Suppurative Corneal Ulcers at a Tertiary Hospital Southeast Nigeria: A 5-Year Review

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ABSTRACT

Background: Suppurative corneal ulcer is a potentially blinding condition. **Objectives:** To determine the changes in demographic factors, microbial flora and antimicrobial sensitivity of suppurative corneal ulcers. **Materials and Method**s: These were retrieved from the case files and microbiological laboratory register of patients in whom the diagnosis of suppurative corneal ulcer was made from 2015 to 2019: age, sex, laterality, occupation, place of abode, month of presentation, causative factor, duration of symptoms and use of medications prior to presentation, Gram stain, culture isolate and sensitivity result. **Result:** Of the 753 records reviewed there were more males (54%) affected than females (46%); mean age was 42.6 years. The commonest predisposing factor was physical trauma (41.34%). The peaks of infections were in March and August while the least occurred in May and December. Dependents (181) and traders (153) were more likely to have used eye medications before presentation. Though there was no statistical significance between visual acuity and the duration of infection prior to presentation, most patients who presented within 5 days of onset had better visual acuity (6/6 to 6/18).There was a statistical significance between the duration of drug usage before presentation and visual acuity (p = 0.0043). The commonest organisms were *staphylococcus aureus* and *Aspergillus spp.* The highest bacterial sensitivities were to the flouroquinolones, cefuroxime and amoxicillin/clavulanic acid. **Conclusion:** All corneal ulcers must be managed promptly supported by adequate laboratory services. Measures must begin with preventive strategies aimed at curtailing their occurrence through the primary health care program.

Key words: Blinding; corneal stroma; corneal ulcer; suppurative

INTRODUCTION

Corneal ulcer is a breach in the epithelial layer involving the corneal stroma and associated with inflammatory response.[1] Corneal ulcer is a major public health problem in the developing world as it causes prolonged morbidity, blindness and possible loss of an eye.[2,3] Bilateral corneal blindness is estimated to affect 4.9 million persons or 12% of 39 million blind worldwide. The estimate is higher in India and Africa (14.6–15.4% and 11–30%), respectively. Monocular corneal blindness affects an estimated 23million people globally.[4,5]

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A Suppurative corneal ulcer is an infective condition of the cornea involving disruption of its epithelial layer with involvement of the corneal stroma cuased by bacteria, fungi and protozoa.[6] Specifically, the incidence of Suppurative keratitis varies from country to country and from region to region even within the same country. Erie Et al in Minnesota USA reported 11.0 per 100 000 persons/year,[7] while in developing countries like India and Nepal incidence of 113 per 100,000persons/year and 799 per 100 000 persons/year were reported in Mandurai and Bhaktapur respectively.[8,9] The epidemiology of corneal ulceration due to microbial causes is influenced by several determinants, such as predisposing risk factors, region (developed or developing country), urban versus rural location, and climatic and geographic factors.[10] Suppurative corneal ulcers are classified according to the causative organisms: bacterial, fungal and protists, The most common causative bacterial pathogens include *S. aureus*, *Pseudomonas aeruginosa*, *S. pneumonia*, and *Serratia* species. The most common causative fungal agents implicated include both filamentous as well as yeast, including *Fusarium*, *Aspergillus*, *Curvularia*, *Paecilomyces*, *Scedosporium*, and *Candida* species. The third class of pathogens includes the protists, *Acanthamoeba* spp.[9]

