Presentation and Outcome of Microbial Keratitis in Ilorin, Nigeria

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Authors' contributions

The author SES designed the study, wrote the introduction, literature searches, results and discussion in part. Authors DSA and AOM completed the introduction, methodology, results, illustrations and discussion. Author AF concluded and properly referenced the paper. All authors read and approved the final manuscript.

ABSTRACT

Aim: To determine the presentation and outcome of microbial keratitis among patients at University of Ilorin Teaching Hospital (UITH) in Ilorin, Nigeria.
Methods: A 12-month, prospective, hospital-based longitudinal study was conducted by examining all patients with clinical features of infective keratitis, who met the inclusion criteria. A post-treatment evaluation was done at 6 weeks in all cases, during which visual acuity and any complications were re-assessed. The outcome measures included interval between onset and presentation, extent of corneal involvement and final visual acuity. The data was analysed with the SPSS version 20.0 software.
Results: Fifty-five eyes of 54 patients were studied. There were 32 males (59.3%) and 22 females (40.7%). The mean age was 36.9 years (± 12.1). The predisposing factors were trauma in 30 (55.6%) cases, self-medication with topical steroids in 12 (22.2%) and the use of traditional eye

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medication in 12 (22.2%). All of the participants presented with pain, tearing, photophobia and reduction in vision. The right eye was involved in 37 patients (67.2%). The presenting visual acuity in the affected eyes was 6/60 or less in 31 (56.4%), 6/60–6/24 in 18 (32.7%) and 6/6–6/18 in 6 eyes (10.9%). At 6-week follow-up, 5 eyes (9.1%) had <6/60 visual acuity, 40 (72.7%) had 6/60–6/24 and 10 (18.2%) had 6/6–6/18.The risk factors for poor outcome were a centrally located lesion (p=0.018), an area of corneal involvement greater than 4mm (p=0.007) and a lesion affecting the deeper layers of the cornea (p=0.002).
Conclusion: Microbial keratitis is a significant cause of ocular morbidity, and public eye-health education is highly desirable as a preventive measure.

1. INTRODUCTION

Worldwide, keratitis is a known cause of ocular morbidity and is a threat to vision if not properly managed. It is a disease of the cornea than can be caused by infectious agents (bacteria, fungi, viruses or parasites) or be of non-infectious origin [1-4]. The prevalence of keratitis varies depending on geographical location; the incidence is quite high in developing countries, mainly due to late presentation, use of traditional eye medicine and inaccessibility to medical care [5-7]. This study was designed to provide information on the presentation and the outcome of treatment in patients with keratitis at our centre.

2. MATERIALS AND METHODS

This was a hospital-based longitudinal study conducted from January to December 2012. It was carried out at the Ophthalmology Department of the University of Ilorin Teaching Hospital (UITH) in Ilorin, Nigeria. All patients with infective corneal lesions and who gave consent were included. A semi-structured questionnaire was used, which gathered information on the sociodemographic variables of the patients (age, sex, occupation, level of education), risk factors, symptoms of keratitis and outcomes following treatment. Individuals from age zero to sixteen years were considered children, and elderly was defined as an age of more than sixty years.

2.1 Exclusion Criteria

Patients with poor vision secondary to other causes, such as glaucoma, cataract or age-related macular degeneration prior to onset of keratitis, were excluded.

2.2 Clinical Examination

All patients had their distance vision assessed with a Snellen eye chart placed six meters away,

