Original Article

Clinical Pattern and Antibiotic Sensitivity of Bacterial Corneal Ulcers in Kano, Northern Nigeria

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Abstract

Purpose: The purpose of this study is to determine predisposing factors, common bacterial causes, and antibiotic sensitivity of corneal ulcers in Murtala Muhammad Specialist Hospital. **Materials and Methods:** A prospective, cross-sectional, observational study was carried out on patients with corneal ulcers. Information on relevant clinical, sociodemographic profile was obtained. Examination includes visual acuity test and slit-lamp biomicroscopy, especially fluorescein staining. Corneal scrapings from the ulcer were inoculated onto the selected solid culture media plates. Gram staining for microscopic examination was done. Antibiotic sensitivity test on different antibiograms was done using modified Kirby–Bauer technique, determining bacterial isolate sensitivity or resistance to relevant antibiotics (chloramphenicol, ciprofloxacin, ofloxacin, gentamicin, tetracycline, ceftazidime, ceftriaxone, cefotaxime, and penicillin). **Results:** A total of 77 patients with corneal ulcer were examined. Ocular trauma, application of harmful traditional eye medication, and use of unspecified topical medication before presentation were among the predisposing factors. Bacterial growth was seen in 46.8% of the samples, of which 28.6% of the growth were Gram-positive. The common bacteria isolated were *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Streptococcus pneumoniae*, *Proteus* species, and *Klebsiella pneumoniae*. Isolates were sensitive to ciprofloxacin and ofloxacin while an intermediate sensitivity was seen with chloramphenicol and gentamicin. Isolates were resistant to tetracycline, ceftazidime, ceftriaxone, cefotaxime, and penicillin. **Conclusion:** Ocular trauma was the major predisposing factor to corneal ulcer, and *Staphylococcus species* was the major bacterial organism isolated. Isolates were found to be sensitive to ciprofloxacin and ofloxacin, while an intermediate sensitivity was seen with chloramphenicol and gentamicin.

Keywords: Antibiotic sensitivity, bacterial organism, corneal ulcer

Résumé

But: Le but de cette étude est de déterminer les facteurs de prédisposition, les causes bactériennes courantes, et la sensibilité aux antibiotiques des ulcères de la cornée à l'hôpital Murtala Mohammed Specialist. **Matériels et méthodes:** une étude prospective, transversales, l'étude d'observation a été effectuée sur des patients atteints d'ulcères de la cornée. Des informations sur les caractéristiques sociodémographiques, cliniques a été obtenue profi l. Examen comprend test d'acuité visuelle et lampe à fente biomicroscopie, surtout fl uorescein la coloration. À partir de l'ulcère cornéen raclures ont été inoculées sur la plaque de culture solide. La coloration de Gram pour l'examen microscopique a été fait. Essai sur la sensibilité aux antibiotiques a été effectuée à l'aide d antibiograms différentes modifi Ed Kirby-Bauer technique, déterminer la sensibilité ou la résistance d'isoler des bactéries aux antibiotiques correspondants (chloramphénicol, oxacin oxacin ciprofl, ofl, la gentamicine, la tétracycline, la ceftazidime, la ceftriaxone, céfotaxime, et la pénicilline). **Résultats:** Un total de 77 patients atteints d' ulcère cornéen ont été examinés. Un traumatisme oculaire, l'application de médicament traditionnel des nuisibles, et l'utilisation d'unspecifi ed médicament topique avant la présentation ont été parmi les facteurs de prédisposition. La croissance bactérienne a été observée dans 46,8 % des échantillons, dont 28,6 % de la croissance des bactéries Gram-positives ont été. Les bactéries communes isolées étaient Staphylococcus epidermidis, Staphylococcus aureus, Pseudomonas

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Access this article online

Quick Response Code:

Website: www.annalsafrmed.org

DOI: 10.4103/aam.aam_59_17

How to cite this article: Abubakar UM, Lawan A, Muhammad I. Clinical pattern and antibiotic sensitivity of bacterial corneal ulcers in Kano, Northern Nigeria. Ann Afr Med 2018;17:151-5.

aeruginosa, Streptococcus pneumoniae, espèces de Proteus et Klebsiella pneumoniae. Les isolats étaient sensibles à l'oxacin oxacin ciprofl et ofl tandis qu'une sensibilité intermédiaire a été vu par le chloramphénicol et la gentamicine. Isolats étaient résistants à la tétracycline, la ceftazidime, la ceftriaxone, céfotaxime, et la pénicilline. **Conclusion:** un traumatisme oculaire a été le principal facteur prédisposant à l'ulcère cornéen, et Staphylococcus espèce a été le principal organisme bactérien isolé. Les isolats ont été trouvés à être sensibles à l'oxacin oxacin ciprofl et ofl, tandis qu'une sensibilité intermédiaire a été vu par le chloramphénicol et la gentamicine.

