

Original Research Paper

An Overview of the Bacteria Associated with Diabetic foot ulcers

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ABSTRACT:

Diabetes Mellitus is a common metabolic endocrine disorder, once prevalent in developed countries has become the leading “Global epidemic”. World Health Organization estimated that in the year 2000. In India around 61 million of general population affected in 2011 which may rise to 101 million by 2030. Development of foot ulcer changes the quality of life in patients leading to devastating consequences like limb amputation and remains the major risk factor for all non traumatic foot amputations. In our study we focused spectrum of microbial flora in diabetic foot ulcers. This prospective observational study was conducted at the Department of surgery, in a tertiary care hospital attached to a medical college and research institute. 100 patients with diabetes attending general surgery ward for diabetic foot ulcer management at a tertiary care hospital, Sri venkateshwaraa medical college and hospital, redhills, Chennai, tamilnadu were included during the study period from April 2022 to September 2022 (6 months). Patients willing to participate in the study were enrolled. A total of 100 patients enrolled in the study. Out of which 62 patients were male and 38 were female. As per our study conducted, about 43% of patients are under the duration period of 6-10 years in DM. In our study wagner’s classification shows Type I were 64 patients and Type 2 were 36 patients. Cefotaxime were sensitive to all identified pathogens with no resistance profile.

Key words: *Diabetic foot ulcer, microbial sensitive pattern, wagner’s classification, antibiotics*

INTRODUCTION:

Diabetes Mellitus is a common metabolic endocrine disorder, once prevalent in developed countries has become the leading “Global epidemic”. World Health Organization estimated that in the year 2000. Roughly 3% of the total world population had Diabetes. In India around 61million of general population affected in 2011 which may rise to 101 million by 2030. Among the various chronic serious complications of Diabetes, foot related complications top the list. Development of foot ulcer changes the quality of life in patients leading to devastating consequences like limb amputation and remains the major risk factor for all non traumatic foot amputations. More than a million lower leg amputations are performed each year worldwide due to diabetes and every 30 second at least one lower limb is amputated. Chronic lower extremity ulcers are those that do not progress through the healing process in a timely manner and have become a major challenge to healthcare

systems worldwide. In the United States alone, these wounds affect an estimated 2.4–4.5 million people.[1] Chronic leg and foot ulcers occur in many adults with vascular disease or diabetes and are attributed to chronic venous insufficiency, arterial disease, prolonged pressure, or neuropathy. [2] These ulcers last on average 12 to 13 months, recur in up to 60% to 70% of patients, can lead to loss of function and decreased quality of life, and are a significant cause of morbidity.[3] In India around 100,000 leg amputations are carried out per year. The life time risk of developing foot ulcer is 25% [4] with annual incidence 2-3% [5] in diabetic population. Infected foot ulcer is a common cause of morbidity in diabetic patients, ultimately leading to dreaded complications like gangrene and amputations. Lifetime risk to a person with diabetes for developing a foot ulcer could be as high as 25%.[6] Infection is most often a consequence of foot ulceration, which typically follows trauma to a neuropathic foot.[7] The incidence of type 2

diabetes is rising to epidemic proportions in India and the whole world.[8, 9] Because of its relatively low case fatality rate, prevalence of associated chronic complications is expected to increase. The burden of diabetic foot is set to rise further in the future since its contributory factors such as peripheral neuropathy and peripheral vascular disease (PVD) are present in >10% of the cases at the time of diagnosis.[10] In our study we focused spectrum of microbial flora in diabetic foot ulcers.

MATERIALS AND METHODS:

Study subjects:

This prospective observational study was conducted at the Department of surgery, in a tertiary care hospital attached to a medical college and research institute. 100 patients with diabetes attending general surgery ward for diabetic foot ulcer management at a tertiary care hospital, Sri venkateshwaraa medical college and hospital, redhills, Chennai, tamilnadu were included during the study period from April 2022 to September 2022 (6 months). Patients willing to participate in the study were enrolled.

Data collection:

Socio-demographic and anthropological data [age, marital status, literacy status, occupation, life style (sedentary/ active), familial history (parents/siblings), reasons for stress, duration and severity of disease, etc. were collected from patients.

