BACTERIOLOGICAL PROFILE OF DIABETIC FOOT ULCERS AND THEIR ANTIBIOGRAM IN A TERTIARY CARE HOSPITAL

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Abstract

A diabetic foot is one of the most feared complications of diabetes and it is the leading cause of the hospitalization among diabetic patients. Twenty five percent diabetic patients have a risk of developing foot ulcer and amputation is15-45% higher than non-diabetic ulcer. This study is planned with the aim of determining the bacterial profile of infected diabetic foot ulcers and the antibiotic sensitivity pattern of the bacterial isolates. The majority of diabetic foot ulcer patients were above 55years of age. This may be due to higher level of physical activities undertaken by aging patients with diabetes. Monobacterial infections were more compared to that of polybacterial infections in diabetic foot ulcers. Gram negative bacilli were more prevalent compared to gram positive cocci and the incidences of multidrug resistance were high.

Keywords: Diabetic foot, diabetes, foot ulcers, antibiotic sensitivity

INTRODUCTION

A diabetic foot is one of the most feared complications of diabetes and it is the leading cause of the hospitalization among diabetic patients [1]. Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycaemia and about 150- 170 million people are suffering worldwide from this disease. It is characterized by several pathological complications such as neuropathy, peripheral vascular disease, foot ulceration and infection with or without osteomyelitis, which may leads to the development of gangrene. Twenty five percent diabetic patients have a risk of developing foot ulcer and amputationis15-45% higher than non-diabeticulcer [2].

The impaired micro-vascular circulation in patients with a diabetic foot limits the access of immune cells and favoring the development of an infection [3]. Most of these infections are polymicrobial in nature. Antibiotic resistant is a major problem for diabetic foot patients. Multidrug resistant organisms are frequently resistant to many classes of antibiotics so it is necessary for the clinicians to be aware of the prevalence rate of multidrug resistant organisms and their management [4,5]. The foot infections in persons with diabetes are initially treated empirically, a therapy which is directed at the known causative organisms may improve the outcome. This study is planned with the aim of determining the bacterial profile of infected diabetic foot ulcers and the antibiotic sensitivity pattern of the bacterial isolates.

MATERIALSAND METHODS

The study was conducted in the department of Microbiology, Kanachur Institute of Medical Sciences, Mangaluru for a period of 2months.

Type of study: Prospective study.

Study design: Descriptive study.

Sample size: The present study includes 30 known diabetic patients with foot ulcers attending both inpatient and outpatient department over the period of two months. Clinical history was elicited with regards to the age of the

patient, duration of diabetes, the type of treatment and the presence of other systemic illnesses. The patients were also assessed clinically and the ulcers were graded according to Wagner's grade [9].

Inclusion criteria:

Patients should be diabetic with diabetic foot infection presented with Wagner1-5 ulcers and includes both who are with or without antidiabetic treatment.

Exclusion criteria:

Patients who refuse to give consent.

Institutional ethics committee clearance was obtained before starting the work. The samples were collected after obtaining informed consents from the patients. Pus sample was collected from the ulcer base with the help of two sterile swabs under a septic precautions, one for the staining and other for the culture. A direct Gram stain smear of the specimen was examined. The pus swab was inoculated on to blood agar, MacConkey agar and thioglycollate medium and incubated at 37^0C for 24-48 hours [10]. The isolate was identified by standard method and antibiotic susceptibility testing was done by the

modified KirbyBauer disc diffusion method, asperthe CLSIguidelines,2018 [11,12,13]. Quality control of antibiotic sensitivity testing will be done with*Staphylococcusaureus*(ATCC25923),*Escherichiacoli*(ATCC25922)and*Pseudomonasaeruginosa* (ATCC27853)

Statistical analysis:

The data of bacterial profile of infected diabetic foot ulcers and the antibiotic sensitivity pattern are presented as frequency and percentages.

RESULTS

In the present study, out of the 30 diabetic foot ulcer (DFU) cases, 18 diabetic foot ulcer cases were included in Wagner's grade 1 and 12 were included in Wagner'sgrade2. In this study the age group of the diabetic foot ulcer patients ranged from 45 to 75 years. The maximum numbers of patients (10) were in the age group of 56 to 60. The next most prevalent age group was between 61 to 65years [Table1].The study included 24 (80%) males and 6 (20%) females as shown in Fig1. In this study, bacterial etiology could be

identified in 22 cases of diabetic foot ulcers (73.50%) and in 8 cases (26.50%), the culture was sterile as shown in Fig 2. In the present study there was preponderance of monobacterial culture growth 14(63.60%) and polybacterial growth was seen in 8 (36.40%) cases as shown in Fig3.Atotalof30 bacterial isolates were obtained.

