



## Corneal Ulcers at the University of Calabar Teaching Hospital in Nigeria - A Ten Year Review

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### Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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## ABSTRACT

**Aim:** To review the pattern, trend, predisposing factors, characteristics and visual outcome of corneal ulcers at the University of Calabar Teaching Hospital (UCTH) between January 2003 and December 2012 with a view to providing improved quality patient management.

**Study Design:** Retrospective.

**Place and Duration of Study:** Department of Ophthalmology from January 2003 to December 2012.

**Methodology:** A review of medical records of patients diagnosed with corneal ulcers and treated in the Ophthalmology Department of the University of Calabar Teaching Hospital, Calabar.

**Results:** One hundred and fifty-eight (158) patients with corneal ulcer visited the Department of Ophthalmology from 2003 to 2012 but only one hundred and one (101) patient records could be retrieved. Of this number, 69(68%) were suppurative ulcer, 5(5%) Mooren's ulcer, 10(10%) viral, 1(1%) shield ulcer while 16(16%) of the cases were indeterminate. Most patients with corneal ulcer (56, 77.78%) were classified as blind according to the World Health Organisation and at discharge 49 individuals (68.05%) remained blind. This difference was not statistically significant (p-value 0.26). Unilateral presentation was most common 66 (95.65%) during the study period. The age group mostly affected was 41- 60years. Suppurative corneal ulcer was more common (42, 60.87%)

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among male patients. The majority (20, 28.99%) of the people were farmers while (13, 18.84%) were students.

Trauma (agricultural) (34, 49.28%) was the most common predisposing factor in suppurative corneal ulcer with vegetative/agricultural related materials as the most frequent causative agent. Another cause was harmful traditional medication (HTEM) (5, 7.25%). A significant number of patients (52, 75.36%) would have received some form of treatment prior to presentation at the hospital and this included use of licensed drugs and/or HTEM (68, 98.55%). Very few patients (18, 26.09%) had microbiological assessment. Organisms isolated were aspergillus species (18, 26.09%) and *Staphylococcus aureus* (3, 4.35%).

**Conclusion:** Suppurative corneal ulcer remains a significant cause of corneal ulcer in a developing country like Nigeria with potentially devastating visual impairment and significant cost to the public health system. Massive public education programmes and strengthening of existing health systems to enhance its management including rehabilitation will go a long way in the fight against corneal blindness.

*Keywords: Corneal ulcer; visual outcome; predisposing factors; pattern.*

## 1. INTRODUCTION

Bilateral corneal blindness is the second most common cause of blindness in developing countries with global estimates of 4.9 million persons or 12% of 39 million blind [1]. The estimate is higher in India and Africa (14.6–15.4% and 11–30%), respectively, as revealed in various studies [2,3]. Globally, unilateral corneal blindness estimate stands at 23 million. A study in India reports an annual incidence of corneal ulceration of 799 per 100,000 people [2,4].

The major causes of corneal blindness are trachoma, vitamin A deficiency, onchocerciasis, trauma and suppurative keratitis with pre-existing corneal disease, contact lens wear, surgical or non-surgical trauma and ocular surface disease as predisposing risk factors [5]. Other causes include measles, use of traditional eye medicines, surgical procedures, corneal dystrophies and bullous keratopathy with the latter two being more common in the developed world [6,7]. Corneal infections constitute a significant cause of scarring in the cornea with a resultant effect of visual impairment and blindness [8]. In Nigeria, corneal scarring including trachoma and onchocerciasis is the third cause of blindness (13.29%) [6].

Corneal blindness in developing countries is mostly due to corneal ulcers and trauma especially as trachoma, vitamin A deficiency and onchocerciasis are on the decline. This stood initially at 9.5% but is now 7% [7,9]. Corneal ulcer and ocular trauma as a cause of corneal blindness is estimated to contribute 1.5-2.0 million new cases of unilateral blindness every year [10].

