Original Research Article

Diabetes a risk for antimicrobial resistance?

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ABSTRACT

Background: Diabetic foot infections can cause substantial morbidity. The role of Diabetes mellitus in the antimicrobial resistance of pathogens in patients with foot infections is not well clarified. So, we compared the profile of antibiotic resistance in diabetic and non-diabetic foot ulcer infections. Objectives were to compare the antimicrobial resistance pattern in diabetic and non-diabetic lower limb infections.

Methods: T Pus was isolated in 50 Diabetic and 50 non-diabetic foot ulcer infections. The organisms were isolated on specific media and antibiotic susceptibility was done by using Kirby-Bauer disc diffusion method.

Results: The most frequent causative organism in diabetic and non-diabetics is *Pseudomonas* 27.5% vs 27.1%, *Staphylococcus* 24.1% vs 27.1%, *Klebsiella* 24.1% vs 22.03%, *E. coli* 10.3% vs 10.16%, Proteus 5.17% vs 5.08%. No significant differences in resistance rates to Amikacin, Penicillin, Ofloxacin, Vancomycin, Piperacillin + Tazobactum were observed between diabetic and non-diabetic patients. There is significant difference in resistance to Ampicillin (p=0.017).

Conclusions: Diabetes per se does not seem to influence the susceptibility pattern to antimicrobials in our group of patients with foot ulcer infections.

Keywords: Ampicillin resistance, Anti-microbial resistance, Antibiotic susceptibility, Diabetes, Foot ulcer, Kirby-Bauer disc diffusion method, Non-diabetics, *Pseudomonas*

INTRODUCTION

Magnitude of diabetes mellitus is increasing globally at an alarming rate. About 150-170 million populations are suffering from this disease worldwide and the prevalence of diabetes will be double by 2025 as per WHO reports.[1] Diabetic foot lesions are a major medical, social, and economic problem and are the leading cause of hospitalization for patients with diabetes. Infectious agents are associated with amputation of the infected foot if not treated promptly. Proper management of these infections requires appropriate antibiotic selection based on culture and antimicrobial susceptibility results; however, initial management comprises empirical antimicrobial therapy, which is often based on susceptibility data extrapolated from studies performed on general clinical isolates.[2] Higher antibiotic resistance rates in diabetic patients compared with those without DM have been reported in some studies. In Indian outpatients with chronic wounds, most (70%) antibiotic-resistant bacteria were isolated from diabetic patients.[3] Bacterial resistance often results in treatment failure, which can have serious consequences. Resistant bacteria may also spread and become broader infection-control problems, not only within healthcare institutions, but in communities as well.[4] Finally, with respect to the cost-containment pressures of today's healthcare environment, antibacterial drug resistance places an added burden on healthcare costs, although its full economic impact remains to be determined.[5]

The present study was conducted to 1. Compare the microbiological profile in diabetic and non-diabetic foot ulcer patients.[2] Compare the antibiotic resistance pattern in diabetic and non-diabetic foot ulcer patients.

METHODS

Patients of either sex aged between 18-55 years who had come to surgery out-patient department with foot ulcer at Government general hospital, Kakinada were selected for this study. Prior permission was taken from the institutional Ethics committee to conduct the study.

It is a prospective observational comparative study. Study period: From October 2012 to December 2012. i.e. 3 months. After screening of 160 patients, 100 patients who fulfil inclusion criteria were recruited after giving the informed consent form.

Inclusion criteria

Patients aged >18yrs and <55yrs, of either sex was included. 2. Patients who were diagnosed with diabetes within 5 years. 3. Diabetic patients presented with foot infections and had not received antibiotics were included.

Exclusion criteria

Patients who already had undergone skin grafting were not included in this study.

Sample collection

From each patient a swab was collected. The sterile cotton tipped swabs were moistened with sterile saline before collecting specimens. The swabs were collected from the depth of ulcers on the feet of diabetic patients. After sampling all the specimens were processed immediately in the laboratory. For isolation of aerobic bacteria, the media used were 5% horse blood agar and MacConkey agar, which were incubated at 37ºC for 24 hours. The organisms isolated were identified using standard methods. All the isolated were subjected to antibiotic susceptibility testing on Mueller Hinton agar using Kirby-Bauer disc diffusion method. Statistical software: SPSS22.0 was used for analysis of the data.

RESULTS

Of the 50 diabetic foot ulcer patients studied, 32 were male and 18 were female. Of the non-diabetic foot patients, 35 were male and 15 were female.

Microbial organisms

Among 50 diabetic foot infection patients, 43 cases were monobacterial, 7 cases were polybacterial. Among non-diabetic foot patients, 41 were monobacterial and 9 were polybacterial.

The organisms found in diabetic foot patients are *E. coli*, *Staphylococcal aureus*, *Klebsiella*, *Pseudomonas*, *Proteus*, *Acinetobacter*. The organisms found in non-diabetic foot patients *E. coli*, *Klebsiella*, *Pseudomonas*, *Proteus*, *Acinetobacter*, *Staphylococcal aureus*, *Providentia*, *Citrobacter*, *CONS (Coagulase Negative Staphylococci)*.
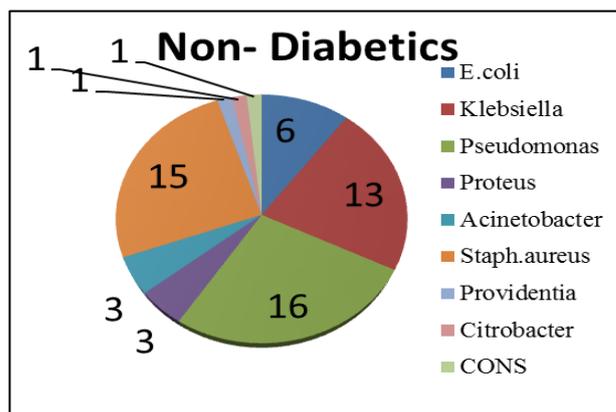
On comparison of organisms in both groups, *Pseudomonas* 27.5% vs 27.1%, *Staphylococcus* 24.1% vs 27.1%, *Klebsiella* 24.1% vs 22.03%, *E. coli* 10.3% vs 10.16%, *Proteus* 5.17% vs 5.08%.