In this study Gram negative bacilli were more prevalent (93.33%) than gram positivecocci (6.66%).The commonest isolate was Pseudomonas aeruginosa (33.33%), followed by Klebsiella species (20%) and Citrobacter species (20%),(Table 2). The antibiotic susceptibility patterns of the gram negative bacilli have been tabulated in Table 3. In the present study 75% of the Enterobacteriaceae were Extended Spectrum BetaLactamases (ESBL) producers. The antibiotic susceptibility pattern of Staphylococcus aureus are shown in Table4.Staphylococcus aureus isolates were methicillin resistant.

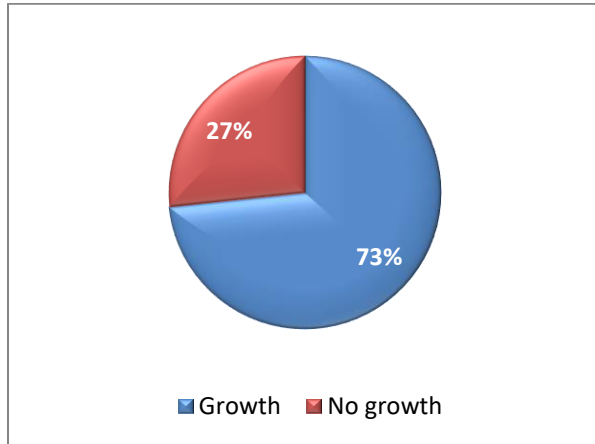**Table1:Age group of patients affected with diabetic foot ulcer.**

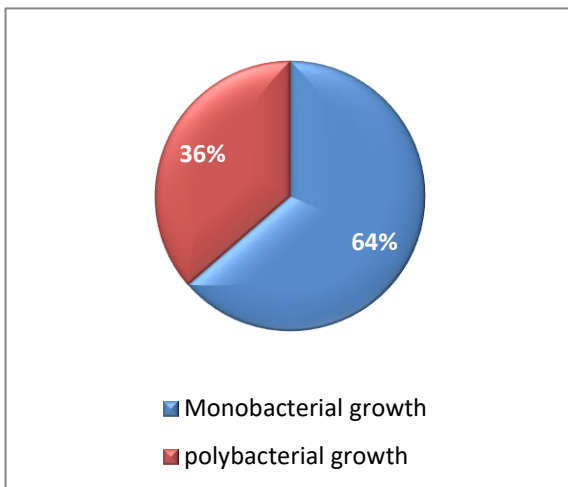| Age group	Numbers
45-50	04
51-55	02
56-60	10
61-65	08
66-70	02
71-75	04
Total	**30**

Fig1:Gender distribution of patients with diabetic foot ulcer
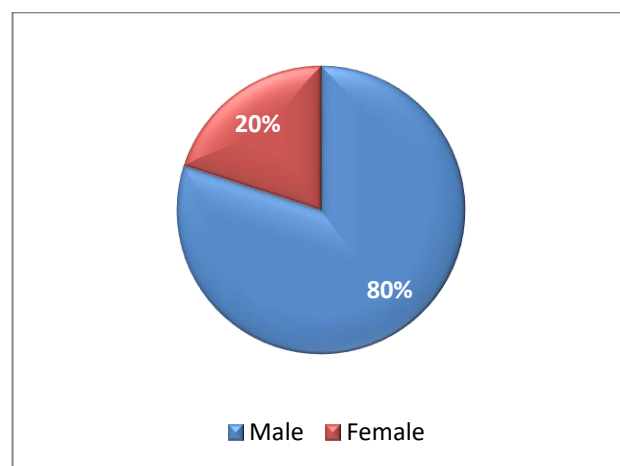
Fig 2:Bacterial growth from diabetic foot ulcers.

Fig 3:DFUpatients showing monobacterial and polybacterial gowth

Table2.Bacteria isolated from diabetic foot ulcers

Name of the organism	No.of isolates (%)
Pseudomonasaeruginosa	10(33.33%)
Klebsiellaspecies	06 (20%)
Citrobacterspecies	06 (20%)
Escherichiacoli	02 (6.66%)
Proteusmirabilis	02 (6.66%)
Acinetobacterspecies	02 (6.66%)
Staphylococcusaureus (MRSA)	02 (6.66%)
Total number of isolates	**30**

Table3:Antimicrobial sensitivity pattern of Gram negative bacilli (% of sensitivity)