and near vision was checked with a Jaeger chart placed 40 centimeters away. Patients then underwent a comprehensive ophthalmic slit-lamp examination to note (the site, size and depth of corneal lesion, stromal infilterate and any anterior chamber activity or hypopyon) the site, size, and depth of stromal infiltrates and any anterior chamber activity or hypopyon. A 2% Fluorescein strip was used to stain the cornea before measuring the size of the lesion in millimetres with the variable slit on the Haag-Streit BQ900 imaging module. The depth of any corneal lesion was assessed using the slit to view the corneal section. Patients with hypopyon, stromal abscess and extensive areas of cornea involvement were admitted for a minimum of 5 days to ensure intensive drug administration (topical ofloxacin 0.3% alone or in combination with antifungal fluconazole 5% in those with features suggestive of a fungal origin)and 125 mg subconjunctival ceftriaxone daily for 5days. All patients were examined daily for 5days and reassessed 6weeks later. At the 6-week follow-up, all patients had their visual acuity checked (distance and near) and the presence of any complications and the response to treatment were re-assessed. The outcome measures were defined as interval between onset and presentation, extent of corneal involvement and final visual acuity (defined as visual acuity at 6-week follow-up). Visual outcome was defined using the World Health Organization World Health Organization classifications of good (≥6/18), borderline (<6/18 to 6/60) and poor (≤6/60).[13]

2.3 Data Analysis

Data were entered into a computer and analysed using SPSS version 20 software. Correlation of numeric data was used to determine the statistical significance of observed differences in categorical variables. Level of significance was set at a p-value of less than or equal to 0.05.

Approval for the study was obtained from the ethical review committee of the University of Ilorin Teaching Hospital. Informed consent was obtained from each individual patient.

3. RESULTS

A total of 55 patients were seen during the study period. The age range was between 6 months and 80 years, with a mean age of 36.9 years (± 12.1). There were 32 males (59.3%) and 22 females (40.7%), for a male-to-female ratio of 1.5:1.0. Most of the patients were traders (18, 33.3%). Children and the elderly constituted 22.2% of the sample. Less than 10% had tertiary education. The age and sex distribution of the patients is shown in Table 1.

Table 1. Age/sex distribution

Age group	Sex		Frequency (%)
	Male	Female	
<1 year	2	0	2 (3.7)
1-20 years	9	5	14 (25.9)
21-40 years	8	8	16 (29.6)
41-60 years	5	6	11 (20.4)
61-80 years	8	3	11 (20.4)
Total	32	22	54 (100)

Table 2 shows the risk factors for keratitis seen in our patients. Trauma (30 cases, 55.6%) and self-medication with topical steroids (12 cases, 22.2%) were the most common risk factors associated with keratitis in this study. The commonest cause of trauma was sand particles followed by a finger poked into the eye, as shown in Fig. 1. Twelve patients (22.2%) applied traditional eye medication; Fig. 2 shows the type of traditional eye medication used.

Table 2. Risk factors associated with keratitis

Risk factor	Frequency (%)
Trauma	30 (55.6)
Topical steroid use	12 (22.2)
Vernal conjunctivitis (complicated byocular injury)	6 (11.1)
Blepharitis	4 (7.4)
Dry eye	3 (5.6)
Chemical injury	2 (3.7)
Diabetes mellitus	1 (1.9)

All of the patients presented with pain, photophobia, tearing and reduction of vision in the affected eye. Only 4 (7.4%) presented within 24 hours, (majority presented after 24 hours with a week of onset of symptoms while other presented after one week) while others presented after one week. (72.2%), presented after 24 hours but within 7 days while 20.4% presented after one week). The right eye was the most-often affected (37, 67.3%) and one patient had bilateral lesions. The presenting visual acuity was 6/60 or worse in 30 eyes (54.5%), while the area of corneal involvement was 3mm or more in 41 eyes (74.5%). Table 3 shows the clinical features of keratitis seen in the patients. Central lesions were present in 21 patients (38.2%), as shown in Fig. 3. In the majority, more than 50% of patients, 25%–50% of corneal thickness was involved, as shown in Fig. 4.