In Nigeria, there have been variations in the microbiological pattern and predisposing factors of suppurative corneal ulcers. Oladigbolu *et al.* in Kaduna, Northern Nigeria, reported the most common organisms as *Staphylococcus aureus* 19.0%, fungal hyphae 15.8%, and *Streptococcus pneumoniae* 4.8%.[11] Ibanga et al in Calabar found Staphylococcus aureus (3, 4.35%) and aspergillus species (18, 26.09%) from their culture –positive samples.[12] A study by Nwosu and Onyekwe reported: fungi (14 eyes), herpes simplex keratitis (9 eyes), staphylococcus aureus (3 eyes), streptococcus pneumonia (2 eyes), mixed infection with staphylococcus aureus and coliform (1 eye).[2] They found that farmers, pensioners, and housewives presented late to hospital compared to literate patients, traders, and artisans. Major predisposing factors were trauma, traditional eye medications, and self-medication with corticosteroids.[2] This study is aimed at determining the changes in microbial flora, demographic factors and antimicrobial sensitivity of suppurative corneal ulcers managed at the Guinness Eye Centre, Onitsha, Nigeria. The information obtained from this study will contribute to useful knowledge in managing patients with corneal ulcers in terms of effective treatment and rational selection of antimicrobials before sensitivity results are obtained.

MATERIALS AND METHODS

Study design: This is a retrospective study.

Study area: The study was done at the Guinness Eye Centre, Onitsha, South east Nigeria. It is the ophthalmology department of the Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Southeast Nigeria.

Study population/sample size/procedure: A register containing records of all newly presenting eye patients from January 2015 to December 2019 was obtained; from this the case files of all patients in whom a diagnosis of suppurative corneal ulcer was made were retrieved. A record of the microbiological test results of the patients was also obtained. The following information were retrieved from the medical case files and microbiological laboratory register of patients in whom the diagnosis of suppurative corneal ulcer was made over the period of 5 years: age, sex, laterality, occupation, place of abode, month of presentation, causative factor, duration of symptoms prior to presentation, use of medications prior to presentation, Gram stain, culture isolate and sensitivity result.

Inclusion criteria: All patients whose diagnosis of suppurative corneal ulcer was made during the period under review.

Exclusion criteria: The patients without a diagnosis of suppurative corneal ulcer within the study period; or with diagnosis of peripheral /marginal ulcers, and dendritic ulcers.

Statistical analysis: Data obtained was recorded in a proforma and statistical analysis was done using python 3.9. One way and two- way analysis of variance were used (ANOVA). The level of statistical significance was kept at 0.05 with a 95% confidence interval.

Ethical consideration: Ethical approval was obtained from the Ethics Committee of NAUTH, Nnewi (Reference: NAUTH/CS/66/VOL.14/VER 3/14/2021/011). Written permission was also obtained from the Heads of both the Medical Laboratory and Medical Records units.

RESULT

A total of seven hundred and fifty three records of patients with suppurative corneal ulcers were analysed. There were more males (54%) affected than females (46%). However, in the 6th and 7th decades of life more females were recorded. Both gender showed two peaks and troughs in their age distribution. Statistically, the number of infections was not significant to gender but significant to age ($p = 0.01367$). The mean age of the study is 42.6years hence the mean age range is 41-50years.

Table 1: Age sex d istribution

Age (years)	Male(%)	Female(%)
0-10	59	50
11−20	34	33
21-30	59	43
31-40	60	41
41-50	59	57
51-60	56	60
61-70	33	39
71-80	34	17
>80	11	8
Total	405 (54)	348(46)

Table 2: laterali ty

	Male	Female
Right	204	164
Left	188	168
Bilateral	18	10

Unilateral disease was far more common than bilateral cases.

Table 3: Place of abode

Place of abode	Frequency
Rural	238
Semi-Urban	228
Urban	137
No Response	82

Incidence of suppurative corneal ulcers showed marked seasonal variation with peaks recorded in the months of March and August. The lowest numbers of cases were seen in May and December, with high clusters from June to September. There were no data on the months of infection in 32 (4.11%) patients.

Table 4: Causative factors of suppurative corneal ulcers

Causative Factor	Frequency(%)
Physical trauma	41.34
Chemical injury	3.49
Abnormal ocular exposure	2.55
Non-identifiable	49.93
Surgery/Clinically related	2.68

In half (49.9%) of all the cases there were no identifiable causative factors of corneal ulcers.

