Original Article

Ophthalmology and Allied Sciences
Volume 3 Number 2, July - December 2017
DOI: http://dx.doi.org/10.21088/oas.2454.7816.3217.13

Clinical Study and Management of Bacterial Corneal Ulcer

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Abstract

Context: Corneal blindness is a major challenge faced today in the whole world; corneal ulcers being the most common cause. Bacterial corneal ulcers should be recognized and treated at the earliest as they can lead to permanent sight threatening complications. *Aims:* To study clinical course, antibiotic sensitivity pattern and treatment aspects of bacterial corneal ulcers. *Settings and design:* Prospective clinical study carried out at department of Ophthalmology, Karnataka Institute of Medical Sciences, Hubli. *Methods and Material:* A prospective clinical study was carried out. All patients attending ophthalmology out patient during the study period of November 2010 to May 2012 with definitive signs and symptoms of corneal ulcers were included in the study. Bacterial corneal ulcers were specifically studied in detail after microbiological evaluation. *Statistical Analysis:* Data was entered in Microsoft Excel worksheet and analyzed using proportions. Statistical test like chi square test was used wherever appropriate. P value of less than 0.05 was considered as statistically significant. *Results:* Majority of ulcers were caused by staphylococcus aureus (33.34%), followed by Pseudomonas (23.81%), Klebsiella (14.29%), Staphylococcus epidermidis (9.52%), alpha hemolytic streptococci (7.14%), beta hemolytic streptococci (4.76%), Streptococci pneumonia (4.76%), E. coli (2.38%). Fluorquinolone monotherapy was used in 64.39% cases. Surgical debridement was done in 76.2%. Most common complication was healed corneal *scar in 69.05% of cases. Conclusion:* Microbiological evaluation is the most important step in the management of bacterial corneal ulcer.

Keywords: Ulcer; Evaluation; Management; Intervention; Complications.

Introduction

Corneal blindness is a major challenge to ophthalmologists worldwide. Corneal ulcer is a major cause of corneal blindness and is an important ophthalmic condition causing significant morbidity especially in developing countries. According to several epidemiological studies, it is estimated that nearly 1.5 to 8 million corneal ulcer occur each year in developing nations [1]. Scarring of cornea developed secondary to suppurative corneal ulcer is the second commonest cause of preventable blindness after un-operated cataract among people in Asia, Africa and in the Middle East [2]. It is estimated that 30,000 cases of microbial keratitis (including bacteria, fungus and Acanthamoeba) occur annually in the United States [3].

Corneal ulcer is special as they cause permanent opacities leading to loss of vision. It also leads to complications that are fatal for the eye. The corneal ulcer are 10 times more common in developing countries as compared to developed countries [4], suppurative keratitis is becoming the major cause of corneal blindness in the developing world [5].

While contact lens use is a major risk factor for corneal ulceration in the developed world, a high prevalence of fungal infections, agriculture related

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Received on 17.06.2017, **Accepted on** 24.06.2017

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trauma, and use of traditional eye medicines [6] is unique to the developing world.

Corneal ulcers may be infective or non-infective. Bacterial, fungi, viruses are the commonest causes of infectious bacterial ulcers. Though bacteria causing corneal ulcers have gradually decreased over years following the advent of antibiotics, they are still responsible for majority of infective ulcers occurring in our country [7].

The proper understanding of changing pattern of bacteria affecting cornea, the changing antibiotic sensitivity pattern and the altered clinical presentation with indiscriminate use of antibiotics are important in the management of bacterial corneal ulcer. Also emerging antibiotic resistance has posed a difficult task in the management of bacterial corneal ulcer. Skilful usage of antibiotics, adequate supportive therapy, and management of co-existing morbidities are the challenges today in order to prevent or reduce corneal blindness due to bacterial corneal ulcers. Keeping this in mind, present study was carried out to study clinical course, antibiotic sensitivity pattern and treatment aspects of bacterial corneal ulcers.

Material and Methods

A prospective clinical study was carried out. Institutional Ethics Committee permission was obtained. All patients attending ophthalmology out patient during the study period of November 2010 to May 2012 with definitive signs and symptoms of corneal ulcers were included in the study. Patients were selected at random. They were subjected to microbiological evaluation for both bacteria and fungi. Out of total 106 corneal patients, 42 (39.6%) were of bacterial etiology, 48 (45.3%) were of fungal origin and 6 (5.6%) were of mixed (bacterial and fungal) etiology and remaining 10 (9.5%) were sterile. Viral studies were not done as the facilities were not available.

