International Journal of General Medicine & Surgery

Available Online: http://ijgms.edwiserinternational.com

Microbiological Profile of Diabetic foot Ulcers Experience from a Tertiary care center in South India

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Article info

Received 28 August 2017
Revised 06 September 2017
Published 13 September 2017

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Abstract

Aim: *To determine the microbiological profile and antibiotic susceptibility pattern of organisms in diabetic foot ulcers in our population.*
Settings and Design: *A prospective observational study*
Material and Method*: A prospective study was carried out on 62 patients of diabetic foot ulcers attending the endocrine OPD. The aerobic bacterial agents were isolated, and their antibiotic susceptibility pattern was studied.*
Results: *Organisms were cultured from 90.32% cases of diabetic foot ulcers. Staphylococcus aureus (both MRSA and non-MRSA) was the commonest organism found in 36.77% cases followed by E. coli in 30.88%, Enterococci in 7.35%, Pseudomonas aerogenosa in 5.88% and Klebsiella in 5.88% of cases. Polymicrobial infection was seen in 9.68% cases. In 47.05% of the cases infections was due to gram negative organisms. Staphylococcus aureus was chiefly susceptible to levofloxacin, vancomycin, pipracillin tazobactum, linezolid while E. coli to levofloxacin, piperacillin tazobactum, and meropenem.*
Conclusion: *Gram-negative organisms were most frequent type of isolate. Staphylococcus aureus was the most common type of bacteria. All bacterial isolate in our study have sensitivity for levofloxacin, pipracillin- tazobactum linezolid, and meropenem.*

Keywords: Diabetic foot ulcer; infections; Gram positive bacteria; Gram negative bacteria

Introduction

Chronic diabetic foot ulcers cause serious morbidity and disability with prevalence of 3-5% [1]. They frequently lead to amputation causing added disability. Hyperglycemia, neuropathy, peripheral arterial disease, foot deformity, foot trauma, impaired immunologic response and infections are the major predisposing factors leading to limb threatening diabetic foot ulcers. The increasing association of multi drug resistant (MDR) pathogens with diabetic foot ulcers further compounds the challenge faced by the physicians and the surgeons in treating these cases. The antimicrobials are selected empirically for control of infection [2].

Present study was done to determine the microbiological profile and antibiotic susceptibility pattern of organisms in diabetic foot ulcers in our population as there is scanty information from our country regarding common microbiological agents and their susceptibility pattern.

Materials Methods

It is a prospective observational study where 62 diabetic foot ulcer patients were studied, who attended the Endocrine OPD from January 2016 to June 2016. The inclusion criteria for enrolment into the study included the following: (1) Diabetic foot ulcer patient for duration of more than 2 weeks; (2) willing to participate in study; Exclusion criteria included (1) Not willing to participate in study; (2) Seriously ill patients; (3) Patients with neuropathy other than diabetic neuropathy; (4) Cases with acute limb ischemia.

After thorough evaluation of cases, culture studies were performed. Culture specimens were obtained at the time of OPD visit. Pus or discharges from the ulcer base and debrided necrotic tissue were obtained with a sterile curette after washing the wound with saline to prevent contamination of specimen with superficially colonized organisms. The specimens were taken immediately to the microbiology laboratory and processed without any delay. The specimens were subjected to Gram staining; the specimens were promptly sent to the laboratory and processed for aerobic bacteria. Standard methods for isolation and identification of aerobic bacteria were used.

Antibiotic susceptibility testing was performed by Kirby Bauer's disc diffusion method according to Clinical Laboratory Standards Institute (CLSI) guidelines.

Table 1: Demographic profile of patients.

Demographic Variables	**(n=62)**	
Age (Years)	**No.**	**%**
31-40	5	8.06
41-50	17	27.42
51-60	34	54.83
61 or more	6	9.67
Mean Age (years)	53.67 ± 9.67	
Female	17	27.42%
Male	45	72.58%

Table 2: Duration of foot ulcer.