Table 3. Clinical findings of keratitis

Clinical information	Frequency (%)
Duration of pain before presentation	
Within 24hours	4 (7.4)
2-7days	39 (72.2)
8-14 days	8 (14.8)
>14 days	3 (5.6)
Total	54 (100)
Affected Eye	
Right	37 (67.3)
Left	18 (32.7)
Total	55 (100)
Visual acuity at presentation	
6/6–6/18	6 (10.9)
6/24–6/36	19 (34.5)
6/60–1/60	15 (27.3)
HM-PL	15 (27.3)
Total	55 (100)
Size of lesion at presentation	
1-2mm	14 (25.5)
3-4mm	26 (47.2)
>4mm	15 (27.3)
Total	55 (100)

There was a statistical relationship between the clinical presentation, clinical findings and visual outcome of keratitis, as shown in Tables 4 and 5. The majority of the keratitis eventually healed, with scar formation in 93.5%. Corneal 797 ascularisation (pannus) and irregular astigmatism were each seen in 25% of the eyes. One patient with descemetocele had Gundersen's procedure (conjunctival flap) to prevent perforation.
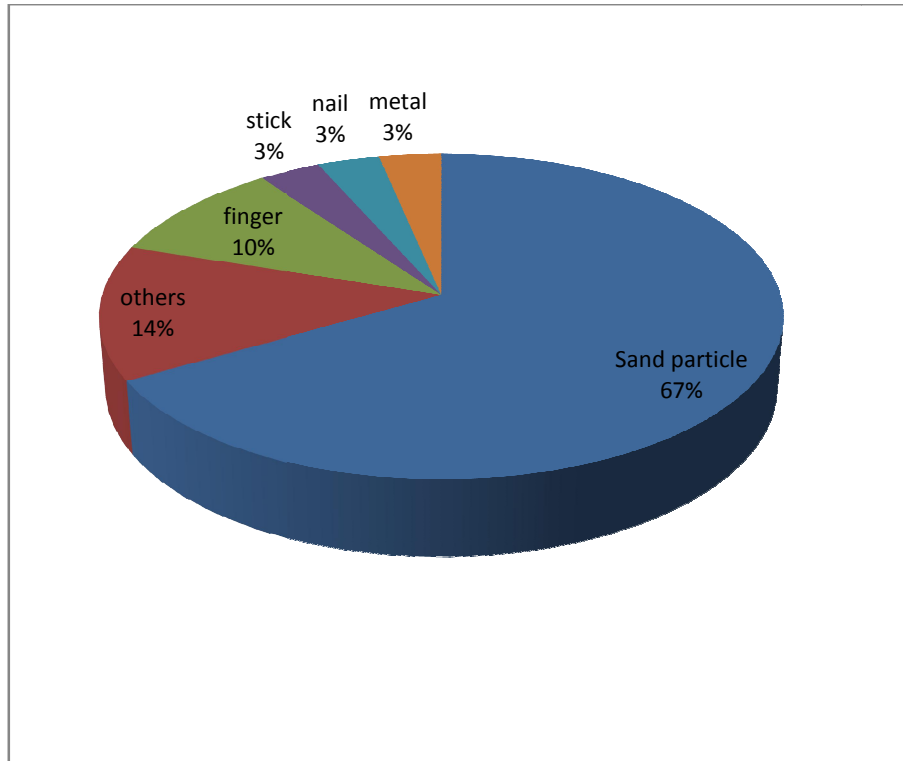
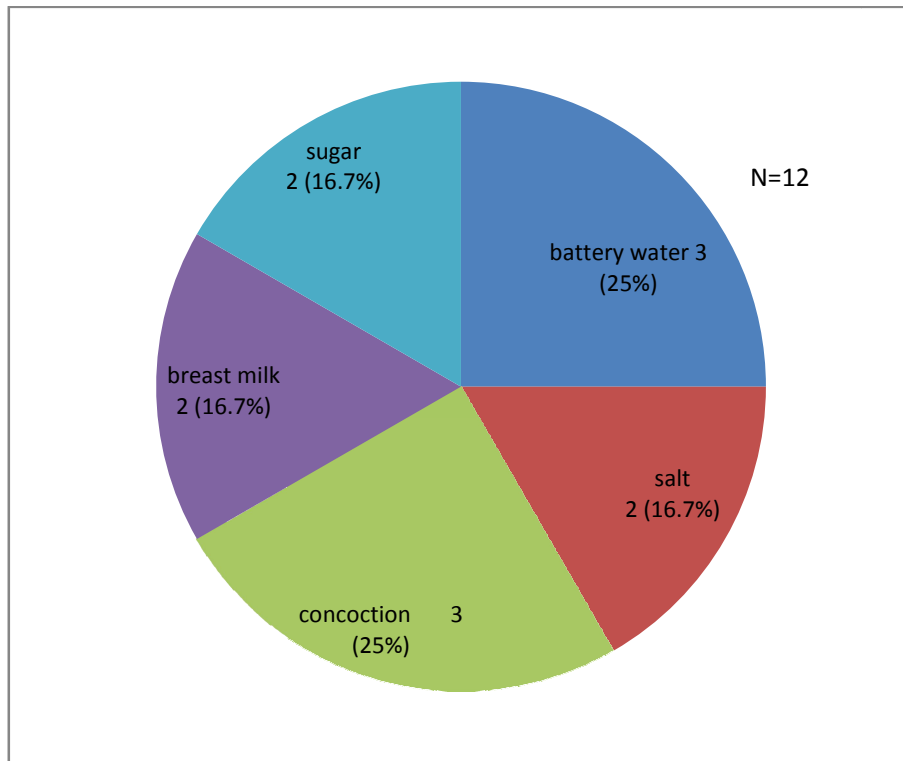**Fig. 1. Causes of trauma in patients with microbial keratitis**