Corneal ulcer is a major public health problem in the developing world as it causes prolonged morbidity, loss of vision and, many a time, loss of an eye [11,12]. In South East Asia, an estimated 12 million cases of suppurative keratitis occur each year with an unknown proportion of cases progressing to visual loss or blindness [13]. This is a potentially blinding disease if left untreated and rural communities in developing countries are often unable to access appropriate treatment. [14].

Corneal blindness is largely avoidable, affects younger population and has very high disability adjusted life years (DALYs) compared to cataract blindness [7,9,15]. A population-based study in Hyderabad showed the average age for cataract blindness to be 68.5 years while that for blindness caused by corneal opacities was 50 years [16]. The strong association between corneal diseases and poverty leads to a significant reduction in life expectancy especially in children with corneal blindness [7]. Corneal ulcers predominantly affect the poorest in the developing world who often cannot afford treatment. Millions are affected every year even by conservative estimates and their blindness often is under-reported [17].

Corneal transplantation for visual restoration in severe corneal ulcer or corneal scar is mostly unavailable and cost prohibitive in developing countries. However, review of data on indications from corneal transplantation in developing countries showed that corneal scar was the most common indication (28.1%) with keratitis accounting for 50.5%. Of note about 12.2% of all corneal transplantations were performed for active suppurative corneal ulcers [18]. This

further underscores the importance of suppurative corneal ulcers and its complications as an important cause of ocular morbidity and blindness.

Delayed presentation, use of harmful traditional medications, inadequate treatment in developing countries lead to severe disease at initial presentation, which compromise visual outcome especially as access to treatment is often due to cost or simply unavailable. Outcome could be markedly improved by promoting good practice in prevention, diagnosis and treatment including rehabilitation at all levels of care. This study is aimed at reviewing the pattern, trend, predisposing factors, characteristics and visual outcome of corneal ulcers at the University of Calabar Teaching Hospital in Nigeria.

## 2. METHODOLOGY

The University of Calabar Teaching Hospital is a tertiary hospital in Cross River State in the South-South (correct? Yes its correct) region of Nigeria. The state has a population of about 3 million, who are mainly farmers and fishermen. The hospital serves as a referral centre for secondary facilities in Cross River State and its environment. The hospital receives patients from all over Nigeria but mostly from Cross River State and its environment. It has facilities for in-patients, out-patients, surgeries with supportive laboratory services. However, there is no facility for keratoplasty. It has 24 hour emergency service.

A retrospective review of corneal ulcers at the University of Calabar Teaching Hospital (UCTH) covering a 10-year period (January 2003-December 2012) with emphasis on microbial corneal ulcers was undertaken. Medical records of patients diagnosed with corneal ulcers during the period under review were retrieved. Information obtained included demographics, visual acuity at presentation and at discharge, laterality, type of ulcer, predisposing factors, size of ulcer, occupation, microbiological diagnosis, duration of treatment and stay in hospital, actions taken by patient prior to hospital presentation, distance from hospital, treatment instituted in the hospital. Excluded from the analysis were patients with chemical burns since these are not strictly ulcerative keratitis. The results were analysed using StatalC 12 and Microsoft Excel 2010.

## 3. RESULTS

### 3.1 Pattern of Corneal Ulcer at the UCTH

A total of one hundred and fifty-eight (158) patients with corneal ulcer visited the department of Ophthalmology, UCTH between 2003 and 2012, but only one hundred and one (101) records could be retrieved. Of the 101 records of corneal ulcers retrieved, 69(68%) were suppurative, 10(10%) viral, 5(5%) Mooren's, 1(1%) shield ulcer and 16(16%) of the cases lacked clinical information on the aetiology. Diagnosis of corneal ulcers was largely clinical (Fig. 1).

### 3.2 The Trend in Corneal Ulcer at the UCTH from 2003-2012

The number of patients with corneal ulcers visiting the hospital varied throughout the years. The highest number of patients (22) visited during the month of March and the lowest during December (Fig. 2). The highest number of patient visits (41) was in 2012 and the lowest numbers (6) recorded in 2004-2005 (Table 1).