Thus ultimately we included only 42 cases which were of bacterial etiology for corneal ulcer in the present study after their due informed consent. Detailed clinical history and examination was carried out. Ocular examination was done to rule out any predisposing factors like lid abnormalities, lid infections, lacrimal sac infections, dry eye syndrome. Amount of lid edema, type of discharge per cul-de-sac, type of conjunctival reaction to corneal ulcer was noted.

The corneal ulcer was defined on the basis of size, shape and position. The tear film was stained with sterile fluorescein strips to know the size and extent of the associated epithelial defect. Anterior chamber was examined for cells, flare and hypopyon. The hypopyon was measured from the limbus in mm. All patients were subjected to microbiological evaluation. The corneal scrapings were taken in Microbiology department to facilitate direct inoculation on to different media; thereby eliminating the chances of contaminating media/material during transit.

The cornea was anesthetized with 4% lignocaine. Using sterile 21 gauge needle, the floor and the edges of the ulcer were scraped carefully. The scrapings were transferred carefully on sterile microscopic slides and culture media. They were subjected to gram's staining and KOH staining. The culture media in which they were inoculated were blood agar plate, chocolate agar plate, Mac-conkey's agar, Sabauraud's agar and Thioglycolate broth. The antibiotic sensitivity tests were done by disc diffusion technique. In case of perforated ulcers, the conjunctival swabs were taken to inoculate from the discharge.

Once the etiology was confirmed as bacteria by gram staining and microscopy, empirical therapy with broad spectrum antibiotics was initiated. Later depending upon the culture and sensitivity reports and the response to treatment, the antibiotics were changed accordingly. Other supportive treatment like cycloplegics, anti-inflammatory drugs and vitamin supplementation were given.

Patients were asked to come on every third day in out patient department for follow up for first four week, every week afterwards till one month to three moths. During follow up, size of the epithelial defect, amount of stromal infiltrate, amount of hypopyon, amount of congestion and visual improvement was noted. Patients presenting with impending perforation or perforation were asked to get admitted. Admitted cases were debrided daily and other cases were debrided during follow up. Debridement was done till the slough reduced and the epithelium healed. In case of sac infection, sac excision was done.

Statistical Analysis

Data was entered in Microsoft Excel worksheet and analyzed using proportions. Statistical test like chi square test was used wherever appropriate. P value of less than 0.05 was considered as statistically significant.

Results

Table 1 shows visual status of patients at the time of presentation and at the end of 4 weeks of treatment. At the time of presentation only 9 patients (21.4%) had visual status of counting fingers up to 5 meters and better which improved to 47.6% (20 cases) at the end of 4 weeks. At the time of presentation majority i.e. 33 patients (78.6%) had poor visual status like no perception of light or only perception of light or hand movement's only or counting fingers close to face and this decreased significantly to 52.4% at the end of 4 weeks of treatment. This difference was found to be statistically significant ($p < 0.05$).

Table 2 shows bacteriological profile of corneal ulcers. The most common organism found causing corneal ulcer was Staphylococcus aureus in 33.34% of cases followed by Pseudomonas in 23.81% of cases. 14.29% of cases were due to Klebsiella. Only one case was due to E. coli.

Table 3 shows incidence and amount of hypopyon. Majority of cases had moderate degree of hypopyon. Overall incidence of hypopyon was 71.43%. Only 14.29% of cases had marked (> 4 mm) hypopyon.

Out of 14 cases of S. aureus, 12 cases (85.72%) were sensitive to moxifloxacin, 11 cases (78.47%) to gatifloxacin, 10 cases (71.4%) to cefazolin, and 7 cases (50%) to tobramycin. Out of 10 cases of pseudomonas, 9 cases (90%) were sensitive to tobramycin, 3 cases (30%) to gatifloxacin, and 4 cases (40%) to moxifloxacin. Out of 6 cases of Klebsiella, majority of cases (90%) were susceptible to cephazolin and tobramycin. Out of 2 cases of S. pneumonae, both were sensitive to chloramphenicol, gatifloxacin and moxifloxacin. All cases of S. epidermidis were sensitive to moxifloxacin (Table 4).

