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Research Article

CLINICAL AND MICROBIOLOGICAL STUDY OF DIABETIC FOOT IN PATIENTS ADMITTED AT RMMCH, CHIDAMBARAM, TAMIL NADU, INDIA

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ABSTRACT
Worldwide, Diabetic Foot Ulcers are a major medical, social and Economic Problem and are the Leading Cause of Hospitalization for most of the Patients with Diabetes. Diabetic foot is the most common complication of Diabetes. Diabetic foot ulcerations and infections are one of the leading causes of mortality and morbidity, especially in the developing countries. The Indian diabetic population is expected to increase to 57 Million by the year 2025. Mostly, The Diabetic foot infections are mixed bacterial infections and the proper management of these infections requires an appropriate antibiotic selection, based on the culture and the antimicrobial susceptibility testing results. A prospective study was carried out on 50 diabetic patients with foot ulcers for a period of 6 months from January 2013 to June 2013 admitted at Rajah Muthiah Medical College and hospital. A total of 122 organisms were isolated and an average of 1.22 isolates per case was reported. Poly microbial nature was observed and gram negative (52.45 %) organisms dominated the positive (47.54 %) in case of number of organisms isolated. The most frequent bacterial isolate was *Staphylococcus aureus* (39.34 %) and *E. coli* (23.77 %). Antibiotic sensitivity pattern of the isolates was discussed in detail. Neuropathy (29 %) and peripheral vascular disease (27 %) were the common clinical characteristics of the patients. *Staphylococcus* was the most frequent bacterial isolate in this study followed by *E. coli*. Diabetic foot ulcers are poly microbial in nature. Beta lactam/ beta lactamase inhibitor combinations, vancomycin, fluroquinolones were the suitable choices for the empiric antibiotic therapy found by this clinical and bacteriological study.
Keywords: Diabetic Foot Ulcers, *Staphylococcus aureus*, *E. coli*

INTRODUCTION

Worldwide, 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.[1-2] Diabetic foot ulcerations and infections are one of the leading causes of mortality and morbidity, especially in the developing countries[3-4]. *E. coli, Proteus, Pseudomonas sp, S. aureus* and *Enterococcus sp* are the most frequent pathogens which are cultured from diabetic foot ulcers. The infections in the diabetic foot are usually polymicrobial due to aerobic bacteria, anaerobes and *Candida* sp. The severe infections usually yield polymicrobial isolates, whereas the milder infections are generally monomicrobial.[5-9] The decision regarding proper management of diabetic foot infection is a difficult one and still a matter of debate. While optimal therapy is yet to be established, most authors agree that the management of these infections require isolation and identification of the microbial flora, appropriate antibiotic therapy according to the sensitivity patterns, precise selection and identification of the chronic complications and proper surgical intervention for these complications.[11] Most of the diabetic foot infections are polymicrobial in nature and mixed organisms are frequently encountered.[12-17] However, the spectrum of microorganisms depends mainly on microbial flora of the lower limb, metabolic factors, food hygiene and the use of antibiotics.[16,10] A diabetic foot is one of the most feared complications of diabetes and it is the leading cause of the hospitalization among diabetic patients.[17] It is characterized by several pathological complications such as neuropathy, peripheral vascular disease, foot ulceration and infection with or without osteomyelitis, which leads to the development of gangrene and which even necessitates limb amputation. The Indian diabetic population is expected to increase to 57 million by the year 2025.[18] Many studies have reported on the bacteriology of Diabetic Foot Infections (DFIs) over the past 25 years, but the results have been varied and often contradictory.[19] These discrepancies could partly have been due to the differences in the causative organisms, which had occurred over time, geographical variations, or the type and the severity of the infection, as were reported in the studies.[19] Mostly, the diabetic foot infections are mixed bacterial infections and the proper management of these infections requires an appropriate antibiotic selection, based on the culture and the antimicrobial susceptibility testing results[20].

MATERIALS AND METHODS

A prospective study was carried out on 100 diabetic patients with foot ulcers for a period of 6months from January 2013 to June 2013 admitted at Rajah Muthiah Medical College and hospital. A semi-structured questionnaire was developed to record the medical history, examination details, and investigation reports. Detailed medical history and physical examination included demographic data, duration of diabetes, history of previous amputation, awareness about complications, personal habits such as smoking and alcohol consumption, history of ischemic heart disease, hypertension or cerebrovascular disease, nephropathy, neuropathy,

duration of wound, history of antibiotic intake prior to admission.

Lab diagnosis Specimen collection

Deep tissue culture was taken from the infected wound for microbiological examination.microbiological examination done by streak method, fermentation and then 24 hours incubation of cultureat 37^0 C. out of 100 patients 122 bacteria were isolated. 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).[22] Culture, isolation, antibiotic sensitivity and identification of the microorganisms were done according to standard microbiological procedures.[20,21] Due to lack of resources, anaerobic culture was not done; therefore, results were analysed for aerobic flora only.

RESULTS

In 100 diabetic foot patients male population was predominant in the study (78 %) and majority of the patients in the study present with type 2 diabetes (94 %) and out of them (38 %) of the patients suffering from diabetes mellitus over 10 years. 10 complications were observed including vascular disease, neuropathy, retinopathy, nephropathy, hypertension, artery disease, anaemia, renal failure and ischemic heart disease. The details of patients affected with above stated complications with respective percentages are stated below in Table 1.