### 3.3 Entry and Exit Visual Acuties of Corneal Ulcer Patients 2003-2012

Most patients with corneal ulcer fell into the blindness category (56, 77.78%) according to the World Health Organisation. Although there was a reduction in the number of blind patients in the blindness category to (49; 68.05%) at discharge, the difference was not statistically significant with a p-value of 0.26. Information on entry visual acuity was, however, not available (NA) in 4 (5.55%) patients and at discharge 10 (13.89%).

### 3.4 Demographics of Suppurative Corneal Ulcer in UCTH 2003-2012

The largest age group was 41- 60 years and the smallest was 10-20 years. Suppurative corneal ulcer was more common in males (42, 60.87%) compared with females. Unilateral corneal ulcer was the most common form (66, 95.65%) during the study period. Patients were mostly from within the Calabar metropolitan area (31, 44.93%), where the hospital is located, while (25, 36.23%) came from other parts of the state. The patients were mostly farmers (20, 28.99%), students and traders (13, 18.84%), respectively. Others were tailors/seamstress (2, 2.90%), pensioners (2, 2.90%), a native doctor, an electrician, a teacher and a welder (1, 1.45% each) (Table 2).

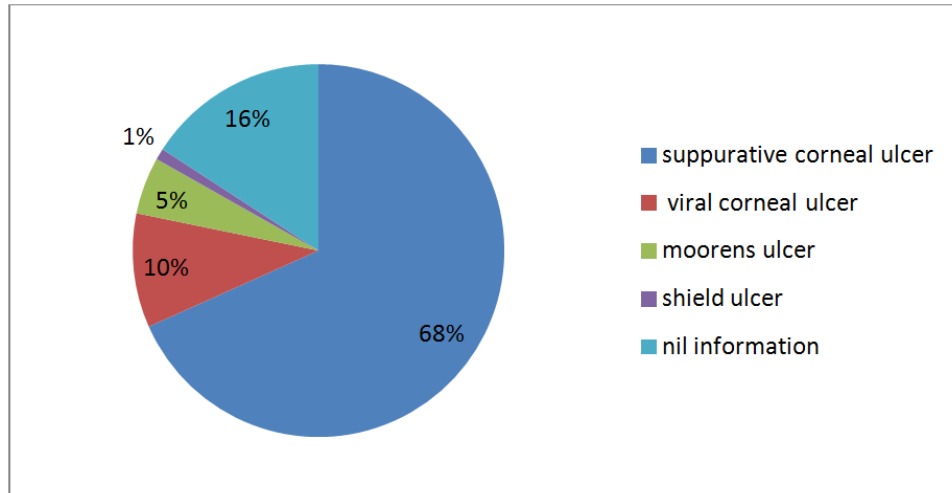


Fig. 1. Pattern of corneal ulcers at the UCTH

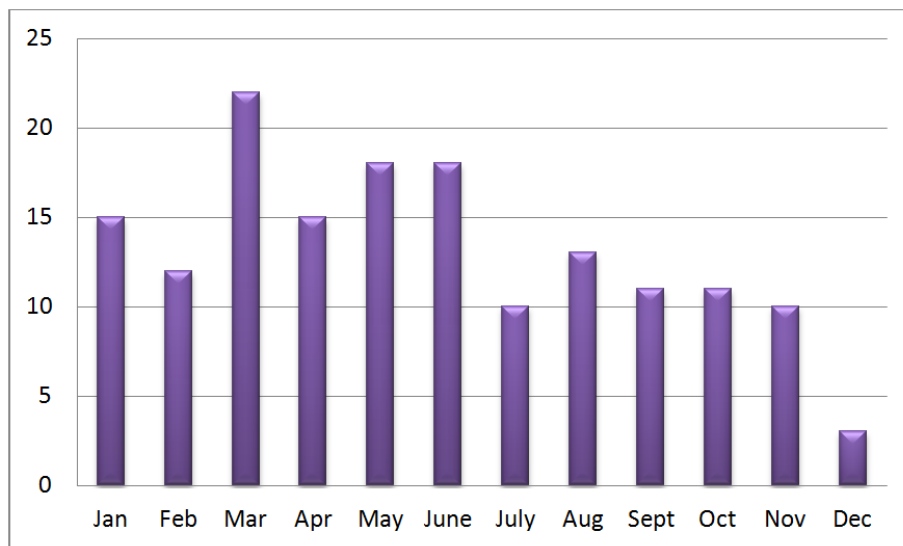


Fig. 2. Corneal ulcer at the UCTH 2003-2012

Table 1. Number of patient visits at the UCTH (2003-2012)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Jan	1	1	0	2	2	2	3	2	1	1	15
Feb	1	0	0	1	1	2	3	0	1	3	12
Mar	0	1	1	3	3	2	1	2	4	5	22
Apr	1	0	0	2	2	4	1	2	1	2	15
May	1	1	1	2	0	1	4	1	4	3	18
June	2	0	1	2	2	2	2	0	1	6	18