In the present study, 76.20% of patients underwent surgical debridement of the corneal ulcer. 11.91% cases underwent dacrocystectomy. In 11.91% of cases the eye was eviscerated. In 3 cases (7.14%) therapeutic keratoplasty was done and in another 3 cases (7.14%) conjunctival hooding was done. In 4.76% of cases, conjunctival foreign body was removed (Table 5).

Table 1: Visual acuity of patients at the time of presentation and at the end of 4 weeks

Visual Acuity	Number (%) at the Time of Presentation	Number (%) at the end of 4 weeks	Chi square and p value
No perception of light	03 (7.14%)	06 (14.29%)	$X^2 = 5.266$
perception of light present	14 (33.34%)	05 (11.91%)	P = 0.01087
Hand movements only	12 (28.58%)	06 (14.29%)	
Counting fingers close to face	04 (09.52%)	05 (11.91%)	
Counting fingers up to 5 m	03 (07.14%)	10 (23.80%)	
Visual acuity 6/60	04 (09.52%)	04 (09.52%)	
Visual acuity 6/36	02 (04.76%)	03 (07.14%)	
Visual acuity 6/24	00	01 (02.38%)	
Visual acuity 6/18	00	02 (04.76%)	
Total	42 (100%)	42 (100%)	

Table 2: Bacteriological profile of corneal ulcers

Bacteria Causing Corneal Ulcer	Number	Percentage
Staphylococcus aureus	14	33.34
Pseudomonas	10	23.81
Klebsiella	06	14.29
Alpha hemolytic streptococci	03	07.14
Beta hemolytic streptococci	02	04.76
Streptococcus pneumonia	02	04.76
E. coli	01	02.38
Staphylococcus epidermidis	04	09.52
Total	42	100

Table 3: Incidence and amount of hypopyon

Amount of Hypopyon	Number	Percentage
No hypopyon	12	28.57
Minimal (< 2 mm)	08	19.05
Moderate (2-4 mm)	16	38.09
Marked (> 4 mm)	06	14.29
Total	42	100

Table 4: Antibiotic sensitivity and culture pattern of bacteria found in corneal ulcer

Bacteria	Sensitivity (S)/resistance (R)	CEF	CHL	GENT	CIPR	GATI	MOXI	NOR	OFLO	TOB
S. aureus	S	10	6	7	8	11	12	8	9	7
	R	4	8	7	6	3	2	6	5	7
Pseudomonas	S	6	5	8	4	3	4	4	7	9
	R	4	5	2	6	7	6	6	3	1
Klebsiella	S	5	4	4	2	4	4	3	3	5
	R	1	2	2	4	2	2	3	3	1
Alpha hemolytic streptococci	S	2	2	2	1	2	1	2	2	2
	R	1	1	1	2	1	2	1	1	1
Beta hemolytic streptococci	S	2	1	1	1	2	2	1	2	1
	R	0	1	1	1	0	0	1	0	1
S. pneumonae	S	1	2	0	1	2	2	2	2	1
	R	1	0	2	1	0	0	0	0	1
E. coli	S	0	1	1	0	1	1	1	1	1
	R	1	0	0	1	0	0	0	0	0
S. epidermidis	S	2	1	0	2	3	4	3	2	1
	R	2	3	4	2	0	0	1	2	3

Table 5: Surgical measures undertaken in the management of bacterial corneal ulcers

Surgical Measures Undertaken	Number	Percentage
Debridement	32	76.2
Conjunctival hooding	03	07.14
Sac excision	05	11.91
Keratoplasty	03	07.14
Evisceration	05	11.91
Foreign body removal	02	04.76

Discussion

A prospective clinical study was carried out. All patients attending ophthalmology out patient during the study period of November 2010 to May 2012 with definitive signs and symptoms of corneal ulcers were included in the study. Bacterial corneal ulcers were specifically studied in detail after microbiological evaluation.