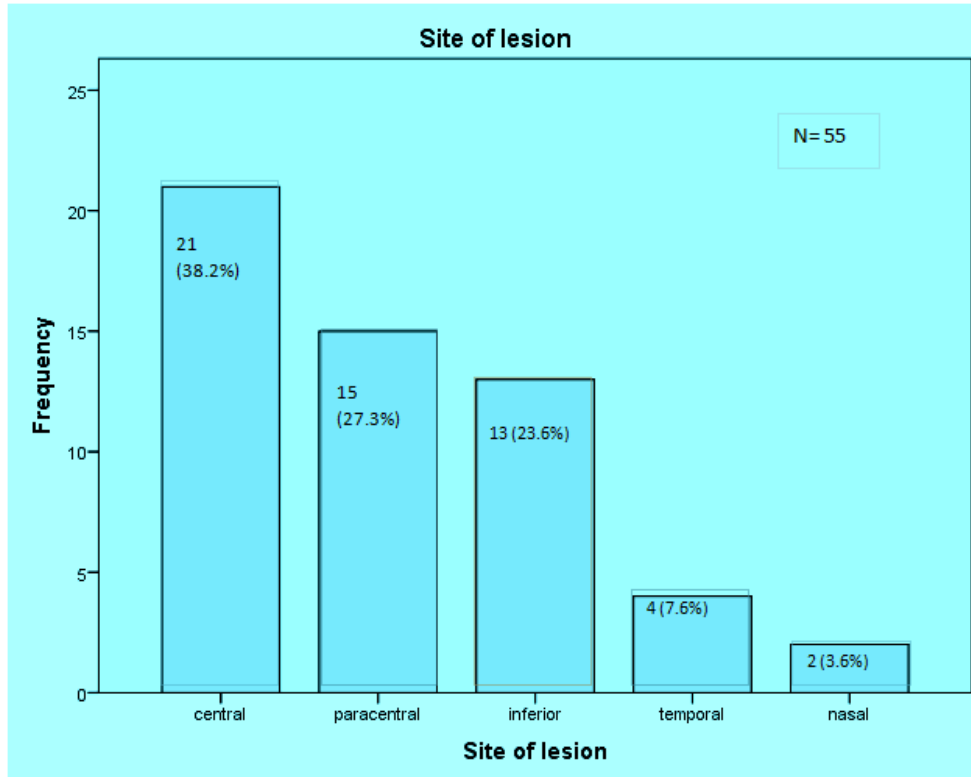**Fig. 2. Types of traditional eye medicine used**

