

Clinico-microbiological Profile of Diabetic Foot Ulcers at a Tertiary Care Hospital of Odisha

Abhipsa Mohapatra¹, Manoj Kumar Mohapatra²

ABSTRACT

Introduction: Foot Ulcer is the most frequent complication of Diabetes Mellitus related to lower extremities with high morbidity. Infection is an important component of foot ulcer. The present study was undertaken to study the clinical and microbiological profile of diabetic foot ulcer in a tertiary care center.

Material and Methods: It is a prospective observational study which has been conducted at VIMSAR, Burla from November 2017 to November 2019. Consecutive patients of Diabetic foot ulcers were included in this study. After admission detailed history and biochemical investigations were done in all cases. Nerve Conduction study, doppler of lower limb were performed to assess peripheral neuropathy and vascular disease. The ulcers were graded according to Wagner's staging. Swabs were taken for culture and sensitivity.

Results: Out of 1234 patients of DM admitted to the hospital, 116 (9.4%) patients had foot ulcer. There were 87 (75.0%) males and 29 (25.0%) females with M:F ratio of 3:1. 95 (81.9%) patients were from rural and 21 (18.1%) from urban area. Majority (n=44, 38.0%) of patients belonged to 51-60 years of age and only 3 (2.0%) were within 21 to 30 years. Type-1 and -2 DM was found in 4 (3.0%) and 112 (97.0%) patients and the duration of DM was given. Grade-2 ulcer was found in 62 (53.5%) cases. Risk factors like peripheral neuropathy, retinopathy and nephropathy were present in (n=65, 56.1%), 24 (20.7%) and 35 (30.1%) cases respectively. Early signs of ulcerative lesion like abundant callus, crack foot, blistering was present in 28 (24.1%), 54 (46.6%), 10 (8.6%) cases respectively.

Conclusion: This study showed that foot ulcer is a common chronic complication of DM mostly found in elderly patients with poor glycemic control from rural areas. *S.aureus* and *P.aeruginosa* are the common organisms detected from the ulcer.

Keywords: Diabetic Infections, Microbial Resistance

syndrome encompasses several pathologies including diabetic neuropathy, peripheral vascular disease, Charcot neuroarthropathy, foot ulceration, osteomyelitis, and gangrene. Foot ulceration is the most common, affecting approximately 15% of diabetic patients during their lifetime.⁴ The three factors that lead to diabetic foot ulceration are neuropathy, vasculopathy, and infection. Infections may progress to involve deep tissues, joints, and bone that may lead to amputation.

MATERIAL AND METHODS

The present research was conducted at VSS Institute of Medical Sciences and Research (VIMSAR), Burla from November 2016 to October 2019. During the study period all patients of Diabetic Foot Ulcer who were admitted to Dept. of Medicine and Surgery were enrolled in the study. After admission all patients were evaluated regarding their diabetes status. For this blood was collected for fasting blood glucose, urea, creatinine, lipid profile, complete blood count, HbA1C. In a proforma demographic profiles that include age, sex, habits, duration of diabetes, history of trauma, nature of injury, occupation, comorbidities are recorded.

Diabetes was diagnosed on the basis of fasting blood glucose of 126 mg/dl with symptoms of polyuria, polydipsia, polyphagia and weight loss and or a random blood glucose of 200mg/dl or more. Diagnosed cases of diabetes were made on history, intake of oral antidiabetic drugs, and insulin.³

Diabetic foot infection is defined as the presence of ulcer, evidence of inflammation, discharge, with or without osteomyelitis, and gangrene. The gradation of ulcer was determined by Wagner's Classification from Grade-1 to Grade-5.⁵

All patients were subjected to Nerve-Conduction Study and Doppler lower limb to detect peripheral neuropathy and peripheral vascular disease.