The most identifiable causative factor was physical trauma (41.3%). Other factors were chemical injury (3.49%), surgery/clinically related (2.68%) and abnormal ocular surface exposure (2.55%). From the 4th decade of life upwards physical trauma declines as a causative factor, but suddenly spikes briefly in the 6th decade before waning off. Comparing the causative factor and age shows no statistical significance at $p = 0.1391$.

Figure 1: Seasonal Variation

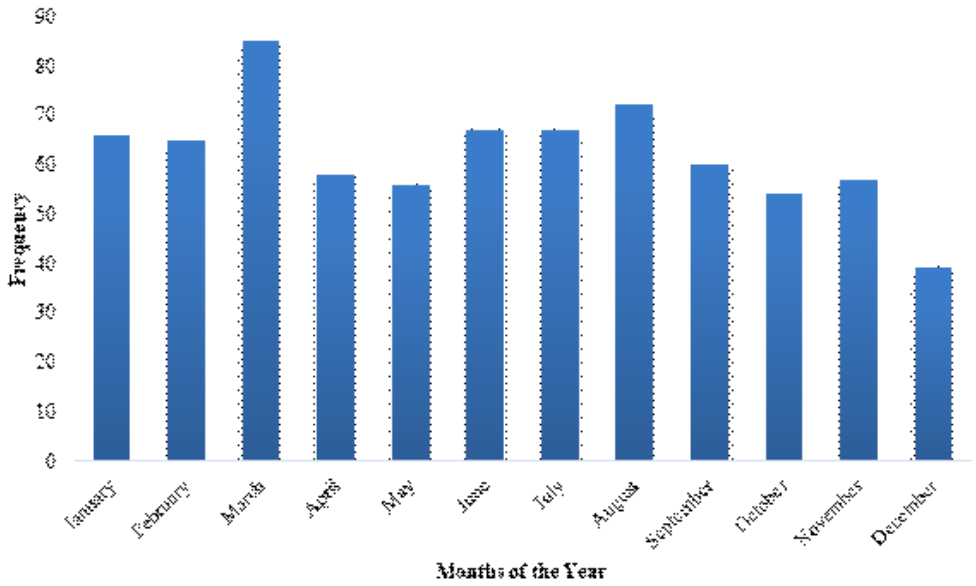

Table 5: Age versus Causative factors

Age (years)	Physical Trauma	Chemical Injury	Abnormal Ocular Exposures	Non-Identifiable	Surgery/Clinically Related
0-10	52	6	2	45	2
11−20	37	2	0	28	1
21-30	47	5	4	47	2
31-40	38	7	2	53	1
41-50	36	4	5	62	5
51-60	49	2	2	57	2
61-70	28	0	1	38	3
71-80	12	0	2	34	3
>80	9	0	1	8	1
	308(41.3)	26(3.5)	19(2.6)	372(49.9)	20(2.7)

Dependents (181) and traders (153) were more likely to have used eye medications prior to hospital visit use of eye medications prior to presentation was seen mostly among. Data on the use of eye medication prior to hospital visitation was missing in 127 (16.30%) patients.

Table 6: Visual acuities of patients on presentation

Visual Acuity	% Frequency
6/6 to <6/9	8.29%
6/9 to <6/12	8.57%
6/12 to <6/18	8.01%
6/18 to <6/24	5.34%
6/24 to <6/36	7.30%
6/36 to <6/60	6.46%
6/60 to 3/60	10.67%
<3/60 to HM	27.81%
LP	11.52%
NLP	5.76%
Not Ascertained	0.28%