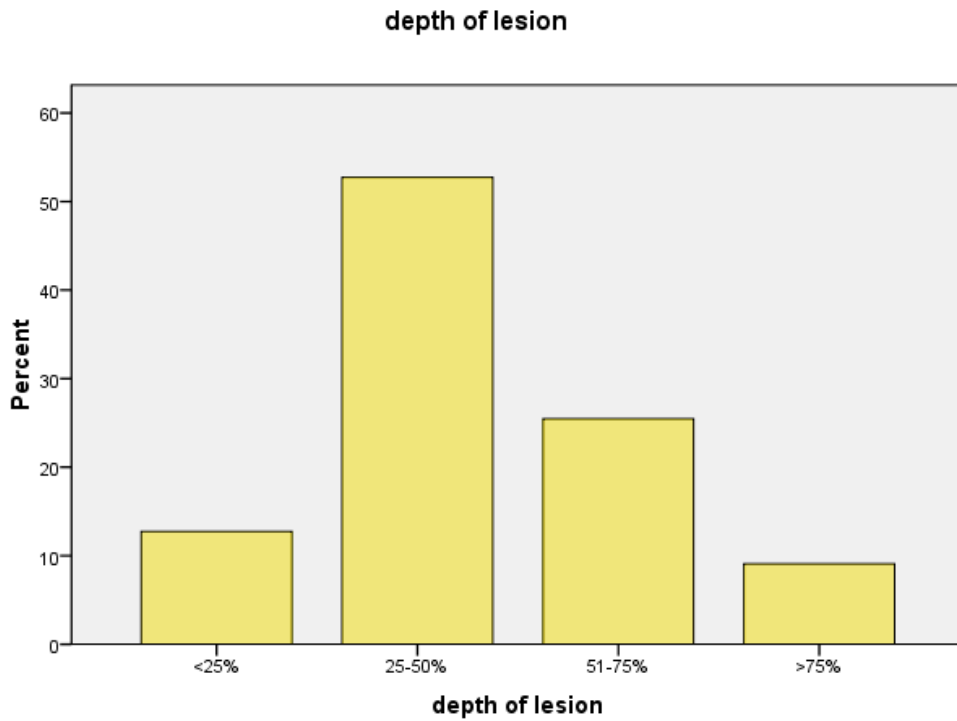**Fig. 3. Site of corneal lesion**

Fig. 4. Depth of corneal involvement in keratitis as shown on slit beam of slit lamp microscope

Table 4. Relationship between clinical presentation and visual acuity at presentation and at 6-week follow-up

Examination findings	Visual acuity								Total		Correlation coefficient
	6/6–6/18		6/24–6/36		6/60–1/60		HM-PL				
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
Duration of pain											
<1 day	2(3.6)	2(3.6)	2(3.6)	2(3.6)	0(0)	0(0)	0(0)	0 (0)	4(7.2)	4 (7.2)	Initial VA 0.161
2-7 days	4(7.4)	8(15)	14(26)	18(33)	10(19)	9(17)	11(20)	4(7.4)	39(72.2)	39 (72.2)	(p=0.001
8-14 days	0(0)	2(3.6)	2(3.6)	1(0.9)	3(5.6)	4(7.4)	3(5.6)	1(0.9)	8(15)	8 (14.8)	
> 14 days	0(0)	0(0)	0(0)	2(3.6)	2(3.6)	1(0.9)	1(0.9)	0(0)	3(5.6)	3 (5.6)	Final VA 0.184
											(p=0.052)
Total	6(11)	12(22)	18(33)	23(43)	15(28)	14(26)	15(28)	5(8.3)	54(100)	54 (100)	
Use of traditional eye medicine											
Yes	1(0.9)	0(0)	2(3.6)	2(3.6)	6(11)	6(11)	3(5.6)	4(7.4)	12(22)	12(22)	Initial VA 0.276 (p=0.098)
No	5(9.3)	8(15)	16(30)	20(37)	9(17)	11(20)	12(22)	3(5.6)	42(78)	42(78)	Final VA 0.021 (p=0.001)
Total	6(11)	8(15)	18(33)	22(41)	15(28)	17(31)	15(28)	7(13)	54(100)	54(100)	

Table 5. Relationship between clinical examination findings and visual acuity (VA) at presentation and at 6-week follow-up

