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ANALYZING OUTCOMES OF MICROBIAL KERATITIS BY USING BCVA (BEST-CORRECTED VISUAL ACUITY)

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ABSTRACT

Background: The epidemiology pattern of microbial keratitis is mostly determined by geographic and climatic conditions. Data on the infiltration size, organism, and depth of microbial keratitis outcomes are, however, limited in the literature currently in publication.

Aim: Analyzing how infiltration size, organism, and depth affect microbial keratitis outcomes is the goal.

Methods: Records of patients with infective keratitis over the specified study period were evaluated in this retrospective analysis. Subjects were divided into groups based on the size and depth of the ulcer at presentation, which was also used to evaluate the organism causing the condition. Subjects in Group I had an anterior to mid-stromal infiltrate of less than 6 mm, those in Group II had an ulcer of less than 6 mm in full thickness, those in Group III had an ulcer greater than 6 mm in full thickness, and those in Group IV had an ulcer greater than 6 mm in full thickness. At follow-up, outcome variables such as response to therapy and BCVA (best corrected visual acuity) were evaluated in each of the enrolled individuals.

Results: Of the 2234 participants evaluated in this study, 60.8% were in Group I. When compared to Groups III and IV, visual acuity significantly improved in Groups I and II. Regardless of the organism, Group I responded to medical care the best. Using Group I as a comparison, Group III had a greater chance of surgery than Group II. 70%, 64.8%, 64.3%, 62.5%, 52.6%, and 12.1% of participants with bacterial keratitis, mixed keratitis, acanthamoeba keratitis, fungal keratitis, and Pythium keratitis experienced overall remission with medical care. Fungal keratitis was less responsive to medicinal treatment than Acanthamoeba and bacteria, but Pythium was associated with a greater risk of surgery.

Conclusion: The current study found that the size and depth of the infiltration, as well as the virulence of the organisms, significantly influence the outcome of microbial keratitis.

Keywords: Acanthamoeba keratitis, bacterial keratitis, corneal ulcer, fungal keratitis, infective keratitis, ulcer

INTRODUCTION

The epidemiological patterns of bacteria that cause infectious keratitis (IK) are primarily influenced by geographical and climatic conditions. Fungal keratitis is more common in tropical agrarian nations, while bacterial keratitis, or BK, is more common in nations like Australia and the United Kingdom. Between 0 and 5% of instances of infective keratitis worldwide are caused by Acanthamoeba, while Pythium has become a refractory organism in recent years due to more knowledge.

In recent literature studies, it has been reported that AK (acanthamoeba keratitis) requires a significantly longer time for re-epithelization compared to bacterial and fungal keratitis; however, no difference is reported in other time-to-event outcomes such as the discontinuation of antimicrobials and the need for therapeutic keratoplasty.2 Other factors that are considered predictors of outcome in keratitis cases include depth and size of the infiltrate, age, delayed presentation, hypopyon, and systemic comorbidities.1 On the other hand, other data has focused on the significance of the depth of infiltrate.

This is further influenced by the variable of whether the extent and magnitude of engagement are the same or different, which is yet unclear. In order to determine if early surgical intervention is essential, it is vital to evaluate the distinction between deeper, smaller bacterial infections and bigger, surface fungal infections. Furthermore, nothing is known about how any other factor, such as the ulcer's size and depth, relates to a specific causal substance. It will also assist in identifying deeper participation or larger infiltrations, which significantly impact the result for different species.3

Whether causative organisms have an effect on the result based on the size and depth of the infiltration is likewise unknown. The present study aimed to compare how the depth, organism, and size of the infiltration affect the course of microbial keratitis.

MATERIALS AND METHODS

To compare the impact of infiltrate size, organism, and depth on the course of microbial keratitis, a retrospective comparative clinical investigation was conducted. Participants in the research were from the Institute's Department of Ophthalmology. All subjects gave their written and verbal informed permission before to participation.