In the present study, 19.05% of cases had already received antibiotics, 11.91% had received antibiotics with steroid, 2.38% had received native medications like cow's milk, rose water, breast milk etc. In 19.05% of cases, medications were received but its nature was unknown, 47.61% of patients had no history or prior medication. Though 19.05% of patients had used local antibiotics, bacteria were still recovered on culture indicating inadequate use of drugs, poor patient compliance or organisms being resistant to antibiotics. Topical steroid usage noted in 11.91% might have potentiated the infective process. The use of native medications might have been responsible for secondary bacterial infections in an otherwise epithelial abrasion due to trauma. 47.61% of patients did not use any local antibiotics suggest lack of awareness about seriousness of ocular ailments. Bourcier et al [8] found that 76% of patients in their study did not take prior medication at the time of presentation. Srinivasan M et al [9] reported that a significant proportion of patients (57.7%) had history or prior use of antibiotics at the time of presentation.

In the present study, only 8 patients presented early and they were found to have a better prognosis. At the time of presentation only 9 patients (21.4%) had visual status of counting fingers up to 5 meters and better which improved to 47.6% (20 cases) at the end of 4 weeks. At the time of presentation majority i.e. 33 patients (78.6%) had poor visual status like no perception of light or only perception of light or hand movement's only or counting fingers close to face and this decreased significantly to 52.4% at the end of 4 weeks of treatment. This difference was found to be statistically significant ($p < 0.05$).

We found that prevalence of bacterial corneal ulcer was 39.62% and that of fungal corneal ulcer was 45.28%. Thus the prevalence of fungal corneal ulcer was more than bacterial corneal ulcer. Similar findings were reported by Bharathi MJ et al [10], but Srinivasan M et al [9] found that the prevalence of bacterial corneal ulcers was slightly more than that of fungal corneal ulcers.

In the present study majority of the bacterial

corneal ulcer were caused by S. aureus (33.34%) followed by Pseudomonas in 23.81% of cases. But Bharathi MJ et al [10], Srinivasan M et al [9], and Schaefer et al [11] observed that Streptococcus pneumonae was the causative agent in majority of cases (37.51%) in their studies. The higher incidence of S. aureus ulcers in the present study may be due to increased prevalence of beta lactamase producing strains which are more resistant to antibiotics.

In the present study, we observed that cases due to Streptococcus pneumonae responded well to the treatment by showing a significant decrease in the number of corneal ulcers but cases caused due to Klebsiella did not respond well. This is due to more sensitivity of gram positive organisms in comparison to gram negative organisms.

We found that majority of the patients (54.76%) had central corneal involvement and among them majority were due to S. aureus. Similar findings were reported by Bourcier T et al [8] we found that majority of cases (45.23%) had deep stromal involvement followed by superficial stromal involvement in 30.96% cases. Bourcier T et al [8] in their study found that the depth of ulcer was less then one third in 77.2% of cases, between one third to two thirds in 13.1% cases and more than two third in 9.7% cases.

In the present study out of 14 cases of S. aureus, 12 cases (85.72%) were sensitive to moxifloxacin, 11 cases (78.47%) to gatifloxacin, 10 cases (71.4%) to cefazolin, and 7 cases (50%) to tobramycin. Out of 10 cases of pseudomonas, 9 cases (90%) were sensitive to tobramycin, 3 cases (30%) to gatifloxacin, and 4 cases (40%) to moxifloxacin. Out of 6 cases of Klebsiella, majority of cases (90%) were susceptible to cephazolin and tobramycin. Out of 2 cases of S. pneumonae, both were sensitive to chloramphenicol, gatifloxacin and moxifloxacin. All cases of S. epidermidis were sensitive to moxifloxacin. Study by Akter L et al [12] found that S. aureus was sensitive to tobramycin, and S. epidermidis was susceptible to chloramphenicol.

In the present study, the most common complication was leucomatous grade corneal opacity (35.71%). Macular grade corneal opacity was seen in 19.05% cases and nebular grade corneal opacity in 14.29% cases. Gopinathan U et al [13] found that 75.5% had healed scar (nebular, macular, leucomatous opacity), 1.1% had adherent leucoma and 4.9% had undergone evisceration.

Key Messages

Appropriate timely intervention reduces the morbidity. Patient compliance is equally important.

Conclusion

Staphylococcus aureus was the most common bacteria found responsible for bacterial corneal ulcers. It responded well to moxifloxacin/gatifloxacin therapy. Maximum cases of Pseudomonas responded to fortified tobramycin therapy. Majority of patients had improvement in the visual acuity. Microbiological evaluation is the most important step in the management of bacterial corneal ulcer. Appropriate timely intervention reduces the morbidity. Patient compliance is equally important.

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