Figure 3: Duration of disease prior to presentation

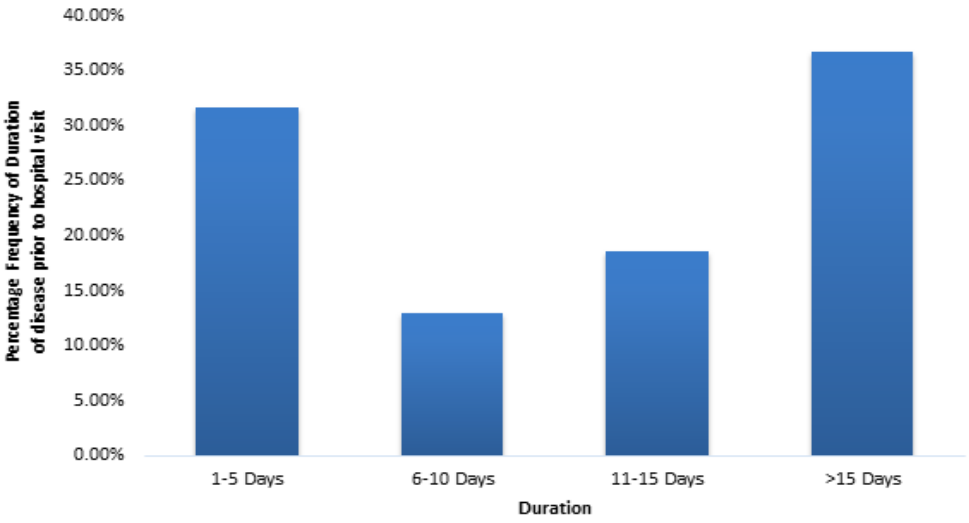

Table 7: Visual acuity versus duration of disease (days) prior to presentation

Visual Acuity	1-5 Days	6-10 Days	11-15 Days	>15 Days
6/6 to <6/9	30	2	10	11
6/9 to <6/12	28	6	11	14
6/12 to <6/18	20	9	17	8
6/18 to <6/24	10	4	8	12
6/24 to <6/36	14	8	8	16
6/36 to <6/60	9	6	6	21
6/60 to 3/60	15	5	7	27
<3/60 to HM	44	31	25	76
LP	24	8	20	24
NLP	4	2	4	23
Not Ascertained	0	0	1	1

The largest number of patients (74) presented with vision less than 3/60 to hand movement (HM) after 15 days of onset of symptoms. However, most patients who presented within 5 days of onset still had better visual acuity(6/6 to 6/18). No statistical significance between visual acuity and the duration of infection prior to presentation. (sum sq =382.0887, mean sq =382.0887 p = 0.1679).
Tab 8

There is a statistical significance between the duration of medicine usage and visual acuity (p = 0.0043). However, the number of infections was not statistical significant to the visual acuity.

Microscopy/culture result

A total of 52 patients had corneal scrapping specimens done for Potassium Hydroxide (KOH) mount, Gram staining, culture and sensitivity evaluations. Culture media employed were chocolate agar, blood agar and Sabouraud dextrose agar. There were some mixed growths of

Table 8: Visual Acuity vs duration of drug use prior to presentation

Visual Acuity	1 Day	2 Days	3 Days	4 Days	5 Days	6 Days	7 Days	>7 Days
6/6 to <6/9	4	4	0	1	4	0	3	10
6/9 to <6/12	3	2	2	1	4	0	5	6
6/12 to <6/18	0	0	4	2	3	0	16	0
6/18 to <6/24	1	3	2	0	3	2	2	5
6/24 to <6/36	2	0	3	1	1	0	5	9
6/36 to <6/60	3	3	2	0	2	0	2	15
6/60 to 3/60	0	1	0	2	21	0	1	19
<3/60 to HM	7	7	8	2	9	9	8	64
LP	2	4	2	4	7	2	6	16
NLP	1	0	0	1	0	0	3	14
Not Ascertained	0	0	1	0	0	0	0	1

Staphylococcus aureus, Streptococcus pneumonia and coliform. However, 18 specimens were culture-negative. There was no record of fungal culture. The following were the organisms recorded:

Sensitivity result

The bacterial sensitivities to the various antimicrobial discs varied from moderate (2+) to highly sensitive (3+). The following represents the frequency of bacterial sensitivity to the commonest antimicrobials tested.

