

## CORNEAL ULCER OF BACTERIAL AND FUNGAL ETIOLOGY FROM DIABETIC PATIENTS AT A TERTIARY CARE EYE HOSPITAL, COIMBATORE, SOUTH INDIA

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**Summary.** The inability of the body to regulate blood glucose level during diabetic condition leads to high blood sugar (hyperglycemia). Individuals with diabetes can have any microbial infection that affects the general population. However, people with diabetes are at an increased risk of a variety of specific infectious complications. A retrospective study was undertaken to bring out the bacterial and fungal prevalence among diabetic patients with corneal ulceration. Among 87 ocular clinical specimens collected from diabetic patients and processed for the microbiological analyses, as much as 71 specimens were confirmed to be positive for various bacterial and fungal infections. A total of 7 gram negative organisms (six of *Pseudomonas aeruginosa* and one of *Kelbsiella* sp.) and 31 gram positive organisms were identified. *P. aeruginosa* (6; 8.5%) and *Staphylococcus epidermidis* (15; 21.1%) were the most prevalent pathogens among gram-negative and gram-positive bacteria respectively and *Fusarium* sp. (13; 18.3%) was determined to be the common pathogen among fungi. Female preponderance was obvious and the number of infections was bigger during the month of September.

**Key words:** Diabetes, eye infections, prevalence, bacteria, fungi

### Introduction

Insufficient utilization or production of insulin by the body is a condition known as *Diabetes mellitus*. The number of diabetics in India has grown from 19 to 57 million during the last four years, registering a staggering rise with a variety of local and systemic microbial infections. Corneal ulcer or ulcerative keratitis of microbial etiology is one of such serious complications of the eye. It is characterized by the inflammation of the cornea and disruption of its epithelial layer with involvement of corneal stroma. This may lead to subsequent loss of corneal integrity and transparency. The corneal ulcer caused by bacterial and fungal pathogens particularly among diabetic patients is important because the clinicians often express the belief that diabetic patients are at a high risk during such infections than non-diabetic patients. In particular, the defects in host immune defense mechanisms demonstrated in diabetic subjects make infections more complicated and vulnerable (1). This highlights the need for the implementation of new treatment modalities with antimicrobials whenever corneal ulcers are diagnosed with bacterial / fungal etiology in diabetic patients (2). At this juncture it becomes imperative to conduct adequate local surveillance

studies among diabetic patients so as to identify and record details such as the most common pathogens, their prevalence rate, seasonal variation and antibiotic susceptibility patterns etc. (3) This will help in the design and implementation of appropriate and effective infection control methods/ guidelines by the epidemiologist, microbiologist and physicians collectively. The major objectives of the present study were to bring out the local epidemiology of corneal ulceration in diabetic patients who received treatment at the tertiary care Aravind Eye Hospital, Coimbatore, Tamilnadu, India and also to describe the antibiotic susceptibility patterns of the bacterial pathogens isolated from diabetic subjects.

### Materials and Methods

This retrospective study was carried out for a period of fifteen months between January 2004 and March 2005. The microbiological reports made from the Department of Microbiology, Aravind Eye Hospital, Coimbatore, Tamilnadu, India were used for the study. The details of all the diabetic patients such as sex, age and place were recorded and evaluated. Further, the microbiological data viz., type of microorganism identified, their prevalence, and their

seasonal variation were noted and analyzed. In addition, the antibiotic susceptibility patterns of the reported bacterial pathogens were evaluated and the percentage distribution of sensitive (S) and resistant (R) organisms against different antibiotics [Amoxycillin (Am), Vancomycin (Va), Cephalothin (Ch), Cefazolin (Cz), Cefuroxime (Cu), Cephotaxime (Ce), Gentamicin (G), Ciprofloxacin (Cf), Ofloxacin (Of) and Amikacin (Ak)] representing various groups were critically analyzed. The routine procedure of the microbiology laboratory included the collection of different ocular specimens from patients referred to the microbiology laboratory, processing them using standard conventional methods such as microscopic observation after simple staining, Gram staining, Giemsa staining and Lactophenol Cotton Blue mount. The microbiological culturing of the specimens directly onto blood and chocolate agar and in thioglycolate broth for bacteria and in Sabouraud's agar for fungi was the parallel diagnostic step. The biochemical tests and antibiogram - resistogram determination for bacteria followed the above steps of investigation.

