Bacterial Keratitis and Fungal Keratitis In South Kerala: A Comparative Study

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Abstract: A prospective study on microbial profile and epidemiological characteristics of suppurative keratitis was done at our institution from 2007 March to 2009 February.

Aim: Of the study was to analyse the frequency of bacterial and fungal keratitis and to compare the clinical, epidemiological and microbiological characteristics of bacterial and fungal keratitis.

Materials and methods: All clinically suspected cases of infective keratitis, attended our institution for a period of 2 years were enrolled for the study. Corneal scrapings were performed and processed for direct microscopy and culture in appropriate media using standard laboratory protocols. All culture positive cases, where microorganisms could be isolated were included in the study and analyzed.

Results: Out of 1503 patients enrolled for study, microorganisms were isolated in 321 cases (21.36%). These cases were selected for analysis. 88 cases (27.41%) were bacterial and 224 cases (69.78%) were fungal. Among bacteria, Pneumococci and Pseudomonas were predominant (26.14% each). Among fungi Fusarium (37.05%) was the most frequent.

Conclusions: Incidence of fungal keratitis is significantly high in south Kerala compared to other country. This regional information is very valuable in the initial diagnosis and better management of suppurative keratitis before microbiological confirmation.

Keywords: Keratitis, Bacterial, Fungal, Infection

Introduction

The problem of blindness is universal, but the magnitude is much more in India, having 1/4th the world’s total blind population. Out of these corneal infections is a leading cause of ocular morbidity and blindness world wide. Though prevalence of corneal blindness is less compared to cataract, gravity of problem is more serious than cataract blindness for some important reasons. First, over half of corneal blindness occurs in children and young adults unlike cataract. Secondly, the best available treatment of corneal blindness is corneal grafting, which is totally dependant on availability of donor corneas.

In our country, one of the most important causes for corneal blindness is infective keratitis caused by various infective agents like agents fungi or bacteria. Depending on the characteristics of population and of geographical areas, there is variation in distribution of causative organisms.

All over the world, bacterial keratitis is more common than fungal but this does not hold true for India and other tropical countries. Unlike other parts of our country, hot and humid climatic weather conditions of Kerala favour fungal infections more than bacterial infections. So a proper understanding of the microbiological and clinical characteristics of the disease, will enable the ophthalmologist to initiate appropriate antimicrobial therapy, there by helping to decrease the incidence of corneal blindness world wide.

Surprisingly there are only very few studies comparing the various aspects of fungal and bacterial keratitis reported from our country. So in this study, we analysed about various aetiological agents responsible for suppurative keratitis and a comparative analysis of various characteristics and final visual outcome were done.

Aim

- To analyse the frequency of bacterial and fungal keratitis.
- To compare the epidemiological and microbiological characteristics of both ulcers.

Materials and Methods

Study design: Prospective comparative study.

Study setting: Regional Institute of Ophthalmology, Trivandrum.

Study population: Out of 1503 cases enrolled for study, only culture positive cases (321 cases) were selected for analysis.

Study period: 2 years (March 2007 to February 2009).

Methodology

All consecutive cases of clinically diagnosed suppurative keratitis, who attended our institution during the study period were included in study. Suppurative keratitis was defined as loss of corneal epithelium with underlying stromal infiltration associated with signs of inflammation with or without hypopyon. All culture positive cases, where organism was isolated were analysed. All suspected viral, interstitial and autoimmune keratitis were excluded.

A standardized proforma was completed for each patient documenting sociodemographic information as well as clinical findings. Clinical findings included measurement of visual acuity (by Snellen’s chart) and detailed examination using a slit lamp (size, depth of ulcer, margins, hypopyon, satellite lesions, pigmentation over ulcer surface, impacted...
foreign body). Associated systemic and local factors were also checked. Previous treatment history and use of topical corticosteroids were also noted. Any other preexisting ocular problem contributing to defective vision were also documented.