Table 1: Clinical characteristics of patients

Complication	Number of patients	%
PVD	27	27.0
Neuropathy	29	29.0
Retinopathy	5	5.0
nephropathy	19	19.0
hypertension	23	23.0
CAD	17	17.0
Anaemia	6	6.0
ARF	3	3.0
IHD	9	9.0
Necrotizing fascitis	18	18.0

PVD: Peripheral vascular disease
CAD: Coronary artery disease
ARF: Acute renal failure
IHD: Ischemic heart disease

Microbiological Observation

Total number of patients: 100
Isolated bacteria: 122
Average bacteria per lesion: 1.22

Table 2

Bacteria	Number	Percentage (%)
Gram-positive aerobes	**58**	
1.*Staph.aures*	48	39.34
2.*Enterococci*	6	4.91
3.strept.Group B	4	3.27
Gram negative-aerobes	**64**	
1. *E. coli*	29	23.77
2. *P. aeruginosa*	12	9.83
3. *Klebselia pneumoniae*	9	7.37
4. *Proteus* sp	8	6.5
5. *Acenetobacter*	4	3.27
6. *Citrobacter* sp	2	1.63

Table 3: **Antibiotic sensitivity pattern of gram-positive bacteria**

Antibiotic	*Staph. aureus* n = 48	*Enterococci* n = 6	*Strept.* Group B n = 4
	Sensitivity (%)	Sensitivity (%)	Sensitivity (%)
chloramphenicol	87.5	66.67	66.67
Penicillin	8.33	0	0
Amikacin	93.75	83.33	75
Ofloxacin	91.67	100	100
piperacillin	-	83.33	75
Linezolid	95.83	-	-
cefuroxime	62.5	100	75
clindamycin	100	100	100
cotrimoxazole	0	0	0
erythromycin	6.25	0	0
cephalexin	68.75	-	-
ceftriaxone	77.08	100	-
gentamicin	56.25	16.67	25
kanamycin	0	0	0
rifampicin	93.75	100	100
vancomycin	100	100	100
Cefperazone/tazobactam	100	-	-
Piperacillin/tazobactam	100	100	100
Cefperazone/sulbactam	100	100	-
tetracyclin	50	50	25

Table 4: Antibiotic sensitivity pattern of Gram-negative bacteria

Antibiotic	*E. coli* n = 29	*pseudomonas* n = 12	*Klebsela* n = 9	*Proteus* n = 8	*Acenetobacter* n = 4	*Citrobacter* n = 2
	Sensitivity					
Penicillin	17.24	-	-	50	-	-
Amikacin	82.75	91.67	77.78	100	-	100
Ofloxacin	72.41	100	100	100	-	100
piperacillin	72.41	66.67	55.55	100	-	0
Linezolid	68.96	-	-	100	100	-
chloramphenicol	86.21	-	-	50	-	-
cotrimaxazole	0	-	77.78	0	50	-
clindamycin	4.83	41.67	-	-	25	-
cefuroxime	17.24	50	55.55	50	-	0
cephatoxime	20.69	66.67	66.67	62.5	50	0
cephalexin	6.9	41.67	-	62.5	-	-
ceftriaxone	6.9	-	11.11	50	-	50
gentamicin	55.17	100	100	-	-	-
cefpirome	48.28	-	0	50	100	0
cefazidine	6.9	16.67	-	37.5	-	50
Piperacilin/tazobactam	100	100	100	100	100	100
Cefperazone/sulbactam	100	100	100	100	100	100
tetracyclin	34.48	-	100	0	-	-
levofloxacin	93.10	100	100	100	-	100

DISCUSSION

From our study it is evident that male are predominantly prone to infections post surgically compared to women. Majority of the patients are of age group falling in between 51- 60 (28), followed by 61-70 (26) and 41-50 (23) and it clearly explains the fact that age factor is playing a important role in occurrence of infections, while this may be explained by other factors including non compliance due to poly pharmacy and economical issues. Our study results are in accordance with study findings of vishwanathan *et al*, (12) in aspect of average bacteria per lesion being 1.22. Poly microbial nature was observed and gram negative (52.45 %) organisms dominated the positive (47.54 %) in case of number of organisms isolated. The most frequent bacterial isolate was *Staphylococcus aureus* (39.34 %) and *E. coli* (23.77 %) these results are similar to Shankar *et al* (5) and chincholikar *et al* (13). Other organisms are prevalent in the range of *enterococci* (4.91 %), *Pseudomonas aeruginosa* (9.83), *Klebsiella pneumonia* (7.37 %), *Proteus* sp (6.5 %), *acenetobacter* (3.27 %) and *citrobacter* (1.63 %). Coming to sensitivity patterns of the isolates it is observed that piperacillin/ tazobactam (100), cefoperazone/ sulbactam (100), clindamycin (100), ofloxocin (91.67), rifampicin (93.75) were sensitive to aerobic gram positive bacteria whereas penicillin (8.33), cotrimoxazole (0), kanamycin (0) and erythromycin (6.25) were resistant to aerobic gram negative organisms.

CONCLUSION

In a rural area like chidambaram where the socioeconomic status of the people is not appreciable it is must to follow aseptic procedures to avoid these types of infections. Diabetic foot ulcers not only cause hospitalization but, also affect the patient economically and may lead to increase mortality. Culture and sensitivity from the wounds plays an important role in prescribing the appropriate antibiotic at the time of admission itself rather than starting empirical treatment. The lack of multi-disciplinary approach in the treatment of diabetic foot is quite obvious and there is a lot of scope of improvement in the form of holistic approach to a patient with diabetic foot rather than just treating the FOOT. Therefore a pharmacist can take a step in recording such data that helps in improving hygienic conditions and avoiding sources of such infections insurgery ward and operation theatre.

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