## Results and Discussion

Microbial corneal ulcer is a sight-threatening condition and one of the major causes of blindness. Diabetic patients with microbial keratitis are at an increased risk than non-diabetic persons and require immediate medical attention. In this context, recording the local microbiological status of microbial corneal keratitis would be more useful for clinicians / ophthalmologist as to provide effective treatment. The present study retrospectively evaluated and recorded the microbiology of diabetic subjects who were diagnosed with corneal ulcer of bacterial / fungal etiology.

Out of 87 ocular specimens (such as corneal scrapings, conjunctival swabs etc.) collected and processed from diabetic patients with corneal ulcer, 39% (34) and 61% (53) were respectively from men and women. The median age of diabetic men and women was calculated to be 67.8 and 58.5 respectively. A total of 38 (43.68%) bacterial strains and 33 (37.93%) fungal strains were confirmed from the 87 specimens under microscopy after simple staining, Gram's staining, Giemsa staining and Lactophenol Cotton Blue mount. Gram staining revealed 31 (81.57%) and 7 (18.42%) isolates of gram-positive and gram-negative bacteria respectively. Further, culturing the ocular specimens on appropriate media and biochemical tests together confirmed the presence of various bacterial and fungal species and are given in table 1. Among bacteria and fungi, *S. epidermidis* (15; 21.13%) and *Fusarium* sp. (13; 18.31%) respectively were the most frequent pathogens in both diabetic male and female patients. It was also found that diabetic women were infected more in number compared to diabetic men (Fig. 1) and the number of infected diabetic patients was the highest during the month of September (Fig. 2). Chincholikar and Pal (4) had reported *S. aureus* and *P. aeruginosa* as the most frequently isolated aerobic organisms from diabetic pa-

Table 1. Bacterial and fungal isolates from diabetic corneal ulcer patients

Organism	No. of isolates	
Bacteria positive (n=38)	<i>Staphylococcus epidermidis</i>	15(21.13%)
	<i>S. aureus</i>	6(8.45 %)
	<i>Streptococcus pneumoniae</i>	3(4.23 %)
	<i>S. pyogenes</i>	3(4.23 %)
	<i>Corynebacterium</i> spp.	3(4.23 %)
	<i>Nocardia</i> spp.	1(1.41 %)
	<i>Pseudomonas</i> spp.	6 (8.5 %)
	<i>Klebsiella</i> spp.	1(1.41 %)
	<i>Fusarium</i> spp	13(18.31%)
	<i>Aspergillus flavus</i>	8(11.27%)
Fungi (n=33)	<i>A. fumigatus</i>	3 (4.23%)
	<i>A. nidulans</i>	1 (1.41%)
	<i>Botrydiploidia</i> spp.	1 (1.41%)
	<i>Curuvularia</i> spp.	1 (1.41%)
	Unidentified Hyaline fungus	3 (4.23%)
	Unidentified demateaceous fungus	3(4.23 %)

tients. Huang (5) stated *K. pneumoniae* and streptococcal species as the predominant isolates among diabetic subjects with community acquired spontaneous bacterial meningitis (CASBM). Anandi *et al.* (6) reported higher frequency of *E. coli* (49; 27.7%) and *Proteus* spp. (30; 16.9%) from diabetic patients with foot lesions and further described that gram-negative bacteria infected more frequently than gram-positive bacteria. Panneerselvam *et al.* (7) identified *E. coli* and *P. aeruginosa* as the predominant flora among diabetic subjects. Gonzales *et al.* (8) estimated that in India, the central corneal ulcers caused by fungi accounted for 44% and was found to be in parallel to the present study.

In the present study, the antibiogram - resistogram analysis revealed diverse patterns of susceptibility among bacterial pathogens against commonly used antibiotics (Table 2 & 3). Remarkably, *Klebsiella* sp. (n=1) had 100% susceptibility against all the tested antibiotics. Similarly, all the three isolates of *Streptococcus pyogenes* showed susceptibility against all the drugs except gentamicin. Further, 83.3% and 66.6% of *P. aeruginosa* were susceptible in the presence of cefazolin and gentamicin respectively and complete (100%) susceptibility was recorded among the isolates of *Corynebacterium* sp., *S. pyogenes* and *S. pneumoniae* against vancomycin, cephalothin, cefazolin, cefuroxime and cephotaxime. Nevertheless, none of the antibiotics could inhibit all the isolates of *Staphylococcus epidermidis* and adversely 80% of them showed resistance against the glycopeptide - vancomycin. Antibiotics are generally effective for treatment in most cases of bacterial ocular infections and a suitable antibiotic therapy is carried out based on the susceptibility of the isolated bacterial pathogens against various antimicrobials. Adversely, holes in therapy emerge because of the frequent