Laboratory procedures

After detailed ocular examination, corneal scrapings were collected from each ulcer, after instillation of proparacaine eye drops, using No.15 Bard Parker blade under aseptic conditions. The procedure was done under a slit lamp. The scraping material was taken from the leading edge and base of ulcer. This was inoculated on to the surface of culture media like sheep blood agar, chocolate agar, McConkey agar and Sabouraud Dextrose Agar (SDA) in a raw of ‘c’ shaped streaks. SDA plates were incubated at 27°C and examined daily and discarded if no growth was seen after 21 days. The remainder was incubated aerobically at 37°C and evaluated at 24 hours and 48 hours, discarded after 72 hours if no growth material obtained from scraping was then spread on to labeled slides in a thin even manner for 10% KOH mound and gram staining. Whenever acanthomoeba cysts were suspected, wet saline mounting and inoculation into non nutrient agar was done.

Microbial culture was considered positive when there was growth of the same organism on 2 or more media, confluent growth at site of inoculation one one solid medium, growth in one medium with consistent direct microscopy findings, or growth of same organism on repeated corneal scraping. Specific identification of bacterial pathogen was based on microscopic morphology, staining characteristics and biochemical properties using standard laboratory criteria. Fungi were identified by their colony characteristics on SDA and by the morphological appearance of the spores in lactophenol cotton blue stain.

Clinical procedure

For the purpose of analysis each case was then classified into either of groups A to D, based on presenting Best Corrected Visual Acuity (BCVA). Group A (6/9 to >6/24), Group B (6/24 to >6/60), Group C (6/60 to CF) and Group D (HM to PL). Patients were followed up on 1st day, 2nd day, 1st week, 1 month, 3 months and 6 months from the day of initial presentation.

Details of visual acuity, size, depth, margins and occurrence of corneal opacity were noted at each visit. Signs of healing, progression and complication, if any were also noted. At last follow up, BCVA, condition of cornea, presence/absence of complications and surgical interventions, if done were then documented.

Statistical analysis was done by SPSS version 11. P value of <0.05 was considered significant.

Results

1503 cases of clinically diagnosed corneal ulcer were enrolled for this study. Out of these microorganisms were isolated in 321 cases (21.36%) and these culture positive cases were selected for analysis.

88 cases (27.41%) were bacterial
224 cases (69.78%) were fungal.

Microbiological profile (based on the culture reports)

Fungal Keratitis

<table>
<thead>
<tr>
<th>Fungi</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusarium</td>
<td>83</td>
<td>37.05%</td>
</tr>
<tr>
<td>Aspergillus</td>
<td>59</td>
<td>26.34%</td>
</tr>
<tr>
<td>Penicillium</td>
<td>45</td>
<td>20.09%</td>
</tr>
<tr>
<td>Candida</td>
<td>4</td>
<td>1.79%</td>
</tr>
<tr>
<td>Others</td>
<td>33</td>
<td>14.73%</td>
</tr>
</tbody>
</table>

Bacterial Keratitis

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumococci</td>
<td>23</td>
<td>26.14%</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>23</td>
<td>26.14%</td>
</tr>
<tr>
<td>Staph. Aureus</td>
<td>14</td>
<td>15.91%</td>
</tr>
<tr>
<td>Coagulase Negative Staph. Aureus</td>
<td>8</td>
<td>9.09%</td>
</tr>
<tr>
<td>E. Coli</td>
<td>9</td>
<td>10.23%</td>
</tr>
<tr>
<td>Others</td>
<td>11</td>
<td>12.49%</td>
</tr>
</tbody>
</table>

According to demographic data,
Total number of males: 209(65.11%)
Total number of females: 112(34.89%)
Infective keratitis was most prevalent in the age group, 41-60 years among both sexes, in both groups. Majority of cases were manual labourers (28.4% bacterial, 29% fungal) followed by agricultural workers (6.8% bacterial, 4.9% fungal). This showed no difference among both groups.

Studying the character of ulcer, satellite lesions (32%) and immune ring (60%) were typical of fungal keratitis. Hypopyon were present in both, but it was out of proportions to size in fungal ulcers.

Among various types of foreign bodies found, bacterial keratitis had metallic (50%), stone (33%) and vegetable matter (30%). In fungal keratitis, vegetable matter was more predominant (72%) followed by stone (61.2%) and metallic foreign body (50%).

According to BCVA, cases were divided into 4 groups. Group A (6/9 to >6/24), Group B (6/24 to >6/24), Group C (6/60 to CF) and Group D (HM to PL).