	Klebsiell aspecies	*Citrobacte rspecies*	*Escherichi acoli*	*Proteus mirabilis*	*Pseudomona saeruginosa*	*Acinetobac terspecies*
Amikacin	100	66.66	100	100	100	0
Ampicillin	0	0	0	100	-	-
Amoxyclav	33.33	0	0	100	-	-
Aztreonam	-	-	-	-	40	-
Ceftazidime	33.33	0	0	100	80	0
Cefotaxime	33.33	0	0	100	-	0
Ceftriaxone	33.33	0	0	100	-	0
Cefepime	33.33	33.33	0	100	80	0
Ciprofloxacin	33.33	66.66	50	50	40	0
Cefaperozone Sulbactum	100	100	100	100	100	100
Colistin	100	100	100	0	100	100
Cotrimoxazole	66.66	66.66	0	100	-	0
Gentamicin	100	66.66	100	0	60	0
Imipenem	100	100	100	100	100	0
Levofloxacin	66.66	66.66	100	100	60	0
Meropenem	100	66.66	100	100	100	0
Ofloxacin	33.33	66.66	100	100	40	0
Piperacillin	-	-	-	-	40	-
Piperacillin/ Tazobactum	66.66	100	100	100	100	0
Polymyxin-B	-	-	-	-	100	-

Table 4: Antimicrobial sensitivity pattern of gram positive cocci (%sensitivity)

Antimicrobial agent	Staphylococcusaureus (MRSA)
Ampicillin	0
Azithromycin	0
Clindamycin	0
Ciprofloxacin	0
Cefoxitin	0
Co-trimoxazole	50
Erythromycin	0
Gentamicin	0
Levofloxacin	0
Linezolid	100
Penicillin	0
Teicoplanin	100
Vancomycin	100

DISCUSSION

In the present study, the majority of the diabetic foot ulcer patients were above 55years. This may be an indication of higher level of physical activities undertaken by ageing patients with diabetes and increased prevalence of co morbidities such as neuropathy, peripheral vascular disease and kidney disease in this age group. A study by King *et al* in 1998 mentioned that the majority of people with diabetic foot ulcers were in 45-64 years age range in developing countries [14].

Among the 30 diabetic foot ulcer patients in the present study, 24 (80%) of patients were male and 6 (20%) of patients were females. Higher male prevalence has been reported by Harrison and Lederberg [15]. This may be due to the higher level of out door physical activity in hot humid environment within adequate and improper feet care among them compared to females. Diabetic foot wounds are commonly infected and infection leads to formation of micro thrombi causing further ischemia, necrosis and progressive gangrene.

In the present study, monobacterial etiology was 63.60% and polybacterialin 36.40%. This finding correlates with finding of Pappu *et al* [1]. In the present study gram negative bacilli (93.33%)

were more common than gram positive cocci (6.66%). The study conducted by Priya darshini Shanmugam *et al* showed gram negative bacilli were more prevalent (65.1%) than gram positive cocci (34.9%) [6]. The findings of Ankur Kumar *et al* showed that gram negative bacilli were predominant (56.7%) than Gram positive cocci (40.3%)[7]. Most common bacteria among the Gram negative bacilli was Pseudomonas aeruginosa (33.33%),while from Gram positive cocci category it was Staphylococcus aureus (6.66%).These findings are similar to those reported by Vaidehi Mehta *et al* [16]. Incontrast, Citron et al reported that Staphylococcus aureus was the predominant pathogen, which comprised 57.2% of their isolates [17]. Gram negative bacilli were most sensitive to imipenem, cefaperazone sulbactum, piperacillin tazobactum, colistin [Table 3]. This finding is similar to the study done by Rao *et al* [18]. Acinetobacter species were sensitive only to cefaperazone sulbactum and colistin. This study showed that 75% of Enterobacteriaceae were ESBL producers, which is similar to the finding of the study done by Shobha *et*

al [19]. A study conducted by Jayashree Konar *et al* showed that 46% of the gram negative bacilli were ESBL producers[8]. Staphylococcus aureus isolates were most susceptible to vancomycin, teicoplanin and linezolid. Kaup *et al* reported similar finding in their study [20].

The present study showed that there is emergence of resistance among both gram negative bacilli and gram positive cocci against commonly used antimicrobials. Emergence of multidrug resistant strains is a matter of great concern as it makes the treatment more difficult. Factors responsible for multidrug resistance may be due to frequent hospitalization, chronic wound and inadequate surgical source reduction, irrational use of antibiotics and transfer of resistance genes [21]. To alleviate this situation, clinicians should prescribe antibiotics rationally, timely and sufficiently. Clinicians should switch to culture report based narrow spectrum of therapy. An adequate and timely intervention is also required to reduce the infection source. These can also help in reducing the in discriminate and prolonged antibiotic treatment.

CONCLUSIONS

This study showed that most common organism present in diabetic foot ulcers were gram negative bacilli. Monobacterial infections were more common than polybacterial infection in diabetic foot ulcers. Presence of multi drug resistant organisms was alarmingly high. There are variations in the bacterial etiologies of diabetic foot ulcer infections, based on the geographical location. Knowledge on antibiotic susceptibility pattern of the isolates from the diabetic foot infection is crucial for planning the appropriate treatment of these cases, prior to getting the culture and antimicrobial susceptibility reports from the laboratory.

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