For microbiological study, discharges from margins and edge of ulcers collected with help of two sterile swabs, one for

INTRODUCTION

Diabetes Mellitus (DM) is the most common metabolic disease of the globe affecting about 194 million people and the figure is likely to double by the year 2025.¹ It is notable that India has the highest number of patients with DM and the country is rightly considered as the "diabetic capital of the world".² All forms of DM are characterized by hyperglycemia, a relative or absolute deficiency of insulin, and the development of diabetes specific microvascular pathology in the retina, renal capillaries and peripheral nerves. Diabetes is also associated with various macrovascular complications affecting arteries that supply the heart, brain, and lower extremities.³

Among diabetes related complications, the diabetic foot

¹Post Graduate Student, Department of Microbiology, ²Professor Medicine, Department of Medicine, VSS Institute of Medical Sciences and Research, Burla, Sambalpur, Odisha, India

Corresponding author: Manoj Kumar Mohapatra, Professor Medicine, Department of Medicine, VSS Institute of Medical Sciences and Research, Burla, Sambalpur, Odisha, India

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Gram's Stain and other for culture before antiseptic dressing. The culture was on 5% Sheep Agar, Mac-Chonkey's agar. After 24-48 hours of incubation, bacterial growth was identified by colony morphology, Gram's staining and biochemical reactions. Antibacterial susceptibility test was performed by Kirby Bauer's disc diffusion method.⁶

RESULTS

During the study 1234 patients of DM were admitted to Dept of Medicine for various reason of which 116 (9.4%) patients had leg ulcer. Patients with 21 to 80 years of age were enrolled in this study. Majority (n=44, 38.0%) of patients belonged to 51-60 years of age and only 3 (2.0%) were within 21 to 30 years. There were 87 (75.0%) males and 29 (25.0%) females with M:F ratio of 3:1. Majority of patients 95 (81.9%) were from rural areas and only 21 (18.1%) from urban area. Type-1 and -2 DM was found in 4 (3.0%) and 112 (97.0%) patients and the duration of DM was given in Table-1. Farmers and laborers constituted 86 (74.1%) and rest 30 (25.9%) were having employment. The educational status showed that 38 (32.7%), 55 (47.4%), 19 (16.3%), 3 (2.6%), 1 (0.8%) patients were illiterate, primary school, high school, intermediate, and graduation respectively. The causes, risk factors, and grading of leg ulcers are given in Table-2 and 3. Majority (n=65, 56.1%) had peripheral neuropathy and Grade-2 ulcer was found in 62 (53.5%) cases. Retinopathy and nephropathy were present in 24 (20.7%) and 35 (30.1%) cases. Early signs of ulcerative lesion like abundant callus, crack foot, blistering was present in 28 (24.1%), 54 (46.6%), 10 (8.6%) cases respectively. There were 55 (47.4%) barefoot walkers, 45 (38.8%) used ill fitted chappals. Biochemical investigations showed mean FBS, Urea, Creatinine, S. cholesterol, S. triglyceride 193.8±23.5mg/dl, 38.2 ± 2.4mg/dl, 1.8±0.9mg/dl, 210.7±12.8mg/dl, 145.8±18.9mg/dl respectively. Hematological investigations showed Hemoglobin, total leukocyte count, platelet count 10.8±1.8gm/dl, 9875.5±123.8/cml, 2.5±0.2 lakhs/cml respectively. HbA1C was more than 9 in all cases with a mean of 10.6±1.1.

Microbiological culture showed that growth was found in 97 (83.6%) patients whereas 19 (16.4%) cases had no growth. Out of 97 patients 70 (60.3%) monomicrobial and 27 (23.2%) had polymicrobial growth pattern. From the growth pattern, 124 isolates were found of which aerobic bacteria and fungi were found in 118 (95.1%) and 6 (4.8%) isolates. Out of 118 isolates Gram positive and negative bacteria was found in 42 (35.9%) and 76 (64.4%) cases (Table-4). The distribution of mono microbial isolates (n=70) included *S.aureus*, *K.pneumoniae*, *P.aeruginosa*, *E.coli*, *Citrobacter*, *Enterococcus*, and *P.mirabilis* in 20 (28.6%), 14 (20.0%), 10 (14.3%), 9 (12.8%), 5 (7.1%), 3 (4.3%), 3 (4.3%) respectively. *A.baumannii*, *C.albicans*, and non albicans candida species were found in 2 (2.8%) cases each. Out of polymicrobial isolates (n=27), *P.aeruginosa*+*S.aureus*, *E.coli*+*S.aureus* were present in 7 (25.9%) and 3 (11.1%) isolates. *P.aeruginosa*+*C.albicans*, *E.coli*+*A.baumannii*, *K.pneumoniae*+*E.coli*, *K.oxytoca*+*Enterococcus*,

| Duration of DM (In years) | Number (n) | Per centage (%) |
|---------------------------|------------|-----------------|
| <5 | 24 | 42.2 |
| 6-10 | 49 | 30.1 |
| 11-15 | 35 | 20.7 |
| 16-20 | 7 | 6.1 |
| >20 | 1 | 0.8 |
| Total | 116 | 100 |