Table 1: Sex distribution.

	Diabetics	Non-diabetics
Males	32	35
Females	18	15
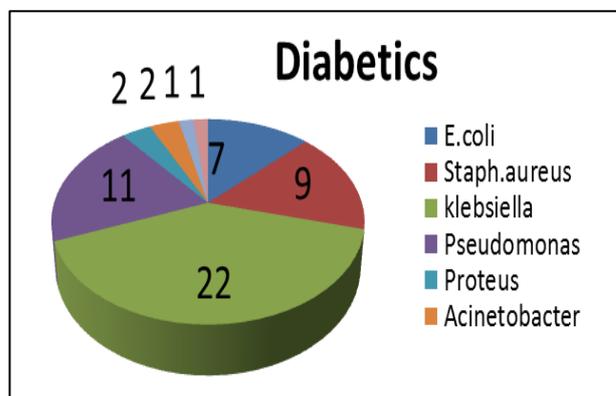
Figure 1: Distribution of organisms in diabetic and non-diabetic foot patients.

Figure 2: Comparison of antibiotic resistance in diabetic and non-diabetic foot patients.

DISCUSSION

Diabetes is the major cause of non-traumatic limb amputation.[6] Several immune defence mechanisms are defective in diabetic patients. Among these are a decrease

in leukocyte chemotaxis, phagocytosis, and intracellular killing.[7-9]

This study presents a comparison of microbiological pattern and antibiotic resistance in diabetic and non-diabetic foot infections.

Among the diabetic foot infection patients, gram negative organisms were predominant *(Klebsiella* -22, *Pseudomonas* -11). Our results are in tune with a similar study from the southern parts of India, which also showed that gram-negative were more common than gram-positive bacteria in diabetic foot infections.[10]

Table 2: Comparison of antibiotic resistance in diabetic and non-diabetic foot patients.

| Antimicrobials | Diabetic patients | | | Non-diabetic patients | | | P value |
	Tested	Resistant	%	Tested	Resistant	%	
Amikacin	44	20	45.45	26	11	42.30	
cotrimoxazole	23	19	82.60	43	26	60.46	
Gentamicin	30	13	43.33	14	2	14.28	0.0894
Linezolid	8	0	0	19	2	10.52	1
Ofloxacin	31	8	25.80	42	11	26.19	1
*P+T	11	2	18.18	12	7	58.33	0.0894
Penicillin	20	19	95	19	12	94.73	1
Vancomycin	9	0	0	18	3	16.16	0.5292
Ampicillin	34	33	97.05	26	19	73.07	0.0164
Ceftriaxone	31	18	58.06	39	19	48.71	o.477
Ceftazidime	16	11	68.75	7	6	85.71	0.6214
*C+S	30	0	0	11	3	27.27	0.0155
Cephalexin	3	1	33.33	7	3	42.85	1
Taxim	14	9	64.28	19	10	52.63	0.7228
Azithromycin	4	2	50	14	7	50	1

*P+T= Piperacillin + Tazobactum, C+S= Cefaperazone+ Sulbactum

Among the non-diabetic foot infection patients, Pseudomonas, Staphylococcal, Klebsiella organisms were found to be predominant. In our study, diabetic foot infection patients were more resistant to Ampicillin (97.05%), Penicillin (95%), Co-trimoxazole (82.60%), Ceftazidime (68.75%), Taxim (64.28%).

Non-diabetic foot infection patients were more resistant to Penicillin (94.73%), ceftazidime (85.71%), Ampicillin (73.07%), Co-trimoxazole (60.46%). The high rates of antibiotic resistance observed in the present study may be due to the fact that ours is a tertiary care hospital with widespread usage of broad spectrum antibiotics leading to selective survival advantage of pathogens.

On comparison of antibiotic resistance pattern in both groups, there is significant difference only in Ampicillin and Cefaperazone + Sulbactum. There is no significant difference in other antibiotics resistance pattern. Our study results correlate with another study which compared resistance pattern in urinary tract infections in diabetic and non-diabetic women.[11] So in our study, diabetes per se is not a risk factor for antibiotic resistance pattern.

When choosing an antimicrobial for the treatment of diabetic foot infections, one should consider the spectrum of causative organisms, their resistant patterns, efficacy, and safety. Awareness of the causative organisms in diabetic foot infections and their antimicrobial susceptibility pattern is essential for the institution of antimicrobial therapy.

Limitations of the study were anaerobic bacteria could not be assessed so we could describe the results of only aerobic bacteria.

CONCLUSION

Gram-negative organisms were more predominant in diabetic foot ulcer patients where as both gram positive and gram-negative organisms were found in the non-diabetic foot ulcer patients. Antibiotic resistance pattern when compared in both groups, there is no significant difference in diabetics and non-diabetics. So, in our study, Diabetes per se did not influence the susceptibility pattern of antimicrobials.

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