



Microbiological Profile of Diabetic Foot Ulcer: An Observational Study

Dr. Kumari Madhu¹
Dr. Ajju Kumar²
Prof. (Dr.) Shital Malua³

1. Senior Resident, Dept. of general surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand.
2. Junior Resident, Dept. of general surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand.
3. Professor & Head of the department, Dept. of general surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand.

ABSTRACT: *INTRODUCTION:* Diabetic foot ulcer is a frequent and serious complication of Diabetes mellitus. Infections in diabetic foot ulcer significantly increases mortality and morbidity. So the identification of micro-organisms responsible for infections in diabetic foot ulcer is quiet important. *AIMS AND OBJECTIVES:* to assess the microbiological profile of diabetic foot ulcer. *MATERIALS AND METHODS:* total 100 patients with diabetic foot ulcer were included in this study. Two sterile swabs from each patient were sent for microbiological examination. *RESULTS:* 90% of samples were culture positive. Most common organism isolated was staphylococcus aureus. *CONCLUSION:* infections in diabetic foot ulcer are quiet common. Improper management of diabetic foot ulcer may lead to limb amputation or even death. So the isolation of micro-organism responsible and treatment accordingly is of paramount importance.

KEYWORDS: diabetic foot ulcer, microbiological profile, staphylococcus aureus.

Received 04 Jan, 2022; Revised 13 Jan, 2022; Accepted 15 Jan, 2022 © The author(s) 2022.

Published with open access at www.questjournals.org

I. INTRODUCTION

Diabetes mellitus is one of the oldest known diseases of mankind which affects all social groups all over the world[1,2]. In 2020, according to the International Diabetes Federation (IDF), 463 million people have diabetes in the world and 88 million people in the Southeast Asia region. Of this 88 million people, 77 million belong to India[3]. Diabetic foot ulcer is a frequent and serious complication of diabetes mellitus[4]. The lifetime risk of developing Diabetic foot ulcer in patients of Diabetes Mellitus is as high as 25% and the risk of lower leg amputation increases by 15-46 times in patients with Diabetes Mellitus as compared to patients without it [5]. Due to infections, the morbidity and mortality in Diabetic Foot Ulcer increases and is seen in 40 %-80 % of cases [6]. The two major risk factors that cause diabetic foot ulcer are diabetic neuropathy and ischemia[7-9]. Commonly cultured bacteria from diabetic foot ulcer are Staphylococcus aureus, E. coli, Pseudomonas spp. and Enterococcus spp. [8-10]. The incidence of multidrug resistant organisms have increased many folds now a days causing increased hospital stay, cost, morbidity and mortality[11]. So the identification of the infecting micro-organism is important in such type of cases. The burden of diabetic foot ulcer in India is projected to grow to 57 million by 2025[12].

II. AIMS AND OBJECTIVE

To assess the microbiological profile of diabetic foot ulcer.

III. MATERIALS AND METHODS

Study design: A cross sectional observational study, conducted over a period of 2 year from october 2019 to september 2021 at Rajendra Institute of Medical Sciences, Ranchi, Jharkhand

Sample size: 100 patients fulfilling the inclusion criteria.

Inclusion criteria: All patients aged 18 and above, with a foot ulcer due to Diabetes Mellitus treated at RIMS, Ranchi.

Exclusion criteria:

- Patients with other foot ulcers without diabetes
- Patients with conditions that may interfere with wound healing (e.g. - chronic liver or renal disease, connective tissue disorder, immune system disorder, malnourished).
- Unwillingness to participate in the study.

Method: A total of 100 patients admitted in different surgery wards between October 2019 and September 2021, with clinical picture showing diabetic foot ulcer were selected for the study after initial evaluation and screening taking into consideration the above-mentioned inclusion criteria. After explaining the procedure of the study, written informed consent was taken before enrolment into the study.

Samples were collected deep from the base of the ulcer using 2 sterile swabs. One swab was used for gram staining and the other was used for culture. Direct gram stained smears were examined under the microscope to evaluate relative number of microorganisms and their morphological characteristics. Any fungal elements observed were confirmed by KOH preparation. The samples for culture were inoculated on 5% Sheep blood agar (SBA), Chocolate agar and MacConkey's agar medium and incubated at 37° C for 24 hrs in 7-10% CO₂ concentration and the plates were examined for growth. Sabouraud dextrose agar slopes were used for culture of fungus. The organisms were identified by direct gram staining, colony morphology and biochemical reactions.

IV. RESULTS

A total of 100 patients with diabetic foot ulcer were included in this study.

Males were more commonly affected, as out of the 100 patients with Diabetic Foot Ulcer, 75 patients (75%) were male and 25 patients (25%) were female. Most patients, 55 (55%) belonged to the age group of 40 – 60 years followed by 35 patients (35 %) to age group of more than 60 years and 10 patients (10 %) were less than 40 years old.

In this study all patients (90%) showed culture positivity. Most common organism isolated in the wound swab culture was found to be *Staphylococcus aureus* (45%) followed by *Pseudomonas aeruginosa* (16%) and *Escherichia coli* (10%).

V. DISCUSSION

Foot ulcers are major complications of Diabetes Mellitus and can lead to lower limb amputation [5,8]. A wide range of bacteria can cause infection in these patients. Treatment targeted at the identified causative micro-organism may help us to get better results [10-13]. This study presents a detailed microbiological survey of infected Diabetic Foot Ulcers of the patients admitted to our hospital. Foot ulcers make up 4% of all Diabetes Mellitus related hospitalizations [13]. Neuropathy, impaired glycaemic control, ischaemia and inflammation are the most important risk factors for Diabetic Foot Ulcer in a patient of Diabetes Mellitus.