At initial presentation, among the bacterial keratitis, majority (43.4%) were in Group D and at 6 months follow up, 30.3% cases healed with treatment with no significant visual disability and were in Group A. Among fungal keratitis, 30.4% cases were in Group C at initial presentation and 60.9% cases healed with treatment and came under Group A, at end of 6 months follow up. About ¼ th cases of both groups were in Group D at end of the follow up, awaiting surgical intervention. Penetrating keratoplasty was done in 7 cases for visual rehabilitation and 3 cases ended up in evisceration.

**At initial presentation**

**At 6 month follow up**

**Discussion**

Microbial keratitis is a sight threatening condition with ocular morbidity that requires prompt and appropriate management. To minimize complications and permanent sequelae timely antimicrobial treatment must be initiated on the basis of clinical and microbiological diagnosis.

Microbial culture and direct microscopic detection always supplement the clinical diagnosis and provide supportive evidence for planning appropriate therapy. Bacteria and fungi frequently cause suppurative keratitis. But the causative agent may vary significantly from country to country and from region to region with in the same country. So knowledge of the local aetiological agent with in a given region is of great value for the diagnosis and treatment of corneal ulcer.

Most of the previously reported studies on fungal and bacterial keratitis were descriptive single case series analysis. Comparison studies of bacterial and fungal keratitis were not reported so far from south India.

In our study, culture isolation was possible only in 321 cases (21.36%), in comparison to Madhurai (77.2%), West Bengal (67.7%) and Ghana (77.2%). Main reason was majority of our cases were referred cases with pretreatment elsewhere. Another reason may be due to the higher prevalence of fungal keratitis, were isolation of organism is much more difficult compared to bacteria.

In our study, among the 321 culture positive cases, 224 cases (69.78%) were fungal and 88 cases (27.41%) were identified as bacterial. Surprisingly almost 2/3 rd of our cases were fungal keratitis. This figure is higher than Madhurai study by Srinivasan et al, Bharathi et al (32.26%), West Bengal study by Basak et al (59.3%) and Ghana study by Leek et al (44.1%). It is higher than the studies from Assam, Eastern India where 32% were fungi. Since this study is conducted at tertiary referral eye care center number of fungal ulcers reported may be due to their prolonged course and poor response to available topical medications.

The most common fungal pathogen isolated in our case series was Fusarium (35.41%) followed by Aspergillus (25.21%). Fusarium species have been found to be the principal pathogen in other studies from South India. Fusarium species have also been and found to be the commonest pathogen in Florida, Paraguay, Nigeria, Tanzania, Hongkong and Singapore. Aspergillus species were predominant in West Bengal, Mumbai, and North India, parts of South India, Nepal and Bangladesh.

The reduction in bacterial ulcer in general at a referral center may be attributed to more effective and successful treatment of bacterial ulcers in the peripheral centers with new generation topical antibiotics.
Studying the demographic data, total number of males (65.11%) was significantly high than number of females (34.89%), indicating significant exposure of organisms in their working environment. Infective keratitis was most prevalent in the age group of 41 to 60 years in both fungal and bacterial groups.

Among the foreign bodies found, fungal keratitis had vegetable matter and bacterial keratitis had metallic foreign bodies more commonly. This shows similar results like the study conducted by Das et al in rural Bengal8.

At initial follow up, secondary glaucoma was more prevalent in fungal group than bacterial. Both groups had presenting vision coming in the groups C and D respectively. But at the end of follow up, 75% cases were in group A with no significant visual disability. Those points to the aggressive early diagnosis and treatment needed to decrease the incidence of this preventable cause of blindness.

Conclusions

In summary, suppurative keratitis continues to be a cause of concern and is a major cause of treatable blindness in South Kerala. Incidence of suppurative keratitis was significantly high in our region compared to other parts of our country. This “regional” information of etiological agent is very important as this will help us to have a high degree of clinical suspicion in starting the appropriate initial treatment before getting the microbiological confirmation. This information will also help primary and secondary care ophthalmologists in initiating therapy as many of these centers lack adequate microbiology facilities. On a wider perspective, this information will also guide us while formulating recommendations for preferred practice patterns and preventive measures of suppurative keratitis in the population at risk.

References

8) Das SK. Hypopyon ulcers in Rural Bengal, JIMA 1972; 58:93-95.