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STUDIES ON BACTERIAL INFECTIONS OF DIABETIC FOOT ULCER

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ABSTRACT

Microbial study for aerobic organisms from 100 cases of diabetic foot ulcers was carried out to determine the etiological agents and their antibiogram. Polymicrobial infection was observed in all the cases. The most frequently isolated aerobic organisms were *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Antimicrobial sensitivity pattern of the isolates were done in which imepenem was found to be effective. Imipenem belongs to the ß lactam group of new generation antibiotics.

Key words: Diabetes, Imipenam, Foot ulcer.

INTRODUCTION

Diabetes is a metabolic disorder of the endocrine system which plagues approximately 17 million people nationwide. Each year over 700,000 new cases are diagnosed; 12,000 to 14,000 of which are children, teenagers and young adults, while this life threatening disease can be controlled. Diabetes is often accompanied by serious complications, and still today there is no cure (1). By 2010 it is predicted that it will affect 239 million people world wide.

Fifteen per cent of people with diabetes will develop a foot ulcer at some time during their life, and 85% of major leg amputations begin with a foot ulcer (2). Poorly controlled diabetes is prone to skin infections because elevated blood sugar reduces the effectiveness of bacteria fighting cells. Carbuncles, boils, and other skin infections may be hazardous if not properly treated. Even a small cut may progress to a deep, open sore, called an ulcer (3). In most cases ulceration is a consequence of the loss of protective sensation that is ,the loss of awareness of trauma that can cause the breakdown of the skin.

The organisms that occur on foot infections are generally Staphylococcus aureus and *Streptococcus pyogens* arising from the patients' own skin and *Enterococci* from bowel. Among the Gram positive aerobes *Staphyloccoci* are more prevalent. Many of these microorganisms are developing resistance to commonly used antibiotics largely due to their indiscriminate use. The present study was undertaken to determine the microbiology of the diabetic foot ulcers and the antimicrobial sensitivity pattern of the isolates.

MATERIALS AND METHODS: A total number of 100 diabetic patients with foot ulceration were studied during the period of December 2005to Feburary2006. The cases were from Government hospital Coimbatore. Swabs were collected from ulcers that were macroscopically examined and classified based on Wagner's method of evaluation (3, 4). Swabbing was done on slouphy or inflammmed tissue as bacteria tend to present in greater number in these areas. From each patient two swabs were collected. The sterile cotton were moistened with sterile saline before collecting the specimens. One of the swabs was used for the isolation of bacteria. The other swab was used for wet mount microscopy. For the isolation of bacteria the media used were blood agar, and Mac Conckey agar, which were incubated at 37C for 24 hours. The organisms isolated were subjected to antibiotic susceptibility testing on Muller-Hinton agar using Kirbey-Bauer disc diffusion method (5).

RESULTS Of the total 100 diabetic foot patients studied 69 were males and 31 were females, the male: female ratio being 2:1. Their ages ranged from 35 years to 85 years with an average of 58 years. The maximum number of patients having diabetic foot infections belonged to the age group of 56-65 years, the cases was with diabetes ellitus for more than a decade.

TABLE 1: AEROBIC BACTERIAL ISOLATES

Culture isolate	Number of isolates	percer
S.aureus	47	42.3
C.koseri	3	2.70
E.coli	17	15.3
K.pneumoniae	10	9.0
Ps.aeruginosa	27	24.3
P.vulgaris	7	6.3

Of the 100 patients, 48 patients had some other complications, such as peripheral vascular disease, neuropathy, nephropathy, retinopathy, cataract, ischaemic heart disease or hypertension along with diabetes mellitus. Peripheral neuropathy has a central role and is present over 80% of diabetic patients with foot lesions

From the 100 patients studied, aerobic bacteria in the pure form were isolated in all the cases in which 47 were *S. aureus*, 3 were *C. koseri,* 17 were E. coli, 10 were *K. pneumoniae*, 27 *Ps. aeruginosa*, 7 were *P. vulgaris.*

TABLE 2: ANTIBIOTIC SENSITIVITY PATTERN OF THE AEROBIC GRAM POSITIVE ISOLATES

Antibiotics	*S.aureus* (n=47)number of sensitive strains(percentag
Amikacin(30 mcg)	19(40.4)
Cloxacillin(30 mcg)	11(23.4)
Cefepine(30 mcg)	11(23.4)
Chloramphenicol(30 mcg)	33(70.2))
Ciprofloxacin(25 mcg)	12(25.5)
Cotrimoxazole(25 mcg)	-
Gentamycin(10 mcg)	18(38.2)
Pencillin(100 mcg)	2(4.2)
Tetracyclin(30 mcg)	5(10.6)
Gatifloxacin(5 mcg)	30(63.8)
Vancomycin(30 mcg)	14(29.7)

