

Bacterial and Clinical Profile of Diabetic Foot Ulcer using Optimal Culture Techniques: A Prospective Hospital Based Study

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ABSTRACT

Background: Diabetic foot ulcers (DFU) are the complications of diabetes mellitus. The infection of diabetic foot ulcer is microbes in nature. If they are not recognized and controlled it may lead to many devastating consequences like limb amputation, sepsis, and even mortality. So, the present study was aimed that to determine the bacterial and clinical profile of diabetic foot ulcer using optimal culture techniques.

Methods: This prospective study was conducted on Type 2 Diabetic patients with foot ulcer. Around 206 total cases were enrolled on the basis of inclusion and exclusion criteria. The duration of study was over a period of two years.

Results: The result of this study revealed that causative agent of DFU were found due to aerobic in n = 170 cases whereas anaerobic bacteria in n = 36 cases.

Conclusion: This study concludes that that proper care should be offered, causative organisms should be timely identified and antibiotic should be sensibly chosen to cut short the morbidity and mortality of DFU.

Keywords: DFU, Aerobic bacteria, Anaerobic bacteria, Sepsis

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INTRODUCTION

Diabetes mellitus (DM) is among one of the foremost public health concerns and its prevalence is mounting very fast at an alarming rate all over the world. As per WHO, 69.2 million people were reported diabetes in the year 2015 and most of these patients are present in India only.¹ Diabetic patients are prone to develop varied complications such as diabetic foot ulcer (DFU) and it is showing an upward trend over the periods.²⁻⁴ 15% of diabetic patients have been reported to develop DFU in their life and these ulcers are vulnerable to infection.⁵ The prevalence of DFU ranges from 4%-27%.⁶⁻⁸ It is considered as one of the most important source of morbidity and a principal reason of hospitalization.⁹ DFU may cause infection, gangrene, amputation, and even death if left unattended.¹⁰ Aerobic gram positive Cocci has been commonly found from the isolates of DFU especially in

patients who have not received any antibiotic cover of late. Gram negative and obligate anaerobic organisms are commonly found in other patients having a polymicrobial infection.¹¹ For DFU, the antibiotic treatment should be chosen judiciously taking causal organism and its sensitivity to various drugs into consideration. And for this treatment a meticulous bacteriological study of DFU is extremely essential.

The aim of the present study is to evaluate the role of aerobic and anaerobic bacteria in the development of DFUs in tertiary care hospital. The clinicians would get immense benefit by antimicrobial spectrum of these isolates in the treatment of DFU and the morbidity and monetary load of the

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disease will be surely reduced by halting the major cause of non-traumatic lower limb amputations.

METHODS

Study population:- This study was conducted on n = 206 cases of diabetic foot ulcer.

Study Duration:- The duration of study was over a period of two years.

Data collection:- Swab samples were obtained from the base of ulcer after cleaning with normal saline & then rubbing the swab over the lesion. Three swabs were collected from the same site. One swab was placed in a sterile test tube, second was placed in Stuart's medium & third was transferred to a sterile tube containing RCM. Discharge was aspirated with a sterile needle & syringe aseptically. In case of patients undergoing any surgical intervention, the surgeon was requested to send the specimen to the laboratory. Samples after collection were immediately transported to the laboratory for culture and susceptibility test. Then report were collected after 48 hours and data were obtained.

Data analysis:- Data were analysed by using Microsoft Excel.

RESULTS

In this study we were included 206 cases. Among all cases 3.8% cases from 31-40 age group, 91.2% cases 41-60 age group & 30.1% 61-70 age group and rest were found more than 70 age group. In this study male were dominantly found as compared to female. This study observed that 93 cases of foul smell, 83 of fever & 30 cases had crepitation. According to Wagner's grading 124 cases found of grade I and rest were found II (64), III (16), IV (2). This result of this study revealed that 170 causes of diabetic foot ulcer due to aerobic bacteria and 36 causes due to anaerobic bacteria.

Table 1: Distribution of cases according to age group

Age groups	No.	Percentage
31-40	8	3.8
41-60	118	91.2
61-70	62	30.1
>70	18	8.7
Total	206	100