Sample collection:

Samples were collected from patients with diabetes having ulcers, surgical sites with infection and other wounds by needle aspirate method. In case of closed wounds, the skin or mucosal surface were disinfected with 2% chlorhexidine or 70% alcohol followed by iodine solution (1-2% tincture iodine or 10% solution of povidone-iodine). Prior to specimen collection, removal of iodine with alcohol was done. Tissue samples were

obtained from depth of ulcers and transferred aseptically into labeled sampling vials with sterile saline and processed in the Microbiology laboratory in the institutional medical centre. Foot ulcers in diabetic patients were categorized into six grades (grade 0 - grade 5) based on Meggit Wagner Classification System.[11] Details regarding type of diabetes, its duration, treatment, compliance by the patient, awareness about complications, personal habits like smoking and alcohol consumption were recorded. Meticulous clinical examination was done. Neuropathy was assessed by the ability to sense touch with a 10-gram monofilament and tuning fork, ischemia by pulsations of dorsalis pedis and posterior tibial arteries, while osteomyelitis (to assess bone involvement) was diagnosed on x-rays.[12-14] Cases with ulcer on the other foot also, were considered as separate cases.

Antimicrobial susceptibility testing of aerobic isolates was performed by the Kirby Bauer disc diffusion method as recommended by the Clinical and Laboratory Standards Institute (CLSI).[15]

Inclusion Criteria:

1. Men and women of age group 18-70 years
2. Diabetic patients, Grade1 &2 [Wagner's] foot ulcers
3. Duration of foot ulcers more than 4-6 weeks
4. Good glyceemic control and Neuropathic ulcers.

Exclusion Criteria:

Uncontrolled DM, Wagner's grade 3,4,5 ulcers, Severely Infected wounds and Gangrene, Neuroischemic ulcers, traumatic ulcers, Peripheral vascular disease, Coronary artery disease, Varicose veins, Deep Venous Thrombosis, Malignancy and Pacemakers.

Statistical Analysis: Data was analyzed using student paired t -test p value <0.05 was considered statistically significant. Statistical software SPSS version 21.0 used for analysis.

RESULTS:

Table 1: Age and Gender Distribution

AGE (years)	Male	Female	Total
18-30	07	04	11
31-40	10	06	16
41-50	14	14	28
51-60	23	10	33
61-70	08	04	12
TOTAL	62	38	100

Table 2: Duration of DM among the study population (n=100)

Duration in years	Frequency	Percentage
<5	33	33%
6 - 10	43	43%
11 - 15	14	14%
16 - 20	10	10%
Total	100	100%

Table 3: Duration of Ulcer

Duration of Ulcer (Months)	No. of Patients
1	30
2-3	38
3-5	20
>5	12
Total	100

Table 4: Wagner's Classification

Wagner's Classification	No. of Patients
Type I	64
Type II	36
Total	100

Table 5: Demographic data and base line data (n=100)

Mean Age (years)	48.4±3.76
Age range (years)	18-70
Mean duration of Diabetes (yrs)	8.52±2.07
Mean ulcer duration (months)	3.12±0.82

Table 6: Prevalence of Pathogens in the Clinical Specimens

ISOLATED PATHOGENS	No of Isolation	Percentage
<i>Klebisella</i>	24	28.6%
<i>Pseudomonas aerugionsa</i>	46	54.8%
<i>Escherichia coli</i>	14	16.7%
Total	84	100%

