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Research Article

Clinical presentation and bacteriological profile of diabetic foot in Eastern Bihar, India

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ABSTRACT

Background: Diabetes is a worldwide problem. A majority of diabetic patients develop foot ulcers in one point of time or other during the course of their illness. Chronic wound, especially non-healing types are the most common surgical conditions. The etiopathogenesis of diabetic foot lesions are multi-factorial like diabetic neuropathies, vasculopathy, poor control of diabetes and bacterial infection. The aim of the present study was to study various modes of presentation and microbiological profile in management of diabetic foot.
Methods: 100 diagnosed cases of diabetic foot were studied over a period of three years in the department of General Surgery at Katihar Medical College with emphasis on clinical features and microbiological picture of diabetic foot and its complications.
Results: Males are more prone to surgical complications three times than females because of more outdoor activities. It is more prevalent in age group 51-60 years (36%). In the present study, cases presenting with ulcer were maximum (52%) followed by cellulitis (20%), cases presenting with gangrene of toe or foot was minimum (12%). Staphylococcus Aureus was found in majority of cases of septic lesions on culture of pus (41%). Other organisms isolated were Pseudomonas, Klebsiella, E.Coli, Proteus etc.
Conclusions: Diabetic foot has varied presentation. The prevalence of diabetes mellitus and its surgical complications can be attributed to poor patient knowledge, education and awareness of the disease. Patient education for care of feet such as pairing of nails, wearing proper footwear and prompt reporting to doctor in case of early lesions is essential.

Keywords: Abscess, Diabetic Foot, Gangrene, Staphylococcus aureus, Ulcer

INTRODUCTION

Diabetic foot is defined as infection, ulceration or destruction of deep tissues associated with neurological abnormalities and various degrees of peripheral vascular diseases of lower limb(based on WHO).[1] In the modern world today diabetic is the problem as metabolic, vascular and neuropathic components are interrelated. Metabolic syndrome is due to alteration of carbohydrate, fat and protein metabolism secondary to absent or markedly diminished secretion or ineffective action of Insulin. Vascular system consists of abnormalities in both large vessels (macroangiopathy) and small vessels (microangiopathy), lastly a variety of abnormalities occur in peripheral nervous system. These neuropathic changes are due to metabolic alteration as well as vascular cause. Defective production and action of insulin is the underlying cause. It is a long term disease with variable manifestations and progression. India has a diabetic population of about 50.8 million which is expected to increase to 87 million by 2030.[2] Foot infections account for 20% of hospitalization of diabetic patients yearly.[3]

Infection worsens the wound condition, delays the healing mechanism and, if appropriate measures are not taken in time, could lead to systemic infection, septicemia, amputation or even death. It is always necessary to evaluate different microorganisms infecting the wound on a routine basis in addition to administering regular glycemic control, wound care, surgical debridement, pressure-offloading, and maintaining adequate blood supply.[4] Initial management of infected diabetic foot comprises of empirical antibiotic treatment but knowledge of the microbes causing infection and leading to complications in diabetic foot is helpful in selecting definitive antibiotic therapy. Mostly the diabetic foot infections are mixed bacterial infections and the proper management of these infections requires appropriate antibiotic selection based on culture and antimicrobial susceptibility testing.[5]

Table 1: University of Texas classification of diabetic foot.

Stage	Stage			
	0	I	II	III
A (no infection or ischemia)	Pre or post- ulcerative lesion completely epithelialized	Superficial wound not involving tendon, capsule or bone	Wound penetrating to tendon or capsule	Wound penetrating to bone or joint
B	Infection	Infection	Infection	Infection
C	Ischemia	Ischemia	Ischemia	Ischemia
D	Infection and ischemia	Infection and ischemia	Infection and ischemia	Infection and ischemia

The Wagner-Meggitt classification which was developed in the 1970s, has been the most widely accepted and universally used grading system for lesions of the diabetic foot.[6] The original system has six grades of lesions. The first four grades (grade 0, 1, 2, and 3) are based on the physical depth of the lesion in and through the soft tissues of the foot. The last two grades (grade 4 and 5) are completely distinct because they are based on the extent of gangrene and lost perfusion in the foot. Grade 4 refers to partial foot gangrene and Grade 5 refers to a completely gangrenous foot. The University of Texas classification represents an advance in the treatment of the diabetic foot.[7] This system (Table- 1) uses four grades, each of which is modified by the presence of infection (Stage B), ischemia (Stage C), or both (Stage D). This system has been validated and is generally predictive of outcome, since increasing grade and stage of wounds are less likely to heal without revascularization or amputation. It is now widely used in many clinical trials and diabetic foot centers.