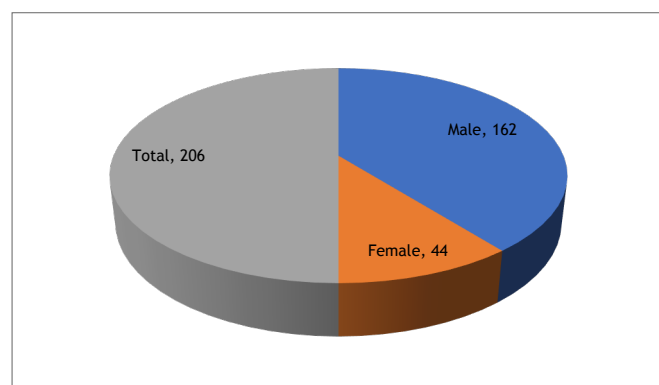


Chart :1 This chart showing gender distribution

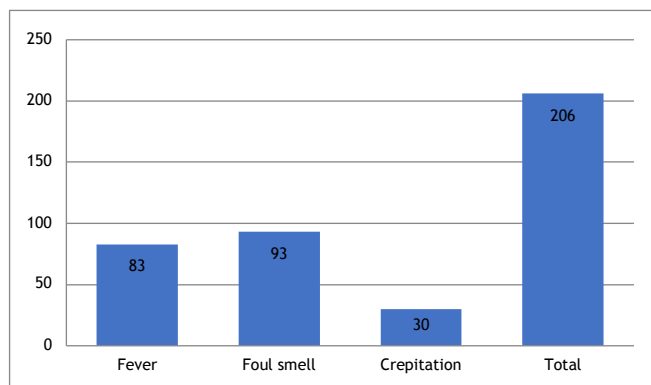


Chart:2 This chart showing sign & symptoms

Table:2 Distribution of cases according to Wagner's Grading

Wagner's Grading	No.	Percentage
I	124	60.1
II	64	31.1
III	16	7.7
IV	2	0.97

Table:3 Distribution of cases according to aerobic bacteria

Aerobic bacteria	No.	Percentage
Gram positive bacteria		
Staphylococcus spp.	74	43.5
Streptococcus spp.	11	5.3
Gram negative bacteria		
E. coli	32	18.8
Proteus spp.	16	9.4
Klebsiella spp.	18	10.5
Citrobacter spp.	19	11.7
Total	170	100

Table:4 Distribution of cases according to anaerobic bacteria

Anaerobic bacteria	No.	Percentage
Clostridium spp.	1	2.7
Peptostreptococcus spp.	18	50
Bacteroides spp.	17	47.2
Total	36	100

DISCUSSION

DFU is one the most common complication of DM. Neuropathy, vasculopathy and/or ischemia can be the causative agent of DFU and its infection may be limb and life threatening.^{12,13} The patients with DFU participated in the present study and the mean age of the patients was 58.31±9.74 years. The findings of the present study are consistent with the study of Ramani et al with mean age being 58 years.¹⁴ Male predominance with 162 males and 44 females were observed in the present study and the reason for this can be attributed to the males spend more time working

outdoors and exposing their feet to more injuries.^{15,16} In the present study, mean duration of DM was 9.02 ± 5.09 years that was consistent with the men duration of 9.1 ± 6.7 years in study of Viswanathan et al.¹⁶ It has been reported in various studies that with increased duration of DM, preponderance of DFU increases.^{17,18} The predisposing factors of DFU found in the present study such as history of trauma in 156 patients, neuropathy in 126, vasculopathy in 26 and smoking in 106 patients are comparable to the results of Reiber et al series.¹⁹ The high percentage of trauma found in the present study can be attributed to poor hygiene, barefoot walking, low socioeconomic status and lack of access to proper health care system. The findings of the present study, that neuropathy is a more common causative agent of DFU than vasculopathy are similar to the findings of other studies.^{20,21} The finding of smokers having increased incidence of DFU is comparable with finding of Kundaje et al.²⁰ In present study, reporting of fever by 83, foul smelling ulcer by 93 had ulcer and subcutaneous gas by 30 patients are consistent with other studies.²² The observations of the present study of majority of DFUs being of Wagner grade I, followed by grade II, III & IV respectively are comparable to the observations of other studies.^{23,24} Out of the 206 organisms isolated from DFU in the present study, 170 were aerobes (82.5%) while 36 (17.4%) were anaerobes. These results were similar to Ramani et al, Citron Ellie et al, Pathare et al.^{25,26} *Staphylococcus* spp was the most common among these isolates and it was consistent with findings of previous studies.²⁷⁻²⁹ *Proteus* spp, *Citrobacter* spp was found only in 9.4% & 11.7% which was almost similar to Alavi et al.³⁰ Out of 36 anaerobes isolated in the present study *Bacteroides* spp group²⁰ was the most frequent, followed by *Peptococcus* spp¹³ and *Clostridium* spp. These reports are similar to other studies.^{27,28} The sensitivity of *Staphylococcus aureus* (92.45%) and coagulase negative *Staphylococci* (95.23%) to vancomycin followed by ofloxacin are consistent to Raja et al.³¹ Similarly, sensitivity of *Streptococci* spp being 100% to vancomycin and 44.44% to penicillin & cotrimoxazole both are comparable again to Raja et al.³¹ *Staphylococcus* spp were resistant to penicillin, which was also demonstrated by Rama Ramani et al.²⁰ Sensitivity of *Proteus* spp to cefotaxime followed by ceftriaxone are consistent with findings of Raja et al respectively.³¹ In the present study, *E. coli* was 90.62% sensitivity to cefotaxime & 87.5% to amikacin in contrast to Anandi et al where *E. coli* was 100% sensitive to both of these.²⁴ Just like Sharma et al, *Pseudomonas aeruginosa* was resistant to most of the antibiotics but was sensitive to imipenem (90.47%) in the present study.²⁹ Similar to Ramani et al, Metronidazole was the drug of choice for anaerobes followed by imipenem.²⁰

CONCLUSION

It is evident that DFU may lead to infections, lower extremity amputations causing disability to patients, producing significant morbidity, long duration hospitalization, and even death. It can be advocated by the above discussion that proper care should be offered, causative organisms should be timely identified, and antibiotic should be sensibly chosen to cut short the morbidity and mortality of DFU.

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