In addition to the microbiological assessments that were carried out at the Institute, such as KOH-calcofluor and gram staining with cultures, medical information from participants who had infectious keratitis during the research period was evaluated. After 48 hours, scraping was repeated with PCR (polymerase chain reaction) in cases that showed no growth and negative microbiological on the stain. Depending on the initial staining report and disease suspicion, acanthamoeba culture and acid-fast staining were recommended based on the initial stain, and in both negative cases, PCR was carried out. All subjects who had corneal ulcers that were larger than 2 mm but involved the visual axis underwent microbiological evaluation. Those who presented with resolving infiltrate and prescribed topical medications along with microbiological reports were not recommended corneal scraping at presentation.

Confocal microscopy or microbiological evaluation was performed on subjects with minor holes who did not require therapeutic grafts following globe stabilization. Subjects who presented with a melt or significant hole requiring a therapeutic transplant had their host corneal tissue submitted for microbiology. Demographics, causal organisms, predisposing variables, and treatment results were noted in medical records. Additionally, each participant had a thorough evaluation and a photo slit-lamp, which aided in the retrieval of pertinent data. Subjects were grouped based on the size and depth of each ulcer, which were recorded during the presentation. For size recording, a larger infiltrate diameter was employed. Ulcers larger than 6 mm were considered poor outcome indicators, and this was the cut-off value for ulcer size.4

The ulcers were divided into four groups. Subjects in Group I had an anterior to mid-stromal infiltrate of less than 6 mm, those in Group II had an ulcer that was less than 6 mm in thickness, those in Group III had an ulcer that was greater than 6 mm in thickness, and those in Group IV had an ulcer that was greater than 6 mm in thickness. Two specialists in the field of ophthalmology were responsible for grouping. Subjects with viral keratitis, unidentified organisms, and those who did not fit into any category were excluded from the research.

The same treatment procedure was used to handle each individual. Broad-spectrum fluoroquinolones were used to treat bacterial keratitis, 5% topical natamycin for filamentous fungus, and amphotericin for yeast. Depending on clinical response and sensitivity testing, voriconazole or other antibacterial drugs were used as second-line treatment. For eyes with limbal involvement resulting in perforation or full-thickness infiltration larger than 6 mm at presentation, systemic medicines were recommended.

Acanthamoeba patients were treated with a combination of 0.02% polyhexamethylene biguanide and 0.1% propamidine. Amikacin was the preferred medication for atypical mycobacteria and Nocardia. 500g of oral azithromycin and a topical solution of 1% azithromycin and 0.2% linezolid were administered for Pythium keratitis. TPK (therapeutic penetrating keratoplasty) and cyanoacrylate glue with bandage contact lenses known as the tectonic surgery were performed as necessary in situations where full-thickness or imminent perforation worsened after therapy. When infectious keratitis reacted and went away with medical therapy, the medical management response was deemed favorable; if a therapeutic graft was required, the condition deteriorated. The therapeutic graft need for the remission of infectious keratitis was evaluated as the major outcome, and the best corrected visual acuity (BCVA) attained at the last follow-up was evaluated as the secondary result. The mean follow-up taken was time from presentation to the last visit, and the mean healing times were time from presentation to clinical infection resolution.

The data gathered were analysed statistically using SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk. NY, USA) for assessment of descriptive measures, Student t-test, ANOVA (analysis of variance), and Chi-square test. The findings were presented as frequency, percentages, mean, and standard deviation. A p-value of less than 0.05 was taken into account.

RESULTS

The goal of the current retrospective comparative clinical investigation was to compare the impact of infiltrate depth, organism, and size on microbial keratitis outcomes. The records of 2234 patients with infective keratitis over the specified study period were evaluated in this retrospective analysis. Subjects were divided into groups based on the size and depth of the ulcer at presentation, which was also used to evaluate the organism causing the condition. The patients ranged in age from 2 to 91 years, with a mean age of 45±18.14 years and a male to female ratio of 2.5:1. Acanthamoeba had the longest mean presentation time from onset, at 42.2±21.03 days.