Table 8: Bacteria isolates

Bacteria	Number of isolates
Staphylococcus aureus	22
Streptococcus pneumonia	1
Gram negative bacilli	2
Gonococci	2

Table 9: Fungi

Fungi	Number (KOH mount)
Candida albicans	1
Aspergillus spp	17

Bacterial sensitivity to antimicrobials

Antimicrobial	Frequency (%)
Levofloxacine	100
Ciprofloxacine	100
Cefuroxime	100
Amoxycillin/Cloxacillin	100
Erythromycin	80
Gentamycin	71.4
Amoxycillin	68.8
Rifampicin	37.5
Chloramphenicol	26.7

Figure 2: Use of medications prior to presentation versus Occupation

Occupation	Yes	No
Trader	133	52
Farmer	58	4
Civil Servants	37	14
Hair Dresser	0	1
Dependents	181	65
Driver	1	0
Artisan	79	19
Pupil	3	2
Retired Servant	1	0
Blacksmith	1	0
Trad. Doctor	1	0

DISCUSSION

Public health care intervention measures have changed the demography and outcome of certain diseases in the Third world countries such as childhood killer diseases being controlled through

immunization programs. These invariably impacted positively and indirectly on certain hitherto prevalent ocular conditions.[2]

Demographically, there was male preponderance, a finding which is similar to many other corneal ulcer studies.[2,11,12] This may be linked to the fact that males are more involved in outdoor activities that predispose to corneal ulcers. In contrast, this study, recorded more female affectation between the ages of 50 – 70years, similar to the finding by Suwal et al in a hospital –based study in Nepal.[14] Apart from the first decade of life most patients fell within the working class group of 20 to 60years. The initial surge in incidence in the 0 -10 years group was a manifestation of increase in ocular trauma rates among school pupils probably due to lack of supervision at home or in school resulting from playmates, self inflicted, corporal punishment by teacher/parent/guardian.[15,16] Similar study previously done in the same centre also documented that this age group constituted the highest rate of 22.2%.[2] In this study, there was no case of suppurative corneal ulcer resulting.

In South-eastern Nigeria, the beginning of the farming activities is heralded by the first scanty rains in March signalling the period of bush clearing and land preparation. This is accompanied by lots of wood and grass cutting which greatly predispose to ocular traumas as shown by the first peak incidence of corneal ulcers in our study. [17] Ibanga et al in Calabar , Southern Nigeria demonstrated the same peak incidence in the month of March.[12] Culturally, the month of August ushers in the harvest period for the new yam, an important staple stem tuber, which also kick-starts another round of farming activities thus coinciding with the documented second peak incidence of corneal ulcers.

Consistently, as in this study, the commonest predisposing factor to corneal ulcers is physical trauma (41.3%). Many studies done in the developing countries have demonstrated this finding, especially resulting from agricultural activities, workplace processes and school events.[2, 12,14, 18-21] Two decades ago physical trauma was much higher and accounted for about 54.8% of the predisposing factors from a similar study done in the same hospital by Nwosu et al.[2] This decrease could have resulted from the proportionally lower number of farmers documented in the present study or more likely due to false increase in the proportion of unidentifiable factors resulting from missing file information. Similarly, the isolated unexpected sudden increase noticed in the rate of physical trauma among the 50 – 60 year age group is worth exploring further since this study did not investigate the details of the actual physical traumas involved. In the south eastern Nigeria, many youth have abandoned agriculture to the older age groups in pursuit of other sources of income such motorcycle transport, internet services. Suwal and co-workers found that the highest number of patients, 40% (18/45) from corneal ulcer positive case belonged to age group 51–60. They attributed it to the fact that people of age between 51 and 60 years have many predisposing factors like CDK (climatic droplet keratopathy), dryness of the eyes, cataract surgery, glaucoma, macular degeneration, previous ocular surgeries and lid deformities due to trachomatous scarring which probably predispose this age group to corneal ulceration more than the other age groups.[14]

This study demonstrated that chemical injury as a predisposing factor to suppurative corneal ulcers was not significant in the study area. In fact no single case was reported from the 7th decade upwards over the 5 year period. It may be assumed that elderly people rarely come in contact with culpable chemicals in this environment.