Mots-clés: sensibilité aux antibiotiques, organisme bactérien, un ulcère cornéen

Introduction

Corneal ulcer is defined as a disruption of the epithelial layer with the involvement of the corneal stroma, associated with inflammation either sterile or infectious.[1] It is a major cause of monocular blindness in developing countries.[2] corneal ulcer has been recognized as a silent epidemic.[3] A conservative estimate indicates the annual occurrence of 1.5–2 million in developing world.[4] 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.[5]

Studies on corneal ulcers in developed and developing countries show considerable differences in the types and frequency of causative microorganisms in their respective communities.[6] Antibiotics are preferentially used in cases of bacterial corneal ulcers, but in most of the instances, it is used empirically which may lead to resistant mutants with consequent treatment failure.[7]

The aim of the study was to determine clinical pattern and antibiotic sensitivity of bacterial corneal ulcers in Murtala Muhammad Specialist Hospital (MMSH) Kano, Northwestern Nigeria. We often see purulent corneal ulcers which show slow resolution with empirical antibiotic treatment, probably caused by unusual or resistant organisms that failed to respond to initial therapy. Therefore, information from the study on this sight-threatening condition would further contribute to knowledge and contribute to improving the care of the patients with corneal ulcers in terms of effective treatment and rational selection of antibiotics before sensitivity results are obtained.

Materials and Methods

Ethical approval was obtained from the Ethical Committee of Aminu Kano Teaching Hospital and MMSH, Kano. The study adhered to the tenets of the Helsinki Declaration. The study was conducted in the eye Clinic of MMSH. A cross-sectional observational study was carried out over 8-month period (November 2014 to July 2015). The minimum sample size calculated for the study was 77. Consecutive patients who consented and satisfied the inclusion criteria for corneal ulcer were recruited till the required sample size was obtained. Patients with corneal ulcers in one or both eyes aged 12 years and above who would cooperate in obtaining corneal scrapping met the inclusion criteria. Patients with chemical burns-related corneal ulcers, suspected viral ulcers, noninfective traumatic corneal ulcers that presented <12 h and aged younger than 12 years were excluded from the study.

Written informed consent/assent was obtained from each participant. Necessary information was obtained from each participant using interviewer-administered structured questionnaire. This consists of interview section to obtain information on relevant clinical, sociodemographic data, duration of symptoms, risk factors, and drug history. History of symptoms such as ocular pain, sensitivity to light, decrease vision, redness, tearing, eye discharge, and ocular discomfort among others. Examination of the patient includes visual acuity test with Snellen's acuity chart, or E-chart, as the case may be. The eye was stained with rose Bengal strip (1.5 mg) and examined with slit lamp (Keeler SL 16, Manufactured by CSO Italy), followed by fluorescein strip (1 mg) stain. Slit-lamp biomicroscopical examination was performed on every patient to characterize the ulcer such as the location of ulcer, presence of satellite lesions, margins of the ulcer, presence of foreign body on the ulcer, presence of pigments, stromal infiltrations, and surrounding inflammation with or without hypopyon.

The procedure was performed under slit-lamp magnification with aseptic precautions. Lid speculum (Barraquer) was used to expose the globe after instillation of preservative containing amethocaine eye drop (0.5%). Using a sterile 23-gauge bent needle, three corneal scrapings and in some cases corneal swabs were obtained gently from the base and peripheral margins of the ulcer with great care avoiding contamination from lashes or the eyelid.

Corneal scrapings from the ulcer were directly and immediately inoculated onto separate solid culture media plates including blood agar, MacConkey agar, and chocolate agar. The inoculation was done in C-shaped streaks pattern ensuring localization of inoculation site of the scraped material on the culture medium.