As seen in several other studies, Diabetic Foot Ulcer had a male predominance in our study. Out of the 100 patients with Diabetic Foot Ulcer, 75% were male while 25% were females.

These findings are similar to the results of Jeffcoate WJ et al, who reported a higher incidence of Diabetic Foot Ulcer in males with 67% in his study report [14] and K.M. Mohanasoundaram's study, which showed a prevalence of 65% in males [15]. This could be due to more outdoor activities performed by males, having more chances of getting trivial injuries leading to chronic non-healing ulcers.

In our study, culture positivity was found to be 90 % which was comparable to the report of Khare et al of 90.32% from a Tertiary care centre in South India [16].

A culture negative in certain studies can be attributed to antibiotic therapy prior to collection of tissue or pus for microbiological processing.

The differences in the study region, age group, study settings might be the reason for differences in the prevalence of pathogens in a Diabetic Foot Ulcers. Diabetic Foot Ulcer bacterial colonization may advance to become an active infection which will delay the healing of the wound. Regular monitoring of the bacterial profile and its antibiotic susceptibility should therefore also be part of the overall Diabetic Foot Ulcer management strategy to direct effective antibiotic therapy while the dressings do their part [17].

In this study, wound swab culture was sent at the time of admission. The most common organism isolated in the first wound swab culture in the present study was found to be *Staphylococcus aureus* (45%) followed by *Pseudomonas* spp. (16%) and *E. coli* (10%). These findings were similar to that of Chincholikar et al [18] and Tahaway's [19] studies.

Limitations of the present study : Small sample size & anaerobic cultures were not done due to limited resources.

VI. CONCLUSION

Proper management of Diabetic foot ulcers is very important as it can prevent limb amputation and even sometimes potentially life-threatening limb complications. Isolation of microbial agent and determination of the sensitivity / resistance of different anti-microbial drugs are vital for the in-hospital management of these patients. Development of multi-drug resistance can be prevented by institution of appropriate antibiotic regimen. Prompt initiation of antibiotic therapy, as well as surgical debridement of necrotic or de-vascularised tissue along with strict glycaemic control is essential for control of infection in Diabetic foot ulcer patients who are often found to be battling with various complications of diabetes mellitus involving multiple organ systems. Present study highlights and suggests that prospective multicentre studies with higher sample size are required to assess the causative micro-organisms in diabetic foot ulcers and proper management of antibiotics must be implemented to decrease the incidence.

Conflict of interest: There is no conflict of interest among authors.

REFERENCES

- [1]. Levin ME. An overview of the Diabetic foot: Pathogenesis, Management and Prevention of Lesions. *Int. J. Diab. Dev. Countries* 1994; 14: 39-41
- [2]. National Diabetes Data Group. Classification and Diagnosis of Diabetes Mellitus and other categories of Glucose Intolerance. *Diabetes* 1979; 28: 1039-57
- [3]. *"Members": idf.org. Retrieved 2020-04-29*
- [4]. Jeffcoate WJ, Harding KG. *Lancet* 2003; 361: 1545-51.
- [5]. Umadevi S, Kumar S, Joseph NM, Easow JM, Kandhakumari G, Srirangaraj S, et al. Microbiological study of diabetic foot infections. *2011;2(1):12-7.*
- [6]. Richard J-L. New insights in diabetic foot infection. *World J Diabetes.* 2011;2(2):24.
- [7]. Anandi C, Alaguraja D, Natarajan V, Ramanathan M S, CS, Thulasiram M et al. Bacteriology of diabetic foot lesions. *Indian J Med Microbiol.* 2004;22:175-8.
- [8]. Ozer B, Kalachi A, Semerci E, Duran N et al. Aerobic, Infections and Infections., bacterial pathogens in diabetic foot. *African J Microbiol Res.* 2010;4(20):2153-60.
- [9]. NS R. Microbiology of the diabetic foot infections in a teaching hospital in Malaysia: a retrospective study of 194 cases. *J Microbiol Immunol Infect.* 2007;40(1):39-44.
- [10]. Viswanathan V, Jasmine JJ, Snehalatha C RA. Prevalence of pathogens in the diabetic foot infections in south Indian type 2 diabetic patients. *J Assoc Physicians India.* 2002;50:1013-6.
- [11]. Shankar EM, Mohan V, Premalatha G, Srinivasan RS UA. Bacterial aetiology of diabetic foot infections in south India. *Eur J Intern Med.* 2005;16:567-70.
- [12]. May K. Preventing foot ulcers. *Aust Prescr.* 2008;31(4):94-6.
- [13]. Clinical Laboratory Standards Institute. Performance standards for the anti-microbial disk susceptibility tests. Approved standard ,9th ed. CLSI document M2-A9. Wayne, PA:CLSI;2006.
- [14]. Jeffcoate WJ, Harding KG. Diabetic foot ulcers. *Lancet.* 2003 May 3;361(9368):1545- 51
- [15]. Mohanasundaram KM. The microbiological profile of diabetic foot infections. *J Clin Diagnostic Res.* 2012;6(3):409-11
- [16]. Khare J, Srivastava P, Khare J, Wadhwa J, Deb P. Microbiological Profile of Diabetic Foot Ulcers- Experience from a Tertiary care centre in South India. *Int J Gen Med Surg* 2017; 1: 109.
- [17]. Liwimbi OM, Komolafe IOO. Epidemiology and bacterial colonization of burn injuries in Blantyre. 2007;4-6.
- [18]. Chincholikar DA, Pal RB. Study of fungal and bacterial infections of the diabetic foot. *Indian J Pathol Microbiol.* 2002;45(1):15-22
- [19]. Ahmad T, El-Tahaway. Bacteriology of diabetic foot infections. *Saudi Medical Journal* 2000; 21(4): 344-47.