TABLE 3a: ANTIBIOTIC SENSITIVITY PATTERN OF THE AEROBIC GRAM NEGATIVE ISOLATES

Antibiotics	*S. aureus* (%) n = 37 Number of Sensitive Strains
Amikacin (30mcg)	19 (70.3)
Cloxacillin (30mcg)	11 (40.7)
Cefepine (30mg)	11 (40.7)
Chloramphenicol 30mcg	23 (85.1)
Ciprofloxacin (25mcg)	12 (44.4)
Cotrimoxazole(25mcg)	-
Gentamycin(10mcg)	18 (66.6)
Penicillin(100mcg)	2 (7.4)
Tetracyclin(30mcg)	5 (18.5)
Gatifloxacin(5mcg)	20 (74)
Vancomycin(30mcg)	14 (51.8)

TABLE 3b: ANTIBIOTIC SENSITIVITY PATTERN OF AEROBIC GRAM NEGATIVE BACTERIA

Antibiotics	*E.coli* n = 17	*C.koseri* n = 3	*K.pneumoniae* n = 10	*P.vulgaris* n = 7	*Pseudomonos* n = 27
Ciprofloxacin (5mcg)	9 (52.9)	3 (100)	5 (50)	5 (71.4)	6 (22.2)
Ceftazidine (30mcg)	11 (64.7)	2 (50)	3 (30)	5 (71.4)	11 (40.7)
Piperacillin(100mcg)	12 (70.5)	3 (100)	5 (50)	4 (57.1)	22 (81.48)
Ceftoxine (30mcg)	10 (58.8)	3 (100)	2 (20)	2 (28.5)	3 (11.1)
Amikacin (30mcg)	10 (58.8)	3 (100)	8 (80)	4 (57.1)	13 (48.14)
Imipenam(10mcg)	16 (94.1)	3 (100)	10 (100)	7 (100)	27 (100)
Chloramphenicol (30mcg)	6 (35.2)	2 (50)	7 (70)	-	8 (29.6)
Gentamycin(10mcg)	10 (58.8)	-	6 (60)	5 (71.4)	4 (14.8)
Gatifloxacin (5mcg)	12 (70.5)	3 (100)	8 (80)	5 (71.4)	17 (62.96)
Cotrimoxazole (25mcg)	2 (11.7)	-	-	-	-
Tetracyclin(30mcg)	2 (11.7)	-	-	-	2 (74.07)

Over 63.8% strains of *S.aureus* were sensitive to gatifloxacin. Only 25.5% of strains were sensitive to ciprofloxacin (Table 2). While *E. coli* was highly sensitive to the antibiotics tested, Pseudomonas was highly resistant to them (Table 3).

DISCUSSION

The presence of S. *aureus, Proteus species* and other aerobic gram negative bacilli in septic complications of infected diabetic feet have been reported in various studies.

The infections are usually polymicrobial in nature, caused by aerobic Gram- positive *S. aureus*, and by Gram-positive bacilli like *E. coli, Klebsiella species* and *Proteus* (5). In the present study S. aureus (43.2%) was predominantly isolated. As regards the aerobic Gram negative bacilli, Pseudomonas aeruginosa (24.3%) E. coli (15.3%) C. koseri (2.7%) P. vulgaris(6.3%) and K. pneumoniae(9%) were the common organisms isolated. When testing the susceptibility to fluroquinolones, individual drugs must be included, as susceptibility to one drug cannot be taken as evidence of susceptibility to other fluroquinolones .

Among the 17 isolates of *E. coli* quinolone and cephalosporin group of antibiotics showed a higher sensitivity than to commonly used chloramphenicol. The 3 isolates of *C.koseri* were found to be sensitive to all major groups of antibiotics except to tetracycline so further analysis of its prevalene of resistance is required.10 isolates of *K.pneumoniae* showed marked difference in their sensitivity pattern to the quinolone group of antibiotics there was a pattern of resistence to ciprofloxacin and sensitivity to gatifloxacin .The 7 isolates of *Proteus* were resistant to major group of antibiotics but a high sensitivity pattern was shown towards to gatifloxacin. In *Pseudomonas* the total isolates were resistant to the most commonly used antibiotics like ciprofloxacin, ceftoxime, amikacin, chloramphenicol and tetracycline,but all were sensitive to the beta lactum antibiotic imipenem.

In this study all the Gram negative isolates were susceptible to carbapenem beta lactum antibiotic imipenem, which is resistant to inactivation by most bacterial beta lactamases and so it has the widest spectrum of antibacterial activity. Imipenem should therefore be used as a monothreraphy against polymicrobial infections in difficult gram negative infections. It produces a response rate comparable to that of third generation cephalosporins.

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