Examination findings	Visual acuity								Total		Correlation coefficient
	6/6–6/18		6/24–6/36		6/60–1/60		HM-PL				
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
Size of lesion											
1-2mm	4(7.2)	7(12)	5(9.1)	4(7.2)	3(5.5)	3(5.5)	2(3.6)	0(0)	14(26)	14(26)	Initial VA
3-4mm	2(3.6)	3(5.5)	12(22)	14(26)	9(17)	9(17)	4(7.2)	1 (0.9)	27(48)	27(48)	0.057(p=0.000)
>4mm	0(0)	0(0)	1(1.8)	5(9.1)	4(7.2)	5(9.1)	9(16)	4(7.2)	14(26)	14(26)	Final VA 0.546
Total	6(11)	10(19)	18(33)	23(42)	16(29)	17(31)	15(28)	5(9.1)	55(100)	55(100)	(p=0.007)
Depth of lesion											
<25%	2(3.6)	3(5.5)	4(7.2)	1(1.8)	1(1.8)	3(5.5)	0(0)	0(0)	7(12)	7(12)	
25-59%	4(7.2)	5(9.1)	11(20)	14(26)	10(18)	8(15)	3(5.5)	1(1.8)	28(51)	28(51)	Initial VA
60-74%	0(0)	0(0)	3(5.5)	8(15)	4(7.2)	4(7.2)	8(15)	3(5.5)	15(28)	15(28)	0.547(p=0.004)
>75%	0(0)	0(0)	0(0)	0(0)	1(1.8)	2(3.6)	4(7.2)	3(5.5)	5(9.1)	5(9.1)	Final VA 0.550
Total	6(11)	8(15)	18(33)	23(42)	16(29)	17(31)	15(28)	7(12)	55(100)	55(100)	(p=0.002)
Site of lesion											
Central	5(9.1)	5(9.1)	5(9.1)	6(11)	3(5.5)	7(12)	8(15)	3(5.5)	21(38)	21(38)	Initial VA
Paracentral	0(0)	0(0)	7(12)	8(15)	6(11)	4(7.2)	1(1.8)	2(3.6)	14(26)	14(26)	0.597(p=0.04)
Inferior	1(1.8)	3(5.5)	5(9.1)	7(12)	4(7.3)	4(7.2)	6(11)	2(3.6)	16(29)	16(29)	Final VA
Temporal	0(0)	0(0)	1(1.8)	2(3.6)	3(5.5)	2(3.6)	0(0)	0(0)	4(7.2)	4(7.2)	0.566(p=0.018)
Total	6(11)	8(15)	18(33)	23(42)	16(29)	17(31)	15(28)	7(12)	55(100)	55(100)	

4. DISCUSSION

Keratitis is an ophthalmic emergency that requires immediate treatment. This study showed that males were more frequently affected than females, which may be explained by the males in our study population having greater exposure to risk-prone activities. This finding is similar to that of other studies conducted in Australia,[8] Thailand [9], Malaysia [10], India [7] and Oman [11]. In contrast, there is a female preponderance in studies from Glasgow [12], England [13], Bahrain [14] and Enugu, Nigeria [15].

In the present study, 70.3% of participants were adults aged 20–80 years. This spread across young adults to the elderly contrasts with the study in Oman [11], where keratitis was more common in the elderly. Previous studies [16-19] had also documented a bimodal age distribution of keratitis.

Ocular trauma preceded more than half (55.6%) of the cases in this study. This compares favourably with studies from Nepal, [20] India [21] and Taiwan, [22] where trauma was found to be a significant risk factor. Many times, the trauma may be a trivial abrasion such as sand or soil getting into the eye at work. Such trauma from vegetative matter or objects contaminated with soil can predispose to infection by filamentous fungi [4,18]. Infective keratitis cases secondary to trauma in this study were probably complicated by late presentation. Only 4patients presented within 24 hours of onset of symptoms. It has been reported that corneal abrasions presenting to the hospital within 18 hours of injury and treated prophylactically with 1% chloramphenicol ointment healed without sequelae [4].

Another risk factor identified in this study was ocular surface disease (blepharitis and dry eye). This was also reported by Tanure et al. [23] as the major risk factor for fungal keratitis in their study.