Inoculated culture medium plates were taken to the microbiology laboratory within 30 min, for Gram staining and microscopy (LEICA Microscope, Model DM 500), culture, and sensitivity test. Samples were incubated in Chocolate agar plate at 35°C–37°C in carbon dioxide atmosphere. Blood agar and MacConkey's agar were incubated aerobically. Culture was examined after 18–24 h. Isolated colonies were identified macroscopically to describe colony appearance. A part of the colonies were used to make smears, which were air-dried, fixed, and Gram stained for microscopic examination. The result is considered positive when an organism is isolated on

culture media. Culture plates were discarded after 48 h in the absence of any growth.

Antibiotic sensitivity test on different antibiograms was done using modified Kirby–Bauer technique by disc diffusion method for the bacterial isolates determining its sensitivity or resistance to relevant antibiotics. Results were interpreted based on the Clinical and Laboratory Standard Institute guidelines.[8]

Data analysis was done using a computer-based Statistical Package for the Social Sciences version 16.0 (SPSS Inc, Chicago, IL). The qualitative variables were presented as bar charts, pie charts, and percentages. The nonparametric test Chi-square was used appropriately to compare proportions. A confidence interval of 95% was used and a $P \leq 0.05$ was considered statistically significant.

Results

A total of 77 eyes of 77 patients were examined. There were 47 males and 30 females (M: F = 1.5:1). The patients age range13–65 years with a mean age of 37.1 ± 2 years. None had bilateral corneal ulcer. Ulcer occurred in the right eye in 44 patients and left eye in 33 patients. Ulcers were present mostly in patient age 21–40 years (49.4%). Housewives had the highest percentage (31%), with farmers having least percentage (8%) [Table 1]. The study showed that 44.2% of the patients with corneal ulcer had preceding trauma. Wooden object was the major cause accounting for 15% of cases. Other risk factors are as shown in Table 2.

More than half (53.2%) of the corneal ulcer patients were blind on the affected eye ($P = 0.006$). There was growth in 46.8% of culture plates.

Table 1: Occupational Distribution of 77 patients with corneal ulcer

Occupation	Frequency (*n*)	Percentage
House wife	24	31
Traders	14	18
Civil Servants	13	17
Farmers	6	8
Others	20	26
Total	77	100

Table 2: Risk factors in 77 patients with corneal ulcer

Risk factors	Frequency (*n*)	Percentage
Multiple risk factors	32	41.6
Trauma only	26	33.8
Traditional eye Medication only	11	14.3
Prior eye drop (Steroid/Antibiotic steroid combinations)	6	7.8
Diabetes mellitus only	2	2.6
Contact lenses only	0	0.0
Ocular Surgery only	0	0.0
Total	77	100

Staphylococcus epidermidis was the major isolate accounting for 11.7% of the bacteria isolated from the culture followed by *Staphylococcus aureus* and *Pseudomonas aeruginosa* with 10.4% each as shown in [Figure 1]. The "No Growth" group might be fungal organisms. The isolates were sensitive to ciprofloxacin (94.4%), ofloxacin (91.7%), and gentamicin (72.2%) as shown in Figure 2. Isolates were resistant to tetracycline (91.7%) and penicillin (97.2%) as shown in Figure 3.

The isolate had more intermediate sensitivity to chloramphenicol (63.9%) and resistant to Cefotaxime (63.9%) as illustrated in Figure 4. There was significant association between young age and ocular trauma ($P = 0.008$), there was also significant association between visual acuity and location of ulcer ($P = 0.006$).

Discussion

Microbial corneal ulcers are of great importance as they can lead to avoidable blindness.[9] It affects young adults in their thirties and could affect their productivity in the community. In Bangladesh, 71.4% of patients were between the age of 21 and 50 years.[10] Our study showed that ocular trauma was the major predisposing factor, comparable to similar studies in Bangladesh 59.18%, Enugu 52.4%, and Onitsha 54.8%.[10-12] Homemakers had more corneal ulcer than other occupation probably due to high risk of domestic accident, while breaking firewood and other home-related trauma since most families in the study area cook with firewood. Surprisingly, there were a low proportion of farmers with corneal ulcers. This is probably because most of the patients were from Kano Township where farming is not the main occupation, or probably because of the advent of mechanized farming, there could be lower exposure to traumatic eye injuries for the farmers, hence the low percentage of farmers with corneal ulcers.