indiscriminate use of antibiotics, which has led to the development of resistance to many commonly used antimicrobials (9-14). Therefore, the present evaluation re-

underscores the need of practicing effective and judicial utilization of antibiotics to avoid bacterial resistance to them and to ensure their future potency.

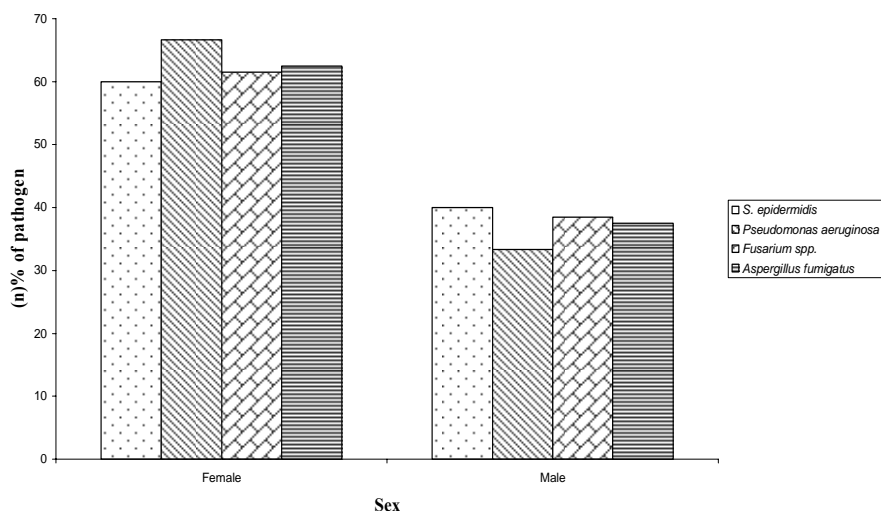


Fig. 1. Sexwise distribution of infective corneal ulcer among diabetic patients

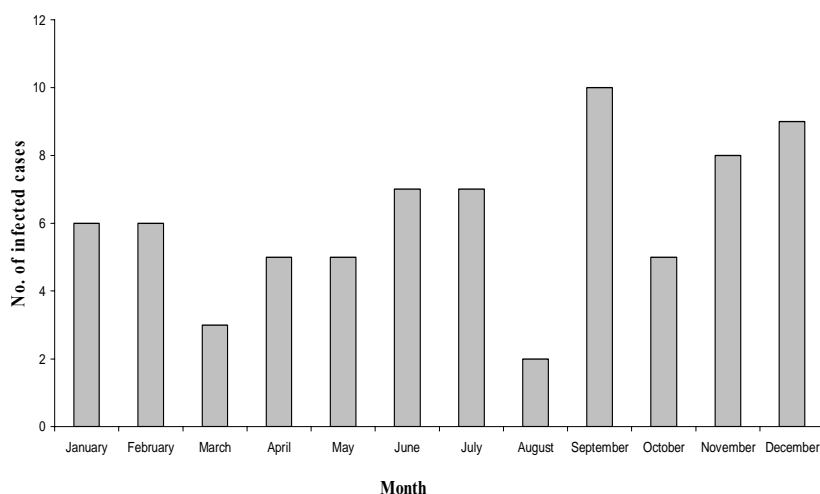


Fig. 2. Month wise distribution of infected corneal ulcer among diabetic subjects

Table 2. Percentage distribution of Antibiotic Susceptibility Pattern among gram-positive bacterial pathogens from corneal ulcer patients.