Table-1: Duration of Diabetes Mellitus and leg Ulcer.

| Causes | Number (n) | Per centage (%) |
|----------------------------------|------------|-----------------|
| Peripheral Neuropathy (PN) | 65 | 56.1 |
| Peripheral Vascular Disease(PVD) | 28 | 12.9 |
| PN+PVD | 8 | 6.9 |
| Thorn Injury | 5 | 4.3 |
| Blunt trauma over stone | 4 | 3.4 |
| Burn | 3 | 2.9 |
| Road Accident | 3 | 2.9 |
| Total | 116 | 100 |

Table-2: Causes of Diabetic Foot Ulcer.

| Grading | Number | Per centage (%) |
|---------|--------|-----------------|
| Grade-1 | 36 | 31.1 |
| Grade-2 | 62 | 53.5 |
| Grade-3 | 10 | 8.6 |
| Grade-4 | 7 | 6.1 |
| Grade-5 | 1 | 0.9 |
| Total | 116 | 100 |

Table-3: Grading of Foot Ulcer

| Microbial Isolates | Number | Per centage |
|----------------------------------|--------|-------------|
| Bacterial Isolates | 118 | 95.2 |
| <i>S. aureus</i> | 35 | 28.2 |
| <i>P.aeruginosa</i> | 23 | 18.6 |
| <i>K.pneumoniae</i> | 17 | 14.7 |
| <i>E.coli</i> | 17 | 14.7 |
| <i>Enterococcus</i> spp. | 7 | 5.7 |
| <i>A.baumannii</i> | 6 | 4.8 |
| <i>P.mirabilis</i> | 5 | 4.3 |
| <i>C.freundii</i> | 3 | 2.6 |
| <i>K.oxytoca</i> | 2 | 1.7 |
| <i>C.koseri</i> | 2 | 1.7 |
| <i>P.vulgaris</i> | 1 | 0.8 |
| Fungal Isolates | 6 | 4.8 |
| <i>C.albicans</i> | 4 | 3.4 |
| Non-albicans <i>Candida</i> spp. | 2 | 1.7 |
| Total | 124 | 100 |

Table-4: Distribution of types of Microbial Isolates (n=124)

P.aeruginosa+*proteus mirabilis*, *S.aureus*+*Enterococcus* species were found in 2 (7.4%) isolates each. *S.aureus*+*A.baumannii*, *S.aureus*+*E.coli*, *S.aureus*+*P.vulgaris*, *P.aeruginosa*+*A.baumannii*, *K.pneumoniae*+*P.aeruginosa* were found 1 (3.7%) patient in each combination. *S.aureus* was found in common in 15 (55.1%) cases of polymicrobial isolates. *S.aureus* was sensitive to ampicillin and sulbactam in 65.8%

cases. Resistant was found to erythromycin (94.2%), and ciprofloxacin (62.8%). 23 (65.7%) isolates of *S.aureus* was found to be Methicillin resistant. MRSA isolates were 100.0% sensitive to Linezolid. Enterococcus species were sensitive to Chloramphenicol (n=5, 81.5%) and resistant to erythromycin (n=6, 85.7%).

Pseudomonas (n=23) was sensitive to imipenem in 19 (82.7%) cases. Enterobacter species (n=47) was mostly sensitive to imipenem (87.3%) and resistant to cefotaxime (85.1%). *A. baumannii* was also mostly sensitive to 66.3% cases. Candida species was sensitive to Amphotericin-B and 50.0% cases showed sensitive to Flucanazole. Among Gram negative organisms (n=76), 35 (45.1%) are ESBL producers of them. majority were from *P.aeruginosa* (n=12, 52.2%).

All the patients were treated with soluble insulin, appropriate antibiotics as per the culture and sensitivity report, wound debridement and dressing. Amputation was done in 7 (6.1%) cases with gangrene.