The use of steroids occurred in about a third of the patients in this study and only one patient had a positive history of diabetes. This may be because of the ready availability of over-the-counter steroid eye drops and the ignorance of both the general populace and the managers of drug stores about the risks associated with steroid use.

In a South Indian study, [4] 37.3% of patients were on traditional or herbal topical treatment, although this was higher than the findings in the present study, in which 22.2% of patients had applied traditional eye medicine before presentation. Use of traditional eye medicine delays patients from presenting to the hospital and may modify the clinical picture because some traditional eye medications are prepared under unhygienic conditions using plant and animal extracts that are often contaminated by pathogenic organisms, thus making an aetiological diagnosis impossible. Although it was observed that the use of traditional eye medication was poorly correlated with visual outcome (correlation coefficient 0.021,p=0.001), the patients who applied traditional medication were noted to have poorer visual acuity at the6-week follow-up.

The symptoms of infective keratitis are similar in most patients. Severity may vary in relation to the underlying causative organism, the immune status of the host and the duration of symptoms before presentation to the hospital. In this study, all of the patients presented with pain, redness, photophobia and reduced vision. The presenting visual acuity of 6/24 to 6/36 accounted for 34.5% of cases. The right eye was involved in 67.3% of the patients in this study. This is higher than the 57.1% reported by Hussein et al. [24] Approximately 27% had corneal lesions measuring greater than 4mm. This is higher than the findings of Annette,[25] in which only 17.8% of eyes had lesions greater than 4mm. This could have contributed to poorer outcomes in this study, as there exists a statistically significant relationship (p<0.007) between corneal lesion size and visual acuity. In 37% of the patients, the corneal lesion was central. This is similar to the studies in Glasgow, [12] Malaysia [10] and India, [4] and is lower than the 60% reported in Jordan [24]. Hypopyon was present in 35% of the patients in the present study, similar to a study from Australia [25] but lower than the value obtained ina study from India [26,27], where 56% of patients had hypopyon. This may be due to difference in sample size, difference in causative agent or difference in timing of presentation in the study population, although the majority of patients in the Indian study also presented late. The 35% rate of hypopyon in this study is higher than the 20% obtained in Jordan [24], which may also be explained by small sample size or difference in causative agent. Only 18.5% of patients attained 6/18 or better visual acuity after treatment. All patients in this study were given

topical ofloxacin 0.3% and all patients with a positive history of trauma or whose corneal lesions were in keeping with fungal keratitis were given topical fluconazole 5%.

The short- and long-term ocular morbidity from keratitis found in this study was very significant. There were significant statistical relationships between clinical findings (size of lesion p=0.007, depth of corneal involvement p=0.002 and site of lesion p=0.018) and the visual outcome. The visual outcome of 23 patients (41.8%) showed some improvement from the presenting visual acuity, but this may not be a true reflection of the best possible visual outcome. Perhaps with penetrating keratoplasty, this percentage could be higher. A retrospective study of fungal keratitis in Singapore [28] showed that almost half of their cases required penetrating keratoplasty due to involvement of the central cornea. In children, however, rotational autokeratoplasty can be a viable alternative to conventional penetrating keratoplasty for a central or paracentral corneal scar, especially in areas where tissue scarcity exists.[29].

The predominant complication at the last follow-up was corneal scarring, seen in 93.5% of cases, with or without vascularization. This was similar to the finding of Al-Yousuf et al. [14] in which 92% of keratitis cases healed with scarring, but was higher than the 40.6% corneal scarring following infectious keratitis as reported by Suman [30].

5. CONCLUSION

This study has illustrated that microbial keratitis is an important potential blinding condition and that the most common risk factors associated with keratitis are trauma, topical steroid use and traditional eye medication. An efficient public eye-health programme focusing on the causes and prevention of corneal infection in the at-risk population is very important.

CONSENT

Written Informed Consent was obtained from the patients before their inclusion into the study.

ETHICAL APPROVAL

Ethical approval for the study was obtained from the ethical review committee of the University of Ilorin Teaching Hospital.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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