The mean follow-up was 337.6±279.26 days, but no significant difference in presentation between organisms was observed. For 266 subjects, incomplete records were excluded from the assessment, so data were finally assessed in 1816 subjects with 3068, 584, 66, 48, 28, and 10 fungal, bacterial, Pythium, acanthamoeba, fungus, and bacteria keratitis. Based on the overall clinical presentation in study groups based on organisms, Group I had miscellaneous, mixed, pythium, acanthamoeba, fungus, and bacteria keratitis in 80%, 78.5%, 21.6%, 58.3%, 57.6%, 57.6%, 14.7%, 12.4%, and 13.41% of subjects, respectively, Group II had miscellaneous, mixed, pythium, acanthamoeba, fungus, and bacteria keratitis in 10%, 2.7%, 16.6%, pythium, acanthamoeba, fungus, and bacteria keratitis, and Group III had miscellaneous, mixed, pythium, acanthamoeba, was seen in 10%, 7.14%, 21.6%, 8.33%, 4.7%, 3.8%, and 5.28% subjects respectively. In Group IV, miscellaneous, mixed, pythium, acanthamoeba, fungus, and bacteria keratitis was seen in 0, 7.14%, 54.05%, 16.6%, 22.9%, and 13.6% subjects respectively (Table 1).

Using Group I as a reference, regression analysis of the different species in the research groups based on the size and depth of infiltration revealed that there was no association in Acanthamoeba (p=0.791) and a significant correlation in Pythium and Bacteria (p=0.003 and 0.02 respectively) in Group I. There was no discernible correlation between Group II and acanthamoeba (p=0.612 and 1.000). Nonetheless, a significant correlation (p=0.01) was seen with bacterial keratitis. Acanthamoeba, Pythium, and bacterial keratitis did not significantly correlate in Group III (p=0.392, 0.556, and 0.182, respectively). In Group IV, bacterial keratitis showed a significant correlation with p=0.03, whereas acanthamoeba and Pythium showed no significant association with p=0.382 and 0.512, respectively (Table 2).

For medically treated subjects, the mean healing time was 1.40±1.11 months for bacterial keratitis, 1.74±1.41 months for fungal keratitis, 2.91±2.54 months for Pythium, 3.73±2.36 months for fungus, and 0.95±0.34 months for bacterial keratitis, according to the study results. With p<0.0001, this difference was statistically significant (Table 3).

DISCUSSION

2234 individuals with infective keratitis within the specified study period had their records retrospectively evaluated for this investigation. Subjects were divided into groups based on the size and depth of the ulcer at presentation, which was also used to evaluate the organism causing the condition. The patients ranged in age from 2 to 91 years, with a mean age of 45±18.14 years and a male to female ratio of 2.5:1.

Mean presentation time from onset was highest for acanthamoeba with 42.2±21.03 days. Nevertheless, no discernible variation in the organisms' presentations was seen. Follow-up was 337.6±279.26 days on average. Due to inadequate information, 266 patients were not included in the evaluation. As a result, data related to 3068, 584, 66, 48, 28, and 10 bacterial, fungal, Pythium, acanthamoeba, mixed, and miscellaneous cases were ultimately evaluated in 1816 patients. These findings were similar to those of earlier research by Fernandes M et al. (2015) and Agarwal S et al. (2019), in which the authors evaluated participants using demographic information similar to that of the current study.

According to the study findings, 80%, 78.5%, 21.6%, 58.3%, 57.6%, and 70.96% of the participants in Group I had miscellaneous, mixed, pythium, acanthamoeba, fungus, and bacterial keratitis, respectively, in terms of overall clinical presentation in the study groups based on organisms.

