


Original Article

Clinical aspects and microbiological pattern of diabetic foot in surgical practice: A study in a tertiary academic hospital, Bangladesh

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ABSTRACT

Background: We have very few authentic data regarding the microbiological pattern of diabetic foot in our surgical practice so far. With this in mind, a prospective study was conducted in BIRDEM General Hospital, Bangladesh in the recent past. This study encouraged us to conduct a similar study in Khulna Medical College hospital, Bangladesh. **Objective:** This study was conducted to assess the microbial pattern, antibiotic sensitivity and other clinical aspects of diabetic foot in our setup. **Methodology:** This study was a prospectively study in Dept. of Surgery, Khulna Medical College Hospital, Bangladesh from January 2018 to July 2021. A total 120 patients with diabetic foot were included on the basis of convenient sampling. **Result:** Most of the patients with diabetic foot were female (63.3%). The incidence was associated with age of the patients. Using the Wagner ulcer grading system, it was found that most of the diabetic foot were in grade III (35.0%). Most the infection was polymicrobial (82.5%) and frequently isolated micro-organisms were *Pseudomonas* (29.3%) and *Streptococcus* (26.7%). The antibiotics sensitivity against the micro-organisms suggest that the usual sensitive antibiotic were Colistin (93.3%), Imipenem (83.3%) and Meropenem (80.8%). The rate of amputation was approximately 25%. **Conclusion:** Advanced age is an associated factor for diabetic foot. Incidence is higher in female. Grade IV ulcer is most common. Infection is most often polymicrobial. *Pseudomonas* and *Streptococcus* was frequently observed organism which are best sensitive to Colistin, Imipenem and Meropenem. The overall amputation rate is 25%.

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INTRODUCTION

According to 2017 statistics, 425 million people worldwide have diabetes. Compared to 2013 and 1980, in which reported 382 million and 108 million, respectively, it can be seen that this progressive chronic metabolic disease is developing rapidly worldwide¹⁻³. Diabetic ulcers develop due to poor blood supply following diabetes. Over 20% of the cases of hospitalization due to diabetes are due to diabetic foot ulcers. Wounds can lead to organ damage or even deadly and dangerous infections for patients. Therefore, the need for antibiotic treatment to minimize these complications is of great importance^{4,5}. Mistreatment of diabetic foot ulcers can be caused by factors such as the use of antibiotics without sensitivity in culture or drugs that do not affect the species extracted from the wound site or incorrect duration of treatment⁶.

Most acute infections in patients who have not been treated with antibiotics are mostly monobacterial and occur, at least in western countries, predominantly with aerobic Gram-positive cocci (especially *Staphylococcus aureus*). Infections that are chronic or have a previous history of antibiotic treatment are often polymicrobial, generally occurring with Gram-positive aerobic cocci or obligate anaerobe Gram-negative bacilli^{7,8}. Previous studies have shown Gram-positive aerobic coccyx bacteria, mainly

Staphylococcus aureus, are the most common causes of diabetic foot ulcer infection. In chronic ulcers, especially those that have recently been treated with antibiotics, infections are mainly polymicrobial. Pathogens in these infections take quite different forms as they are often caused by Gram-negative aerobic bacilli and compulsive anaerobic bacteria^{9,10}.

Early diagnosis of lesions and prompt initiation of appropriate antimicrobial therapy are essential for effective management and to salvage the limbs of the patients. Culture and assessment of antibiotic susceptibility test is therefore the crucial part of management of infections in diabetic foot. This prospective study was conducted to evaluate pattern of microbial infection and sensitivity in Khulna Medical College Hospital, Bangladesh.

METHODOLOGY

This study was conducted as a prospective study in Surgery Unit 1 & 2 in Khulna Medical College Hospital, Bangladesh from January 2018 to July 2021 with a total 120 patients of diabetic foot. Population was selected on the basis of convenient purposive sampling based on the inclusion and exclusion criteria. Wounds were graded by Wagner ulcer grading system as the assessment tool. The survey data were usually be analyzed using both analytic as well as descriptive statistic. Such as;

mean, SD, percentage etc. Informed consent was from the individual patient and ethical clearance was taken from the ethical review committee of Khulna Medical College Hospital.