July	0	0	1	1	0	0	1	1	2	4	10
Aug	1	0	0	2	0	0	1	1	2	6	13
Sept	0	0	1	2	0	1	0	1	1	5	11
Oct	1	0	0	3	0	1	1	1	1	3	11
Nov	1	1	1	2	1	1	1	0	0	2	10
Dec	0	2	0	0	0	0	0	0	0	1	3
	9	6	6	22	11	16	18	11	18	41	158

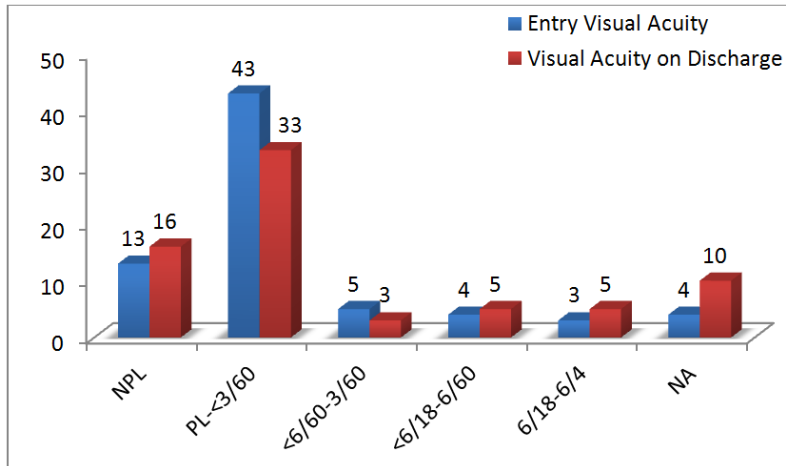


Fig. 3. Entry and exit visual acuities of corneal ulcer patients 2003-2012

Table 2. Demographics of suppurative corneal ulcer at the UCTH 2003-2012

Variables	Frequency
<b>Age group in years</b>	
1-20	6(8.70%)
21-40	22(31.88%)
41-60	32(46.38%)
≥61	9(13.04%)
<b>Gender</b>	
Male	27(39.13%)
Female	42(60.87%)
<b>Laterality</b>	
Unilateral	66(95.65%)
Right eye	39(56.52%)
Left eye	27(39.13%)
Both eyes	3 (4.35%)
<b>Origin of patients</b>	
Calabar	31(44.93%)
Other parts of CRS	25(36.23%)
Akwa-Ibom State	5(7.25%)
South Eastern States	6(8.70%)
No information	2 (2.90%)
<b>Occupation</b>	
Farmer	20(28.99%)
Student	13(18.84%)
Trading/Business	13(18.84%)
Civil servant	6(8.70%)
Driver	4(5.80%)
Others	9(13.05%)
Unknown	2(2.90%)

Causative agents were mostly vegetative/agricultural related materials such as palm kernel fruits, periwinkle shell, etc. However, information was largely missing from the records (41, 59.42%).

Information on ulcer size was largely unavailable as only one case note (1, 1.45%) was documented, which was 3x4x0.5 mm.

The duration before hospital visit was 1 -1095 days with a mean of 87.06 days (+/-193.80). Nineteen (29.23%) of the patients visited the hospital within one week, 11(16.92%) within 2 weeks, 10 (15.38%) within one month, 9 (13.85%) within 2 months and 16 (24.62%) at more than 2(? The duration of symptoms before presentation to hospital was more than 2 months and above) months of onset of symptoms.