None of the patients was found to be using contact lenses. This might be due to lack of awareness on the use of contact lenses; uneducated patients who are poor are unlikely to use contact lens. This finding is in contrast to studies in developed nations where contact lens was the main predisposing factor to corneal ulcers in 31% of cases.[5] In Paris, it accounted for 50.3% of cases,[13] while Bahrain had 40%.[14] A study in Northern Nigeria reported that 0.4% of patients with corneal ulcers were associated with use of contact lenses.[15]

Topical steroids and antibiotic/steroid combination had been implicated as a cause of corneal ulcer.[12] Quite a number of the patients had used topical medication. Most of the patients that used eye drop in the study do not know the name of the eye drop used, in which case it might be steroid or steroid-based combination mostly used for noninfective causes. Patients usually purchase drugs on self-medication in patent medical stores and overzealous use of these drugs could lead to corneal ulceration. The proportion of those who used such medications was higher than result from Onitsha that reported 10.5%.[12]

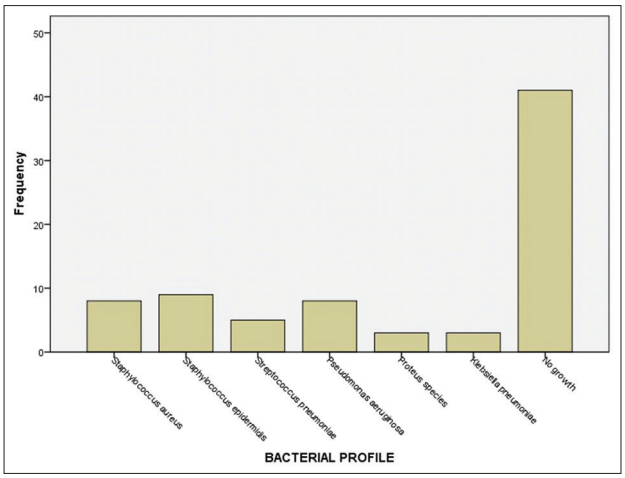

Figure 1: Bacterial profile. *Staphylococcus epidermidis* was the major isolate accounting for 11.7%. The "No growth" group might be fungal organisms

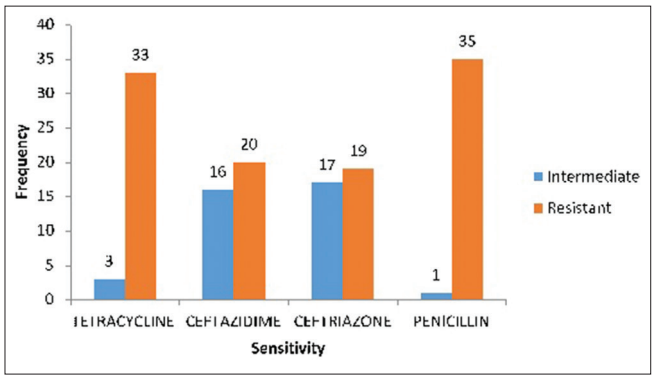

Figure 3: Isolates were resistant to tetracycline, ceftazidime, ceftriaxone, and penicillin

About half of the patients were blind in the affected eye. Most of the ulcers were centrally located which might be the reason for poor vision observed in the affected eye. In Ogun, central corneal opacity was responsible for unilateral blindness in 17.9% and visual impairment in 7.69% of cases.[16]

The proportion of positive culture results was lower than results obtained in Kuwait 68%,[17] Benghazi 68.2%,[18] and India 65.1%.[19]

Gram-positive bacteria were found to be similar with other studies in India 60.3%, 72.86%[19,20] and SanFrancisco 59%.[21] In Malaysia, a developing country Gram-negative bacteria accounted for 78.1%,[6] of cases which were higher than result obtained in this study.