RESULTS

The age and sex distribution of total 120 patients of infected diabetic foot ulcer is depicted in table 1.

Age in years	Female		Male	
	N	%	n	%
20-30	00	00	02	1.7
31-40	12	10	03	2.5
41-50	16	13.3	06	5.0
51-60	18	15.0	11	9.2
>60	30	25	22	18.3
Total	76	63.3	44	36.7
Mean±SD	55±1.4		58±1.5	

Table 1: Age and sex distribution of study population.

Foot ulcer among the study population was graded by using Wagner grading of ulcer²⁰ (Figure 1).

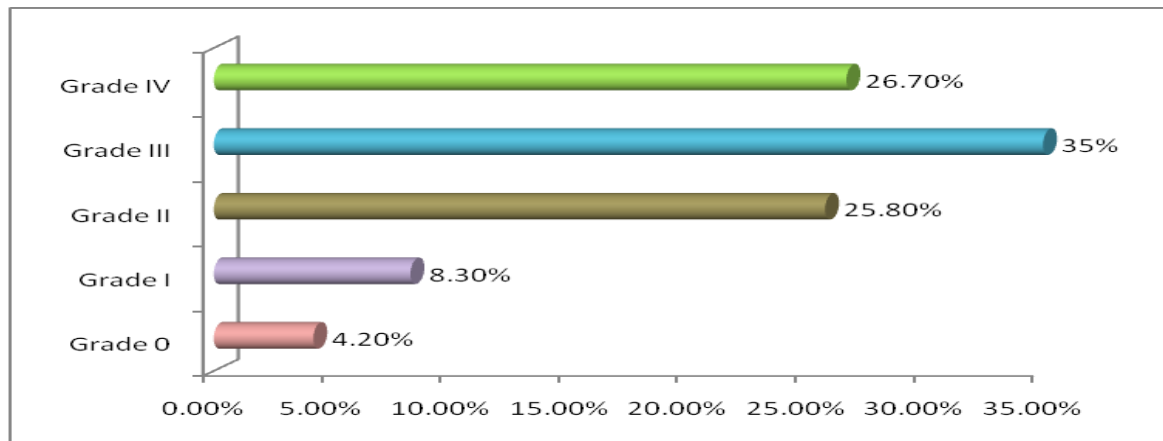


Figure 1: Grading of foot ulcer by Wagner grading of ulcer²⁰.

Most often the infection was polymicrobial. The overall pattern of infection of foot ulcer is represented in figure 2.

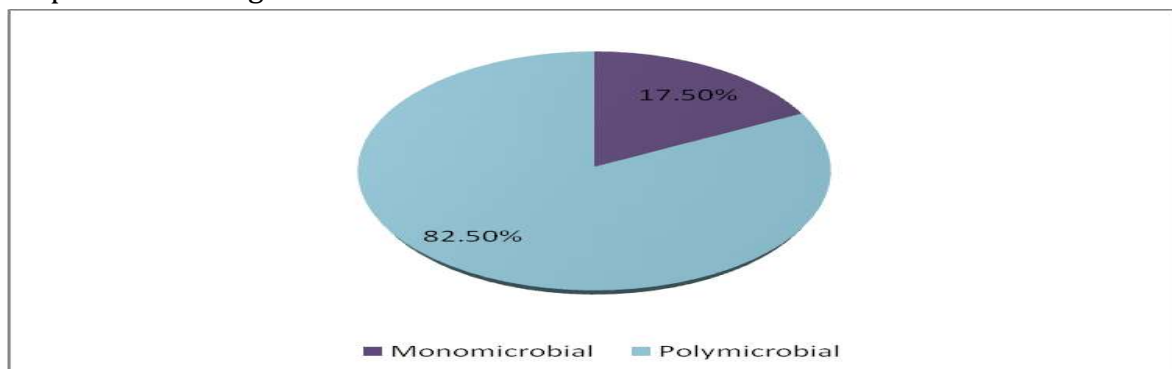


Figure 2: Microbiological pattern of foot infection.