S.No.	Organism	Susceptibility	Antibiotics and susceptibility percentage								
			Am	Va	Ch	Cz	Cu	Ce	G	Cf	Of
1	<i>S. epidermidis</i>	S	33.33	20	66.66	46.6	46.6	60	60	66.6	80
		R	66.6	80	33.33	53.3	53.3	40	40	33.3	20
2	<i>S. aureus</i>	S	33.33	100	66.66	100	100	100	100	100	0
		R	66.33	0	33.33	0	0	0	0	0	0
4	<i>Corynebacterim spp</i>	S	66.66	100	100	100	100	100	100	66.66	66.66
		R	33.33	0	0	0	0	0	0	33.33	33.33
5	<i>S. pyogenes</i>	S	100	100	100	100	100	100	-	100	100
		R	0	0	0	0	0	0	100	0	0
6	<i>S. pnemoniae</i>	S	100	100	100	100	100	100	50	100	100
		R	0	0	0	0	0	0	50	0	0

S – Sensitive

R – Resistant

Am – Amoxycillin

Va – Vancomycin

Ch – Cephalothin

Cz – Cefazolin

Cu – Cefuroxime

Ce – Cephotaxime

G – Gentamicin

Cf – Ciprofloxacin

Of – Ofloxacin

Table 3. Percentage distribution of Antibiotic Susceptibility Pattern among gram-negative bacterial pathogens from corneal ulcer patients.

S.No.	Organism	Susceptibility	Antibiotics and susceptibility percentage									
			Am	Va	Ch	Cz	Cu	Ce	G	Cf	Of	Ak
1	<i>P. aeruginosa</i>	S	66.33	66.33	66.33	6.6	50	50	33.33	33.33	100	100
		R	33.33	33.33	33.33	83.3	50	50	66.66	66.66		
2	<i>Klebsiella</i> spp.	S	100	100	100	100	100	100	100	100	100	100
		R	0	0	0	0	0	0	0	0	0	0

S – Sensitive

R – Resistant

Am – Amoxycillin

Va – Vancomycin

Ch – Cephalothin

Cz – Cefazolin

Cu – Cefuroxime

Ce – Cephotaxime

G – Gentamicin

Cf – Ciprofloxacin

Of – Ofloxacin

Ak – Amikacin

Overall, the present evaluation has brought out the involvement of a variety of bacterial and fungal pathogens in corneal ulcer. This signifies the need for appropriate microbiological diagnosis of microbial corneal ulceration in order to provide prompt and effective medical remedy and to avoid empirical treatment. Equally, the epidemiological factors that predispose a patient to microbial corneal ulceration may be regularly monitored and recorded in order to ensure earliest treatment by the ophthalmolo-

gist and also to develop preventive strategies / guidelines for corneal infections exclusively in diabetic subjects.

## Conclusion

Appropriate treatment of diabetes and optimal metabolic control are key goals in the prevention of complications in diabetes.

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## ULKUS ROŽNJACE SA BAKTERIJSKOM I GLJIVIČNOM ETIOLOGIJOM KOD DIJABETIČARA NA OČNOJ KLINICI SA TERCIJARNOM ZDRAVSTVENOM ZAŠTITOM, KOIMBATORE, JUŽNA INDIJA

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**Kratak sadržaj:** *Nesposobnost tela da reguliše nivo glukoze u krvi kod dijabetesa, dovodi do povećanja nivoa šećera u krvi (hiperglikemija). Osobe sa dijabetesom mogu da obole od bilo koje mikrobne infekcije koja pogadja opštu populaciju. Međutim, kod dijabetičara postoji povećani rizik od pojave raznovrsnih specifičnih infektivnih komplikacija. Retrospektivna studija je sprovedena kako bi se utvrdila bakterijska i gljivična prevalenca kod pacijenata sa dijabetesom i ulkusom rožnjače. Od 87 kliničkih uzoraka oka, koji su prikupljeni od pacijenata sa dijabetesom i mikrobiološki analizirani, čak 71 uzorak je bio pozitivan na različite bakterijske i gljivične infekcije. Identifikovano je ukupno 7 gram negativnih organizama (šest *Pseudomonas aeruginosa* i jedan *Kelbsiells sp.*) i 31 gram pozitivan organizam. *P. aeruginosa* (6; 8,5%) i *Staphylococcus epidermidis* (15; 21,1%) su bili najčešći patogeni kod gram negativnih i gram pozitivnih bakterija, dok je *Fusarium sp.* (13; 18,3%) bio najčešći patogen kod gljivica. Infekcija se pretežno javljala kod žena, dok je broj infekcija bio najveći tokom septembra.*

**Cljučne reči:** *dijabetes, infekcije oka, prevalenca, bakterije, gljivice*