Staph epidermidis was the most common bacteria isolated and was lower than the result obtained in South Africa where it accounted for 27%.[22] *Staph epidermidis* being a normal flora could possibly invade the corneal tissue when it is compromised by trauma or topical steroid. In Bangladesh, *Staph aureus* was the most isolated bacteria, accounting for 43.47%, *Pseudomonas* species accounted for 21.73%, *Haemophilus influenzae* in 13.04%, *Staph epidermidis* in 8.69%,

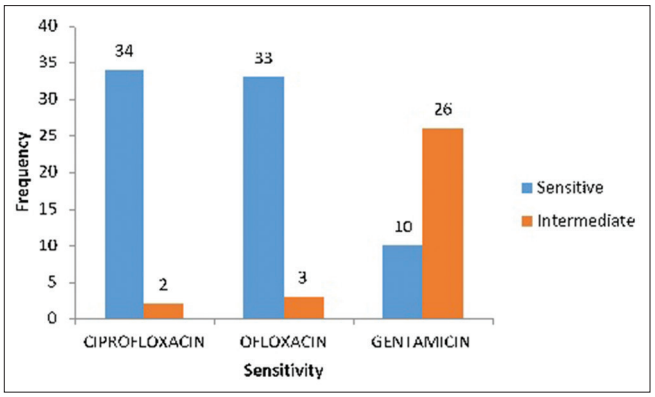

Figure 2: The isolates were sensitive to ciprofloxacin, ofloxacin, and gentamicin

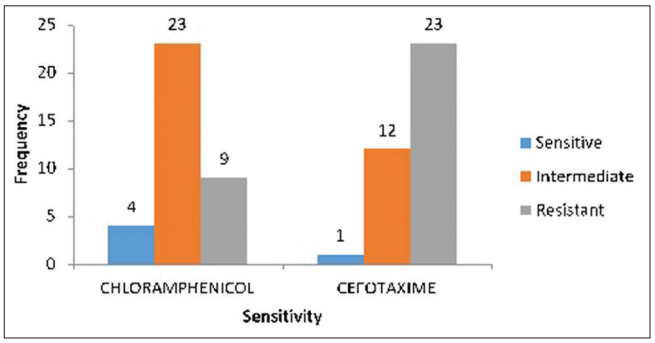

Figure 4: The isolate had more intermediate sensitivity to chloramphenicol and resistant to cefotaxime

Strept pneumoniae in 8.69%, and *Escherichia coli* in 4.35% of cases.[7]

In Southern India, it was reported that the predominant bacterial species isolated from corneal ulcers were *Strept pneumoniae* seen in 41.85%, followed by *P. aeruginosa* seen in 21.25%, and *Staph epidermidis* which accounted for 16.77%.[23] The Indian study show comparable result with ours, although the frequency of occurrence differs. This may be due to socioeconomic status, occupation, cultural practices as well as prior antibiotic use. It is possible that mixed bacterial and fungal infection could have existed but the fungal study was not carried out.

The bacteria isolated showed some varying degree of sensitivity to antibiotics tested. Bacteria isolated showed sensitivity to ciprofloxacin, and ofloxacin in most of cases, while an intermediate sensitivity was seen with chloramphenicol and gentamicin. There was resistance to tetracycline, ceftazidime, ceftriaxone, cefotaxime, and penicillin. In Baroda, India, sensitivity of isolate to ciprofloxacin was 75%; ofloxacin, 65%; and cefotaxime, 70%.[24]

In South India, antibiotic sensitivity of isolate was 90.09% to ciprofloxacin, followed by chloramphenicol 75.24%, and to gentamicin 74.12%.[23] Similarly, a study in Western Nepal showed that antibiotic sensitivity to gentamicin was 76.19%; chloramphenicol, 73.81%; and ofloxacin 71.43%.[25]

A limitation of this study is that it only looked at corneal ulcers of bacterial origin; therefore, viral, fungal, and protozoal ulcers were not included. There was no functioning microbiology laboratory in the hospital where the study was conducted which necessitate carrying samples to the teaching hospital about 5 km away; this could have resulted to the death of some bacterial organisms having more negative culture results. The use of preservative containing amethocaine and prior antibiotic used before corneal scraping could also account for more negative culture result.

Conclusion

Ocular trauma was the major leading predisposing factor. Other factors were use of traditional eye medications, topical steroids, and ocular surgery more than half of the patients were blind in the affected eye and most of the ulcers were centrally located. Common bacteria isolated were *Staphylococcus* spp, *P. aeruginosa*, *Sterpt pneumonia*, *Proteus* species, and *K. pneumoniae*. The isolates were sensitive to ciprofloxacin and ofloxacin, while an intermediate sensitivity was seen with chloramphenicol and gentamicin in most cases.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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