Rate of foot amputation is depicted in figure 3.

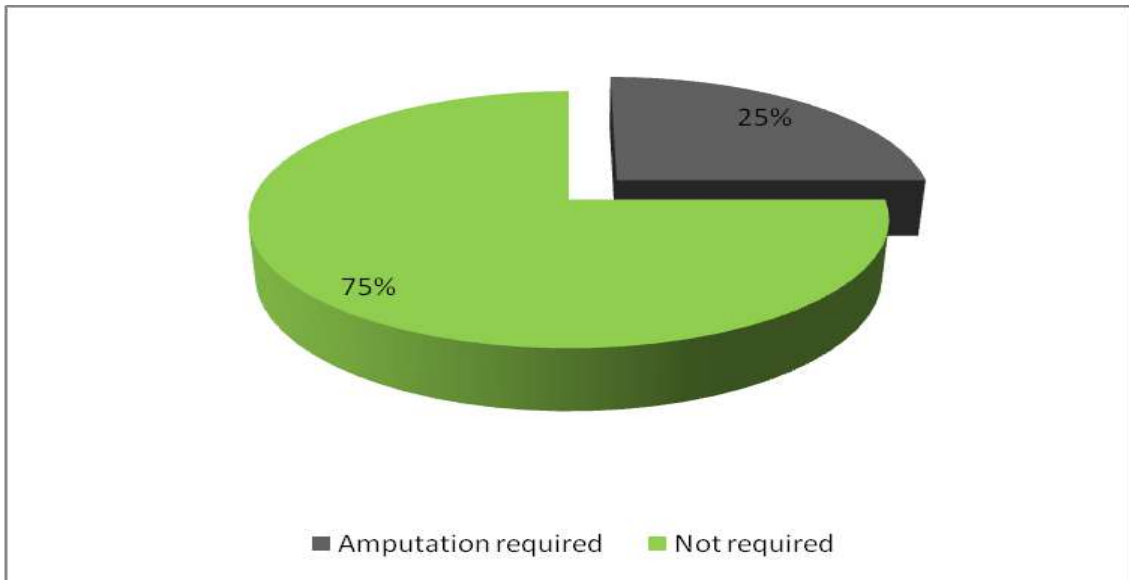


Figure 3: Rate of amputation of foot

Micro-organisms those were isolated in culture of pus/wound swab, are mentioned in figure 4.

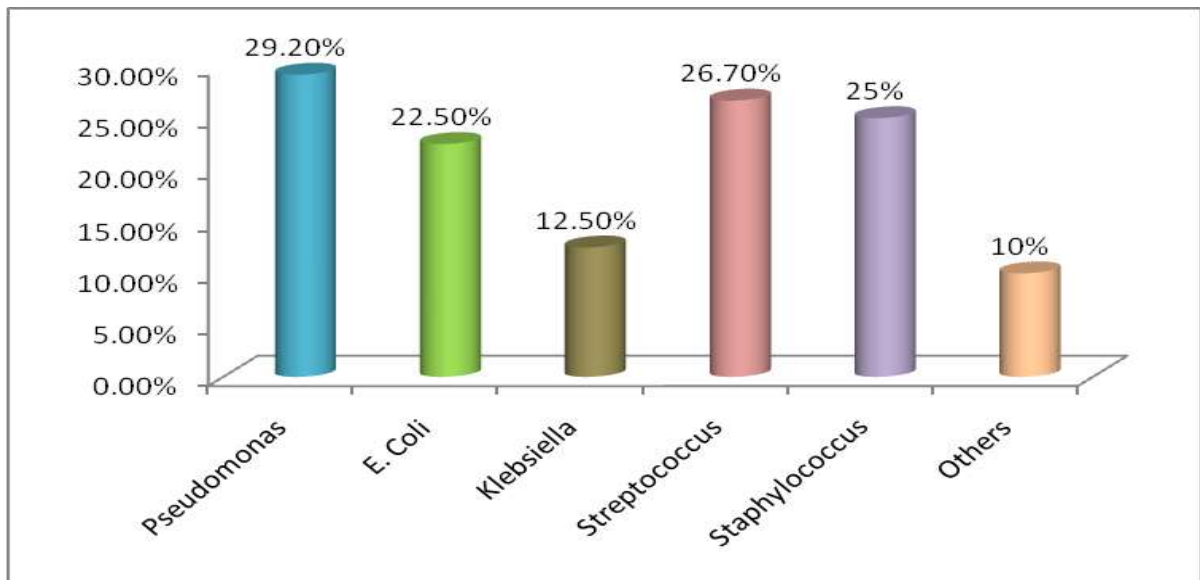


Figure 3: Isolation of micro-organisms in culture.