DISCUSSION

The present study showed that Diabetic foot ulcer is a chronic complication found among 9.4% cases of DM. It is often associated with other chronic complications of DM like peripheral neuropathy, retinopathy, and nephropathy. Majority of patients were from rural areas and belonged to farmers and laborers and mostly were bare footers. Males outnumbered females with M:F ratio of 3:1 and are more common within 51 to 60 years of age group.^{7,8}

Duration of DM has played an important role for development of foot ulcer and the duration was 6 to 15 years among half of the patients.⁹ Apart from duration of DM poor control of DM as evidenced from raised FBS and HbA1C (>8) was found in majority of cases.¹⁰ Grade-2 ulcer was found in 62 (53.5%) cases and gangrene was found in 7 (6.1%) cases.¹¹

Microbiological culture showed that growth was found in 97 (83.6%) patients of which monomicrobial and polymicrobial growth was present in 70 (60.3%) and 27 (23.2%) cases. The present study yielded the growth with an average of 1.27 organisms per case which is similar to other studies.¹² A possible cause for the low incidence of polymicrobial infection in the present study could be clinically mild and superficial subcutaneous infections.

S.aureus was the common pathogen found not only in monomicrobial growth but also as a component of polymicrobial growth. Overall, Gram negative organisms outnumbered Gram positive organisms in polymicrobial growth. This result is in accordance with the results from India as well as from European countries.¹³ MRSA isolates are sensitive to linezolid. Klebsiellas were the common Gram-negative organisms found in diabetic foot ulcer those are sensitive to aminoglycosides. *Pseudomonas*, *Proteus* are mostly sensitive to imipenem.

CONCLUSION

The optimal management of diabetic foot ulcer requires a multidisciplinary approach that includes control of blood sugar with Insulin, appropriate antibiotics according to

the culture sensitivity, dressing and surgical intervention including amputation.

REFERENCES

1. King H, Aubert RE, Harman WH. Global burden of diabetes, 1995-2025. Prevalence, numerical estimates and projections. *Diabetes Care*,1998;21:1414-35.
2. Iyer SR. Type-2 diabetes Express highway. Where is the U turn? *J Assoc Phys Ind*, 2003;51:495-500.
3. Powers AC, Niswender KD, Evans-Molina C. Diabetes mellitus: diagnosis, classification, and pathophysiology. In Harrison's Principles of Internal Medicine, 20th Ed. Eds: Jameson JL, Fauci AS, Kasper DL, Hauser SL, Longo DL, Loscalzo J. McGraw- Hill, New-York, 2019;2:2851-2859.
4. Powers AC, Stafford JM, Rickels MR. Diabetes mellitus: Complications. In Harrison's Principles of Internal Medicine, 20th Ed. Eds: Jameson JL, Fauci AS, Kasper DL, Hauser SL, Longo DL, Loscalzo J. McGraw- Hill, New-York, 2019;2:2875-2883.
5. Wagner FW. The dysvascular foot: a system of diagnosis and treatment. *Foot Ankle*,1981;2:64-122.
6. CLSI. Performance Standards for antimicrobial disk susceptibility tests. 27th Ed. CLSI standard M100. Wayne PA: clinical and laboratory standards institute, 2017.
7. Raja NS. Microbiology of diabetic foot infections in a teaching hospital in Malaysia: a retrospective study of 194 cases. *J Microbiol Immunol Infect*, 2007; 40:39-44.
8. Bansal E, Garg A, Bhatia G, Attri AK, Chander J. Spectrum of microbial flora in diabetic foot ulcers. *Ind J of Path and Micro*, 2008;51:204-208.
9. Banoo S, Shubha DS, Shashidhar V, Venkatesha D. Bacterial and clinical profile of diabetic foot patients. *Annals of Trop Med and Public Health*, 2012;5:69-73.
10. Madanchi N, Tabatabael O, Pajouh M, Heshmat R, Larijani B, Reza M, et al. Who are diabetic foot patients? A descriptive study of 873 patients. *J Dia Met Dis*, 2013;12:36.
11. Janifer J, Sekkizhar G, Kumptala S, Viswanathan V. Bioburden Vs antibiogram of diabetic foot infection. *Clin Res Foot Ankle*, 2013;1:1-4.
12. Viswanathan V, Madhavan S, Rajasekar S, Chamukuttan S, Ambady R. Urban-rural differences in the prevalence of foot complications in south Indian diabetic patients. *Diabetes Care*, 2006;29:701-703.
13. Mendes JJ, Costa MA, Vilela C, Neves J, Candias P, Cavaco-Silva P, Melo-Cristino J. Clinical and bacteriological survey of diabetic foot infections in Lisbon. *Diab Res Clin Practice*, 2012;1:153-161.

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