

Figure 2: Chart showing the number of culture-confirmed infectious keratitis cases due to fungal, bacterial, and Acanthamoeba spp for each day of the year between January 1, 2019, and December 31, 2022.

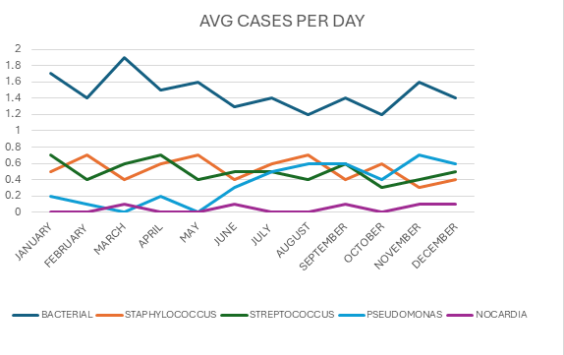

Figure 3: Chart showing the number of culture-confirmed infectious keratitis cases due to all bacteria, Streptococcus pneumoniae, Nocardia spp, and Pseudomonas spp between January 1, 2019, and December 31, 2022.

Evidence of secular trends in case counts was seen over the 4-year period with an increase in mucor positive corneal ulcer cases during the years 2021-2022. Smoothed plots of the number of culture-confirmed cases due to fungal, bacterial, and Acanthamoeba spp for each day of the year suggested the presence of seasonal patterns.

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The predominant bacterial and fungal organisms isolated during the study period was staphylococcus (30.9%) and fusarium (26.12%) respectively. Analyses of total bacterial keratitis, S. pneumoniae, and Nocardia spp revealed no evidence of periodicity using either the Edwards test or the periodogram. In contrast, the majority of cases of Pseudomonas spp occurred from July to December.

DISCUSSION

This article identifies several seasonal trends in infectious keratitis in the southern Indian population served by Regional Institute of Ophthalmology, Chennai.

Previous studies have reported an increased incidence of fungal keratitis with higher temperatures.[7,8] In southeast India, however, a hot climate persists perennially, and therefore other factors must account for the observed trends.7 Previous studies by Prajna et al. noted that incidence of fungal keratitis were becoming more common and this was proved again in our study.[9]

In our study, we noticed overall cases of infectious keratitis peak between January to March with a smaller spike in July. January being the main harvesting season for Samba a common rice variety grown in districts adjacent to Chennai may be a possible explanation. The windy season in Tamil Nadu, which peaks in July, may predispose to the development of infectious keratitis because pathogens invade corneal stroma after trauma by airborne dust particles dispersed in high wind conditions.[10] [Figure 2]

In South India, paddy or rice stalks in the fields, thorns, and tree branches were the most common cause of corneal injury. In this study, corneal injury with vegetative matter predisposing to corneal infection was found to be higher (52.8%) than other agents.

Incidentally, in our study it was also noted that injury caused by cow's tail or horn accounted for 8.13% cases and was more common during January corresponding with the Tamil harvest festival of Pongal.

In contrast with the previous studies from the region, contact lens wear was the most widely recognised risk factor for occurrence of Acanthamoeba keratitis. This reflects the increasing use of contact lens by the study population of which majority belong to Chennai a major metropolitan city in South India.

In contrast with fungal keratitis, bacterial keratitis did not follow a statistically significant seasonal pattern with the exception of P. aeruginosa, which exhibited a broad peak from July to December. The months from July to December correspond to the heavy rainfall season for southeast India, raising a possible association between the monsoon season and the seasonal fluctuation of P. aeruginosa keratitis. [Figure 3]

Another alarming finding that was noted in our study was the non-usage of protective goggles and headgear by agriculture and industrial workers was seen in the study population (99.4%).

Our study has the following limitations. First, this study examined data from only one centre with a limited catchment area. The other limitations include were the non- availability of vision record prior to injury and the long term follow up. Selection bias inherent to a referral centre may result in a disproportionate number of recalcitrant cases in the study.

This article is intended to share our experiences in conducting research activities in the field of microbial keratitis at Regional Institute of Ophthalmology, Chennai over the study period of 4 years. This article selectively deals with our experience of dealing with microbial keratitis. It does not profess to be a comprehensive review article. At the same time, we hope that this article encourages the reader to take steps to formulate additional research which might end up either supporting or refuting our findings.

The regional information is important as the causative agent and pattern of ocular injury varies significantly from region to region with regard to facilities empirical management.

Prevention of injury itself by using protective goggles, head gear during the agriculture work is a cheaper and more feasible option.

CONCLUSION

In conclusion, climate and the environment in which the person lives influences the type of infection that develops. Corneal injury is the principal risk factor for the development of fungal keratitis, but coexisting ocular diseases are the main risk factors for bacterial keratitis. There was a seasonal increase in the incidence of fungal keratitis and the reported cases of microbial keratitis during windy and dry weather, whereas the incidence of bacterial keratitis is consistently the same throughout the year.

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