Sensitivity of antibiotics to the susceptible micro-organisms in bacterial culture is shown in table 2.

<i>Sensitive antibiotics</i>	<i>n</i>	<i>%</i>
Ampicillin	23	19.2
Ciprofloxacin	45	37.5
Amoxicillin clavulanic acid	77	64.2
Cefalexin	35	29.1

Cefotaxime	45	37.5
Ceftriaxone	48	40.0
Ceftazidime	58	48.3
Cefepime	75	62.5
Piperacillin tazobactam	78	65.0
Gentamicin	35	29.2
Meropenem	97	80.8
Amikacin	70	58.3
Imipenem	100	83.3
Colistin	112	93.3

Table 2: Sensitive antibiotics against micro-organisms.

DISCUSSION

Among the total 120 patients, 63.3% (76) were female. Mean±SD of age were 58±1.5 years and 55±1.4 years respectively in male and female patients respectively. The incidence of diabetic foot steadily increases with age, reflected in our study. Majority of the patients were found in > 60 years of age group, the overall incidence of which was 25% and 18.3% in female and male patients respectively. In a prospective study in BIRDEM general hospital, Bangladesh with 81 patients it was found that majority were female (53.1%) patients. Among the male population 23.5% were in 51 to 60 years age group, whereas among female it was 28.4%. Mean±SD of age were 48±1.5 years and 53±1.2 years respectively. In another clinical study, majority male 55.9% and most of them were in 51 to 70 years of age group¹¹. By using the Wagner ulcer grading system^{11,12}, it was found that most of the foot ulcer were in grade III (35.0%) followed by 26.7% were in grade IV. In another study, these were 11%, 20%, 17%, 36% and 16% respectively according to the grade^{11,12}. The overall

rate of foot amputation was 25% (30 patients) of all patients.

In this study, approximately in 82.5% (99 patients), the infection in the local ulcer was polymicrobial. In the study in BIRDEM, 88.9% of all infection was polymicrobial, whereas in the previously cited particular study, it was approximately 81.9%¹². In our study, pseudomonas was the most common micro-organism found in infection of diabetic foot (29.3%, 35 patients), followed by streptococcus (26.7%, 32 patients). In the clinical study in BIRDEM, the frequently observed micro-organisms in was *E. coli* (47.1%) and *Klebsiella* (33.3%). In a clinical study these were enterococcus (27.0%) and staphylococcus (22.0%)¹², where in another research, these were staphylococcus (42.3%) and pseudomonas (24.3%)¹¹.

Regarding the culture sensitivity in this research, Colistin was found as the mostly sensitive antibiotics (93.3% cases), followed by Imipenem (83.3%) and Meropenem (80.8%). In the study in BIRDEM, Colostin was also the mostly sensitive antibiotics (97.5%), followed

by Imipenem (90.1%) and Meropenem (90.1%)¹². Similar results were observed in another research study, where Polymyxin B and colistin sensitivity were found to be 100%¹¹. In a particular prospective study, it was found that all the Gram negative isolates were susceptible to carbapenem beta lactam antibiotic imipenem, which is resistant to inactivation by most bacterial beta lactamases and so it has the widest spectrum of antibacterial activity⁵.

CONCLUSION

The incidence of diabetic foot increases with age, common in female population (possibly due to social negligence). Grade IV ulcer is most common, associated with polymicrobial infection. Pseudomonas and Streptococcus is frequently associated organism which are best sensitive to Colistin, Imipenem and Meropenem. The overall amputation rate is 25%.

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