Duration of Diabetic Foot	**(n=62)**	
	No.	**%**
2- 4 Weeks	21	33.87
4- 8 Weeks	29	46.77
8- 12 Weeks	6	9.68
>12 Weeks	6	9.68
Mean ± SD duration in days	48.22 ± 40.43	

Results

The demographic profile and clinical profile of patient is shown in Table 1. The mean age of our patients was 53.12 + 9.67 years with male to female ratio of 2.6:1. The mean duration of diabetic foot ulcer was 48.22 + 40.43 days Table 2. The Size and Grade of Ulcer in the cases is shown in Table 3.

The culture studies in our cases of Diabetic Foot are shown in Table 4. In our cases 2 micro-organisms were isolated from 6 patients and none from 6 patients. The antibiotic sensitivity of various organisms isolated in our cases is shown in Table 5 in details, but overall sensitivity of various drug shows that all bacterial isolate in our cases have good sensitivity for levofloxacin, pipracillin- tazobactum, linezolid, and meropenem. *e. coli* and *staphlococcus aureus* most common isolates were resistant to ciprofloxacin, amikacin, vancomycin, amoxycillin clavulanic acid, ceftazidime and cefoperazone sulbactum.

Discussion

Foot infections are among the common lower extremity complication in the diabetic population. Infections in persons with diabetes are a common, complex, costly problem and play a major role in the propagation of chronic diabetic foot ulcers [2-9].

Gram-negative organisms were most frequent type of isolates with a total of 32 isolates out of 62 types of isolates (51.61%). This was in concordance with previous observation of Umadevi et al. who demonstrated gram negative isolates in 52.4% of study subjects [10]. This also matches study of Gadepalli et.al at AIIMS which showed gram negative organisms are more common [11].

Table 3: The size and grade of ulcer in the cases (*3 patients have 2 ulcer).

Size of ulcer (in cm^2)*	**(n=65)**	
	No.	**%**
<5	25	38.46
5-20	19	29.23
>20	21	32.31
Wagner grade		
1	20	30.77
2	24	36.92
3	14	21.54
4	6	9.23
5	1	1.54

Table 4: Showing the findings of culture studies in our cases of diabetic foot (*2 isolates from 6 patients and no isolate from 6 patients).

Microflora	**(n=68)***	
	No.	**%**
E. coli	21	30.88
S. aureus	13	19.12
MRSA	12	17.65
Enterococcus	5	7.35
Klebsiella	4	5.88
Pseudomonas	4	5.88
Proteus	3	4.41
No isolate	6	8.83

But Gaur et al. in 2007 in their studies observed that *Eneterococcus sp, Staphylococcus sp* and anaerobes were responsible for majority of the foot ulcers [12]. This was in contrast to studies mentioned above where Gram-negative bacteria were predominant organisms and anaerobes were not isolated. This was similar to previous studies which also found gram-positive aerobes as predominant in diabetic foot infections [13,14].

In our cases *Staphylococcus aureus* both methicilline sensitive (non-MRSA) and resistant (MRSA) was the most common type of bacteria with a total of 25 isolates (40.32%) out of a total of 62 isolates. S. aureus being the most common type of bacteria matches the observation in studies by Zubair, Malik and Ahmad at Aligarh Muslim University and Gadepalli et al. at AIIMS [15].

E. coli was a close second with a total of 21 isolates out of a total of 62 isolates accounting for 33.87% isolates. *E. coli* was most common isolates among gram negative organisms. Enterococcus was in 5 cases accounting for 8.06% of isolates and Proteus was isolated in 3 cases accounting for 4.83%, pseudomonas was isolated in 4 cases accounting for 6.45%, Klebsiella had same percentage as Pseudomonas.

In our cases 6 patients (9.68%) were having more than 1 organism infecting chronic diabetic foot ulcer and no organism was found in 6 patients (9.68%) of total 62 cases.

In our cases sensitivity pattern of different antibiotics is shown in results. All bacterial isolate in our have sensitivity for levofloxacin, pipracillin-tazobactum, linezolid and meropenem.

Table 5: Sensitivity pattern to different antibiotics on the micro-flora among study population in percentage.