Some form of action had been taken by 52 (75.36%) of patients prior to the hospital visit, which were largely use of licensed drugs and/or HTEM (68, 98.55%).

The number of patients admitted and those not admitted were similar (33, 47.83%). This ranged from 2-30 days with a mean of 5.5 +/-7.34.

### 3.5 Characteristics of Patients with Suppurative Corneal Ulcer at the UCTH 2003-2012

The cause of corneal ulcer was mainly from trauma (agricultural) (34, 49.28%) followed by harmful traditional medication (HTEM) (5; 7.25%). This information was not available in 28(40.58%) of the case records.

Information on microscopy, culture and sensitivity (mcs) (please specify! – is it the culture media used? We usually use chocolate, blood and Saboraud dextrose Agar) was unavailable in the records of 50 (72.46%) patients. Only 18 (26.09%) had MCS investigation of which 13 (18.84%) were negative. The organisms identified were *Aspergillus species* (2, 2.90%, *Staphylococcus aureus* (3, 4.35%).

**Table 3. Characteristics of patients with suppurative corneal ulcer at the UCTH 2003-2012**

Variables	Frequency
<b>Causes of Ulcer</b>	
Agricultural trauma	34(49.28%)
TEM	6(8.70%)
Burns	1(1.45%)
No information	28(40.58%)
<b>Causative agent</b>	
Vegetative material	26(37.68%)
Foreign body	1(1.45%)
Gonococcal organism	1(1.45%)
No Information	41(59.42%)
<b>Ulcer size</b>	
4x4x0.5 mm	1(1.45%)
No Information	68(98.55%)
<b>Actions taken prior to hospital visit</b>	
Actions taken	52(75.36%)
No information	17(24.64%)
<b>Types of actions taken</b>	
Eye drops alone	20(28.99%)
TEM	17(24.74%)
Eye drops+TEM	11(15.95%)
Hospital visit	1(1.45%)
<b>Range</b>	
Range prior to hospital presentation	1-1095 days
No information	4 cases
Mean	87.06+/-193.80
<b>Admissions</b>	
Number of admissions	33(47.83%)
Outpatient treatment	33(47.83%)
No information	3(4.35%)
Mean days of admission	5.5+/-7.34
<b>Systemic diseases</b>	
No systemic diseases	32(46.38%)
Systemic diseases present	7(10.15%)
No information	30(43.48%)
<b>Types of systemic diseases</b>	
HIV/AIDS	2(2.90%)
Hypertension	2(2.90%)
Gonorrhoeal	1(1.45%)
Collagen vascular disease	1(1.45%)
Measles	1(1.45%)
<b>Clinical diagnosis</b>	
No information	47(69%)
Bacterial	3(4.35%)
Perforated corneal ulcer	6(8.70%)
Hypopyon corneal ulcer	1(1.45%)
<b>Microbiological study</b>	
<b>Microscopy</b>	
No information	51(73.91%)
Negative	14(20.29%)
Gram positive cocci	3(4.35%)
Fungal hyphae	1(1.45%)
<b>Culture</b>	
No information	51(73.91%)
Information present	18(26.09%)
<b>Culture Results available</b>	
Negative culture	13(18.84%)
<i>Aspergillus sp</i>	2(2.90%)
<i>Staphylococcus aureus</i>	3(4.35%)

Thirty-two (46.38%) patients did not have any associated systemic diseases. However, information on this was unavailable in 30 (43.48%) of the records retrieved. Only 7 (10.15%) persons had systemic diseases, which included HIV (2, 2.90%), Gonorrhoea (1, 1.45%), measles (1, 1.45%) collagen vascular disease (1, 1.45%), systemic hypertension (2, 2.90%).

Treatment received by these patients included medical, optical and surgical interventions depending on the clinical presentation. Topical antibiotics, antifungals, atropine, steroids and non-steroidal anti-inflammatory and systemic antibiotics, antifungals, non-steroidal anti-inflammatory, carbonic anhydrase inhibitors were among the drugs used for treatment. Surgical treatment included Gunderson's flap (2), evisceration (2), enucleation (1). Bandaged contact lenses were applied as a form of treatment for only one patient.