The prevailing economic challenges have implications on the health-seeking behaviour of the populace. Consequently, there is an increasing tendency to obtain solution at the minimal cost. The perceived solutions, at the expense of standards and quality, lay outside of the standard health care facilities.[22] Therefore, most of the patients with corneal ulcers, irrespective of occupation, would

have tried one substance or the other in the form of harmful traditional eye medications (HTEM), antibiotics, and steroids. This practice is common in many resource-poor countries. [2, 11, 12, 23, 24] In this study dependents were noted to have used medications mostly, followed by traders. These dependents were economically handicapped hence more likelihood of seeking cheaper remedies. Traders, on the other hand, are likely to use medications purchased from open market which were within their reach especially when these are readily purchased in Nigeria without doctor's prescription. Unfortunately, most eventually present with complications as found in the previous study.[2]

About 31.6% of the patients presented in the first 5 days of onset of symptoms similar to the 36.7% reported by Nwosu *et al* [2] and 29.2% documented by Ibanga *et al*.[12] Amongst these patients that presented in the first 5 days 43.5% had presented with vision in the range 6/6 to 6/18, while 39.6% presented with vision <3/60. Though early presentation in this study was not statistically significant in relation to visual acuity however other studies such as the work done by Rathi et al in India found it significant.[25] The duration of medication used prior to presentation was not significantly related to visual acuity; this in addition to mechanism of action/agent of causation, presence of complications, and co-morbidities may significantly affect vision. Among those who presented beyond 15 days of onset of disease (36.7%) about 52% of the eyes were already in the blind category while 14.1% still retained vision in the 6/6 to 6/18 range.

Staphylococcus aureus was the leading bacterial cause of corneal ulcer while Aspergillus was the commonest fungal cause. Bacterial cause (27, 3.6%) was equally reported in many previous works done globally.[2, 7, 8, 10, 14-17] Contrary to our finding of *S.aureus*, many studies have shown *S. pneumoniae* as a major biological agent causing corneal ulcer in developing as well as industrial nations.[14, 24, 26]

Sensitivity tests of culture isolates for their susceptibility to antimicrobial drugs is necessary for selection of appropriate antibiotics or for changing an already administered drug. In this study all the bacterial isolates (Gram positive and negative) were 100% susceptible to levofloxacine, ciprofloxacine, cefuroxime and amoxicillin/cloxacillin. Consequently, as suppurative ulcers are ocular emergencies efforts must be made to employ the floroquinolones as first line empiric treatment.

This retrospective study is limited by the unaccounted missing information encountered in some of the case files and the limited microbiological sensitivity panels used in our laboratory.

CONCLUSION

All cases of corneal ulcers must be managed promptly supported by adequate laboratory services. Measures must begin with preventive strategies aimed at curtailing their incidence in the farms, homes, schools and workplaces through the already existing primary health care program. Alternative therapy providers must be controlled, trained and supervised with a view to standardising, refining and regulating their practice.

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Author Contribution: CCU and AIA conceptualized and designed the study. All authors were involved in the writing and revision of the manuscript. The authors read, approved the final manuscript and agree to be accountable for all aspects of the work.

Data Availability: The data used to support the findings of this study are available from the corresponding author upon reasonable request.

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Conflict Of Interest: None declared

Ethical Approval: The study was approved by the Nnamdi Azikiwe University Teaching Hospital Nnewi Ethics Committee.

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