Antibiotic	Sensitivity against isolates	E. coli	MRSA	Staph. Aureus (non-MRSA)	*Enterococcus*	*Klebsiella*	*Pseudomonas*	*Proteus*
1	**R**	10.00	11.11	11.11	25.00	0.00	0.00	0.00
	MS	75.00	0.00	66.67	50.00	50.00	100.00	66.67
	S	15.00	88.89	22.22	25.00	50.00	0.00	33.33
2	**R**	5.00	33.33	22.22	20.00	50.00	0.00	0.00
	MS	15.00	66.67	33.34	40.00	50.00	100.00	66.67
	S	80.00	0.00	44.44	40.00	0.00	0.00	33.33
3	**R**	65.00	66.67	66.67	60.00	100.00	100.00	33.33
	MS	30.00	33.33	33.33	40.00	0.00	0.00	66.67
	S	5.00	0.00	0.00	0.00	0.00	0.00	0.00
4	**R**	45.00	11.11	11.11	80.00	50.00	0.00	100.00
	MS	25.00	55.56	55.56	0.00	0.00	100.00	0.00
	S	30.00	33.33	33.33	20.00	0.00	0.00	0.00
5	**R**	60.00	11.11	0.00	40.00	100.00	100.00	33.33
	MS	10.00	44.44	44.44	40.00	0.00	0.00	66.67
	S	30.00	44.44	55.56	20.00	0.00	0.00	0.00
6	**R**	55.00	11.11	22.22	80.00	50.00	0.00	66.67
	MS	0.00	55.56	22.22	20.00	0.00	100.00	33.33
	S	45.00	33.33	55.56	0.00	50.00	0.00	0.00
7	**R**	60.00	77.78	77.78	80.00	50.00	100.00	66.67
	MS	20.00	11.11	0.00	20.00	50.00	0.00	33.33
	S	20.00	11.11	22.22	0.00	0.00	0.00	0.00
7	**R**	60.00	66.67	66.67	100.00	50.00	50.00	100.00
	MS	25.00	22.22	33.33	0.00	50.00	50.00	0.00
	S	15.00	11.11	0.00	0.00	0.00	0.00	0.00
8	**R**	25.00	66.67	44.44	80.00	50.00	0.00	33.33
	MS	10.00	11.11	11.11	0.00	50.00	100.00	66.67
	S	65.00	22.22	44.44	20.00	0.00	0.00	0.00
9	**R**	15.00	44.44	44.44	40.00	50.00	0.00	33.33
	MS	65.00	33.33	22.22	40.00	50.00	100.00	33.33
	S	20.00	22.22	33.33	20.00	0.00	0.00	33.33

*R=Resistant, MS=Moderately Sensitive, S=Sensitive
Antibiotics:1-Levofloxacin, 2-Pipracillin Tazobactum, 3-Ciprofloxacin, 4-Amikacin, 5-Vancomycin, 6- Linezolid, 7-Amoxycillin Clavulanic acid, 7-Ceftazidime, 8-Cefoperazone Sulbactum, 9-Meropenem.

E. coli and *Staphlococcus aureus* most common isolates were resistant to ciprofloxacin, amikacin, vancomycin, amoxycillin clavulanic acid, ceftazidime and cefoperazone sulbactum Main strength of our study was good sample size; also, it gives insight about the empirical use of antibiotics in diabetic foot ulcers. The main limitation of this study is the failure to detect the anaerobic bacteria.

Conclusion

The awareness about the antibiotic susceptibility pattern of the isolates from diabetic foot infections is crucial for appropriate empirical treatment. Gram-negative organisms were most frequent type of isolate. Staphylococcus aureus was the most common type of bacteria with *E. coli* was a close second.

In our 9.68% cases were having more than 1 organism infecting chronic diabetic foot ulcer and no organism was found in 9.68% cases. All bacterial isolate in our have sensitivity for levofloxacin, pipracillin-tazobactum,

Linezolid and Meropenem. *E. coli* and S. aureus most common isolates were resistant to ciprofloxacin, amikacin, vancomycin, amoxycillin clavulanic acid, ceftazidime and cefoperazone sulbactum. Our results of antibiotic sensitivity favours to follow 2012 Infectious Diseases Society of America Clinical Practice Guideline for the Diagnosis and Treatment of Diabetic Foot Infections in Indian population also.

Conflict of Interest

There is no conflict of interest in the study.

Financial Support

Nil.

Acknowledgement

The authors would like to acknowledge the support of senior professors whose continuous guidance helped us in shaping the article.

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This manuscript was peer-reviewed
Mode of Review: Single-blinded
Academic Editor: Dr. Pawel Lizis