In Group II, 10%, 7.14%, 2.7%, 16.6%, 14.7%, 12.4%, and 13.41% of participants, respectively, had bacterial, fungal, acanthamoeba, mixed, miscellaneous, and pythium keratitis. 10%, 7.14%, 21.6%, 8.33%, 4.7%, 3.8%, and 5.28% of Group III participants had bacterial, fungal, acanthamoeba, mixed, and miscellaneous keratitis, respectively. Pythium, acanthamoeba, fungus, bacteria, mixed, and miscellaneous keratitis were observed in 0 7.14%, 54.05%, 16.6%, 22.9%, and 13.6% of the cases in Group IV, respectively. These findings were in line with those of the research conducted by Puangsricharern V et al. in 2021 and Gurnani B et al. in 2021, where the authors' reports of the general clinical presentation of irritational keratitis were similar to the findings of the current investigation.

Using Group I as a reference, regression analysis of the different species in the research groups based on the size and depth of infiltration revealed that there was no association in Acanthamoeba (p=0.791) and a significant correlation in Pythium and Bacteria (p=0.003 and 0.02 respectively) in Group I. There was no discernible correlation between Group II and acanthamoeba (p=0.612 and 1.000). Nonetheless, a significant correlation (p=0.01) was seen with bacterial keratitis.

Acanthamoeba, Pythium, and bacterial keratitis did not significantly correlate in Group III (p=0.392, 0.556, and 0.182, respectively). Group IV showed a significant correlation with bacterial keratitis (p=0.03) but no significant association with acanthamoeba and Pythium (p=0.382 and 0.512).

These results were consistent with the findings of Raj N et al. (2010) and Loh AR et al. (2009), who used regression analysis of different species for keratitis to provide results that were comparable to the current study. Based on the results of the study, the mean healing time for medically managed subjects was 1.40±1.11 months for those with bacterial keratitis, 1.74±1.41 months for those with fungal keratitis, 2.91±2.54 months for Pythium, 3.73±2.36 months for those with fungus, and 0.95±0.34 months for those with bacterial keratitis. With p<0.0001, this difference was statistically significant. These outcomes were consistent with those of Dago TR et al. (2021) and Mills B et al. (2021), where authors reported healing time for keratitis ulcers comparable to the results of the present study.

CONCLUSIONS

Given its limitations, the current study comes to the conclusion that the size and depth of the infiltration, as well as the virulence of the organisms, have a major role in determining the outcome of microbial keratitis. A lower sample size, a shorter monitoring period, and a single-institution design were among the study's drawbacks. Therefore, in order to draw a firm conclusion, more extensive research with a wider sample size and longer monitoring from various geographic locations is necessary.

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Clinical picture	Miscellaneous	Mixed	Pythium	Acanthamoeba	Fungus	Bacteria	Total
Group I	80	78.5	21.6	58.3	57.6	70.96	60.77
Group II	10	7.14	2.7	16.6	14.7	12.4	13.41
Group III	10	7.14	21.6	8.33	4.7	3.8	5.28
Group IV	0	7.14	54.05	16.6	22.9	13.6	20.53

Table 1: clinical presentation

Groups & culture	Odds	95% CI (lower)	95% CI (upper)	p-value
Group I <6mm/anterior to midstream				
Fungal				
Acanthamoeba	0.842	0.226	3.087	0.791
Pythium	2.551	2.608	17.984	0.003
Bacteria	0.829	0.543	1.265	0.02
Group II				
Fungal				0.989
Acanthamoeba	0.590	0.077	4.429	0.612
Pythium	0.000	0.000		1.000
Bacteria	1.045	0.459	2.377	0.01
Group III				
Fungal				0.685
Acanthamoeba	0.276	0.013	5.271	0.392
Pythium	0.554	0.076	3.963	0.556
Bacteria	0.331	0.069	1.562	0.182
Group IV				
Fungal				0.164
Acanthamoeba	0.353	0.032	3.660	0.382
Pythium	2.007	0.245	16.357	0.512
Bacteria	0.392	0.152	0.507	0.03

Table 2: Regression analysis with Group I

	Mean healing time (months)
Bacteria	1.40±1.11
Fungus	1.74±1.41
Pythium	2.91±2.54
Fungus	3.73±2.36
Bacteria	0.95±0.34
p-value	<0.0001

Table 3: Mean healing time