#### 4. DISCUSSION

The trend in corneal ulcers appears to have changed significantly over the years. This study reported one case of measles related corneal ulcer (Table 3). Measles which was a common cause of severe corneal ulceration in sub-Saharan Africa between 1960 and 1970s and until the 1980s with prevalence as high as 44-81% seems to be on the decline [19,20]. Nwosu et al. in 2003 [21] also reported no case of measles-related corneal ulcer in his study. The present low prevalence of measles-related corneal ulcer could be attributed to the wider coverage by the National Immunization Programme.

The most common type of ulcerative keratitis identified in this study was suppurative corneal ulcer (68%) compared to viral (10%), Mooren's/peripheral ulcerative keratitis (PUK) (5%), shield ulcer (1%) and others (16%). Studies in South East Asia also showed suppurative corneal ulcers as the most common type of corneal ulcer with an estimated 12 million cases occurring yearly [22]. Diagnosis of viral, Mooren's, and shield ulcers was clinical. In South India, Srinivasan et al. [23] demonstrated a prevalence of 68.4% of all ulcers to be culture positive, while Bashir et al. [24] showed a confirmed prevalence of suppurative corneal ulcer to be 62.5%. These findings are similar to our study despite the fact that confirmatory laboratory isolates of etiological agents were mostly not undertaken and information was largely unavailable (Table 3).

Aetiological agents identified in this study consisted mainly of bacterial agents, specifically *Staphylococcus aureus* (3, 4.35%) closely followed by a fungal agent (*Aspergillus species*) (2, 2.90%) (Table 3). Although this may be a contaminant from the lid margins but it is not likely as a high preponderance of bacterial agent especially *Staphylococcus aureus* as a major aetiological agent has been reported in other studies in Nigeria [21,25-27]. *Aspergillus species* have been implicated in fungal corneal ulcers as causative agents in many studies conducted in tropical regions, which agree with the finding in our study of *Aspergillus species* as the most common fungal agents [26,28,29]. Of the 18 (26.09%) patients, which had laboratory investigation in this study, 13 (18.84%) were negative. It is reported that microbial culture is often positive in only 70% of cases [30]. Systemic disease is a risk factor for corneal ulcers particularly in the elderly [31]. This was not a predisposing factor in this study being that a significant number (32, 46.38%) did not have any systemic disease in addition to being largely under 60 years of age.

In this study, ulcerative keratitis peaked in the age group 21-60 years, which is in keeping with other studies that found corneal ulcer to be more prevalent in the active population of outdoor workers [26,32-34]. Few studies have also reported greater frequency of corneal ulcers among age group >60years [23,35]. Keshav et al. [35] in Oman advanced the following; climatic droplet Keratopathy (CDK), dryness, cataract surgery, glaucomatous patients on medications and lid deformities due to trachomatous scarring as probable predisposing factors in the development.

More than half 42 (60.87%) of the subjects with suppurative corneal ulcers were males (Table 2). Studies in Nigeria, [21,36,37] other African countries [28] and India [29] have reported a similar male preponderance. This may be due to the greater involvement of males in outdoor activities such as farming, trading, masonry, manual labour, domestic work and artisanry [26,38]. Up to 13 (18.84%) in this study were involved in trading and other business activities that were outdoor in nature (Table 2).

Farming was the predominant occupation (28.99%) in this study. In Nigeria, a large proportion of the population reside in rural areas where farming is a major occupation. Farmers have been observed in studies to be at greater

risk of corneal ulcers as they are exposed to work-related eye injuries, some of which could be very serious [39].

The most common predisposing cause of corneal ulcer in this study was trauma, mostly from vegetative matter (35, 49.3%). Studies have consistently demonstrated that corneal injury is an important risk factor for microbial keratitis in developing countries [40,41]. Several studies have reported accidental trauma via agricultural or workplace processes as the major risk factor in the development of corneal ulcers [23,26,32, 33,35,42,43]. Students are also more likely to sustain injuries while playing sports and the 13 (18.84%) student patients are listed in Table 2.