Table 7: Antibiotic Sensitivity and Resistance Pattern

ANTIBIOTICS	<i>Klebsiella</i>		<i>P.aeruginosa</i>		<i>E.coli</i>	
	S (%)	R (%)	S (%)	R (%)	S (%)	R (%)
AMIKACIN	24(100%)	NILL	40(86.9%)	6(13.1%)	13(92.8%)	1(7.2%)
GENTAMICIN	23(95.8%)	1(4.2%)	33(71.7%)	13(28.3%)	11(78.6%)	3(21.4%)
CIPROFLOXACIN	NILL	24(100%)	8(17.4%)	36(82.6%)	NILL	14(100%)
OFLOXACIN	5(25%)	19(75%)	38(83%)	6(16%)	3(21.4%)	11(78.6%)
NORFLOXACIN	NILL	24(100%)	10(21.8%)	36(78.2%)	NILL	14(100%)
CEFOTAXIME	24(100%)	NILL	46(100%)	NILL	14(100%)	NILL
CEFTRIAZONE	24(100%)	NILL	41(89.1%)	5(10.9%)	14(100%)	NILL
AMPICILLIN	NILL	24(100%)	NILL	46(100%)	NILL	14(100%)
CEFIXIME	24(100%)	NILL	41(89.1%)	5(10.9%)	12(85.7%)	2(14.3%)

DISCUSSION:

The annual population-based incidence of diabetic foot ulcers is estimated to be 1.0–4.1 per cent, while the lifetime rate extends to around 25%.[16] A common complication of these ulcers is infection, which if left untreated, results in the need for distal limb amputation.[17] A total of 100 patients enrolled in the study. Out of which 62 patients were male and 38 were female, as comparing to other study enrolled 374 patients of which males are dominant 227 comparing to counterpart 147 female patients. (v.vijay et al). [18] In our study it was found that maximum patients affected were under the age of 51-60 years (33 patients) in comparison to other studies having 227 males and 147 females of mean 54.9 ± 9.4 years (v.vijay et al). [18] As per our study conducted, about 43% of patients are under the duration period of 6-10 years in DM. As comparing to other study duration of DM has higher significance in period of <10 years counting 154 patients out of 216 patients making 71.2%. (bedilu deribe et al). [19] In our study Duration of diabetes were up to 5 years (33 patients), 6-8 years (43 patients), 9-15 years (14 patients) and >15 years (10 patients). In our study Duration of ulcer were 1 month (30 patients), 2-3 months (38 patients), 3-5 months (20 patients) and >5 months (12 patients). In our study wagner’s classification shows Type I were 64 patients and Type 2 were 36 patients. Other study Amareswari et al [22] shows 16 were Type I and 14 were Type II. The patient’s demographic data shows that the study group included 100 patients with mean age of 48.4 ± 3.76 years. The mean duration of Diabetes is 8.52 ± 2.07 years and the mean duration of ulcer is 3.12 ± 0.82 months. Other study Amareswari et al [20] shows thirty patients with mean age of 55.06 ± 5.01 years. The mean duration of Diabetes is 7.8 ± 1.47 years and the mean duration of ulcer is 4.9 ± 1.2 months. 84 patients out of 100 isolated included for study, 24 (28.6%) isolates had *Klebsiella*, 46(54.8%) isolates *Pseudomonas*, 14 (16.7%) isolates has *E.coli*. All the bacteria isolated were gram negative and out of them

pseudomonas was the major isolate. Isolated pathogens were tested for sensitivity against commonly used antibiotics at the hospital and the sensitivity pattern is summarized in above. Cefotaxime were sensitive to all identified pathogens with no resistance profile. Though, amikacin was sensitive to *klebsiella* and *Pseudomonas aeruginosa* and its resistance was somewhat less when compare to other pathogens. Our finding is mostly isolated pathogen in our study is *Pseudomonas*, but previous studies reported by Mottola et al [21]. *S.aureus* is one of the most important micro-organisms that cause clinical problems resulting high-resistance to different antimicrobial agents. Diabetic foot ulcer is one of the most common devastating complications of diabetes mellitus and the leading cause of agonizing amputation throughout the world [22, 23]. These infections may be colonized by pathogenic and anti-microbial resistant bacteria, harbouring several virulence factors that could impair its successful treatment [24]. Moreover, recent studies from less developed countries, especially in hot, humid climates, report that even with standard microbiological methods aerobic gram-negative bacilli, especially *Pseudomonas aeruginosa* more often cause DFIs [25].

CONCLUSION:

Study results showed the following

- Male pre-dominance study.
- Of all pathogens *Pseudomonas aeruginosa* were more prevalence than other pathogens.
- Cefotaxime was sensitive to all pathogens with number of resistance profile.

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Conflicts of interest

There are no conflicts of interest.

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