Harmful traditional eye medication (HTEM) also played a significant role (7.5%) as a predisposing factor to corneal ulcer development in this study. Many studies in Nigeria, other African countries and India have shown a similar picture [21,23,43,44].

In this study the mean time prior to hospital visits was more than four months 87.06+/-193.80 (Table 3). A little more than half 35 (53.82%) of those with suppurative corneal ulcers did not visit the hospital until one month and later following onset of symptoms. Delayed visits were associated with the use of several remedies in attempts to treat the infection. Although most of the patients 31 (44.93%) that used the services of this hospital came from within the Calabar metropolitan area, where the hospital is located did not have much influence on time of hospital visit following onset of symptoms. This is because traditional healers, registered drugs and other alternative sources of medical care are readily available and are largely used in Nigeria. [21,26,45] The reason for increased use of alternative care services is related to issues of accessibility, responsiveness, availability of drugs among others [45-47].

In this study up to 52 (75.36%) patients had taken some action prior to the hospital visits. The actions taken consisted of use of eye drops only (20, 28.99%), HTEM only (17, 24.74%) and a combination of eye drops and HTEM (11, 15.95%) (Table 3). This is not different from other studies on corneal ulcers where delayed visits contributed to the use of HTEM, antibiotic eye drops and steroid preparations [21,26,44]. Ignorance plays a major part here as well as the lack of information to use traditional healers, spiritual healers and registered drugs for their

ocular health care. Again, ophthalmological services are few and far apart and sometimes not available for the rural population.

The visual outcome after treatment of patients with corneal ulcer in this study was poor with up to 68.05% patients remaining blind at discharge (Fig. 3). A study on microbial keratitis in East Africa also revealed a similar outcome with 66% of patients blind at discharge [48]. This may be attributed to the poor entry visual acuity (VA) due to delayed hospital visits, use of TEM, alternative eye procedures including registered drugs and steroid preparations. Studies conducted in Eastern [49] and Northern parts of Nigeria portrayed similar pictures [21]. Four patients had removal of the eyes by evisceration (2) and enucleation (2) showing failure of primary treatment. Reported failure rate of primary treatment as high as 31% and evisceration rate of 25% in patients with fungal keratitis has been documented [50]. There is limited published data on outcomes of microbial keratitis in Africa for a robust comparison [48].

The number of those admitted in this study was 33 (47.83%) with a mean duration of admission of 5.5+/-7.34. Other studies have reported duration days of 28-127 days. Longer admission duration is associated with fungal infection, which has been attributed to slow drug response for fungus infection compared with that due to bacteria [51,52].

## 5. LIMITATIONS OF THE STUDY

Lack of some of the patient records including some incomplete information limits the possibility of making conclusions from this study. This shows the well-known defects of retrospective studies. This study will be used as the basis for a prospective study on corneal ulcer and development of guidelines for management of corneal ulcers at the centre.

## 6. CONCLUSION

Microbial keratitis remains the leading cause of ocular morbidity worldwide with potentially devastating visual impairment and significant cost to the public health system. A proper awareness campaign on the prevention, causes, avoidance of TEM and early presentation to hospital facilities will remain pivotal in striving towards reduction of morbidity associated with corneal ulcers. Strengthening existing health systems to enhance, diagnosis, treatment and

rehabilitation will contribute immensely to the fight against corneal blindness.

## 7. RECOMMENDATIONS

1. Creating awareness on primary, secondary and tertiary prevention of corneal ulcer in the population
2. Development of management guidelines for corneal ulcer at the centre and surrounding secondary and primary centres
3. Training eye care workers on management guidelines for corneal ulcers at all levels of care in the state
4. Training and re-training of eye health workers at all levels of care on relevant knowledge and skills required in the management of corneal ulcers
5. Advocate to the hospital management the needs to strengthen laboratory services and other systems required for effective management of corneal ulcers at the centre

## CONSENT

Consent for use of patient data for research was obtained from the Head of the Department of Ophthalmology, UCTH.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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