Wagner-Meggitt classification of diabetic foot

Grade 0 - Foot symptoms like pain, only
Grade 1 - Superficial ulcers
Grade 2 - Deep ulcers
Grade 3 - Ulcer with bone involvement
Grade 4 - Forefoot gangrene
Grade 5 - Full foot gangrene

Approximately half of all foot wounds become infected over course of therapy.[8] Diabetic foot ulceration and its sequelae (infection, gangrene and amputation) are associated with a reduced quality of life, high morbidity and premature mortality.[9] Compared with diabetic patients who do not have foot ulcers, those with diabetic foot ulcers have 2.4-fold increased risk of death.[10]

METHODS

This study involving surgical management of cases of diabetic foot consisted of 100 cases of diabetic foot attending in the Department of General Surgery, Katihar Medical College, in Kosi region of Bihar over a period of three years. Prior approval from the Institutional Ethics Committee was duly obtained.

Inclusion criteria

All patients with Diabetes mellitus presenting with foot ulcer, infection of foot and gangrene of foot.

Exclusion criteria

1. Patient above 80 years of age.
2. Patients with foot infection without diabetes.
3. Patients with ulcer and gangrene of foot other than diabetic etiology.

Methods of collection of data

1. Detailed history taking
2. Clinical Examination
3. Routine Laboratory investigations
4. Relevant special investigation
5. Conservative management with meticulous dressing and

6. If needed, Major Surgical interventions with its outcome

RESULTS

Age distribution

Out of 100 cases studied, the youngest patient was 30 years of age and oldest was 71 years The highest number of cases was found in the age group 51-60 years (36%), followed by 41-50 years (28%) (Table 2).

Table 2: Age distribution among 100 presenting cases of Diabetic Foot. Minimum and Maximum number of patients were observed in the age group 21 – 30 and 51 – 60 years respectively.

Age (in years)	No. of Patients	Percentage
0-10	-	-
11-20	-	-
21-30	2	2%
31-40	10	10%
41-50	28	28%
51-60	36	36%
61-70	20	20%
71-80	4	4%

Sex distribution

Out of the hundred cases studied under this series, the majority of the patients were male 74 (74%) and the contribution of female patients were 26 (26%) (Table 3).

Table 3: Sex distribution among 100 presenting cases of diabetic foot. Ratio of males was higher than females.

Sex	No. of patients	Percentage
Male	74	74%
Female	26	26%

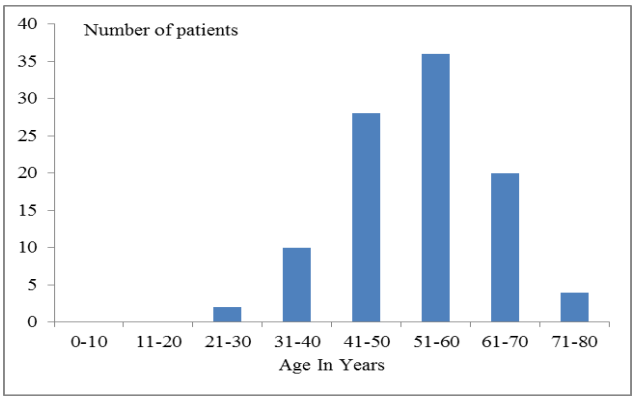

Figure 1: Age distribution among 100 presenting cases of diabetic foot. Minimum and maximum numbers of patients were observed in the age group 21 – 30 and 51 – 60 years respectively.

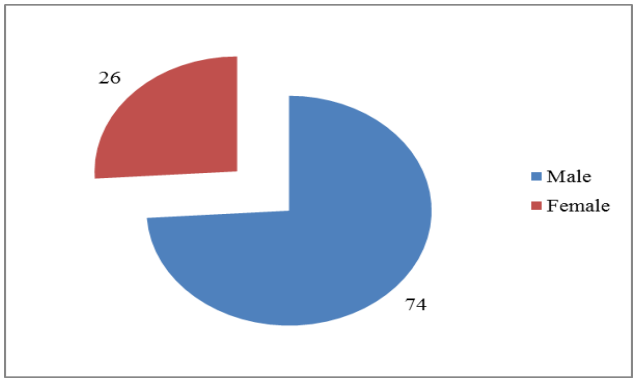

Figure 2: Sex distribution among 100 presenting cases of diabetic foot. Ratio of males was higher than females.

Male incidence is higher and the possible reasons may be that males are exposed more to trauma working in the fields and farms. Smoking habits are higher in males and may cause peripheral arterial disease that may coexist with diabetes mellitus which may flare up lesions.

Mode of presentation

In the present case study, 52 cases presented with ulcer, 12 cases with gangrene of toe or feet, 20 case with cellulitis and 16 cases with abscess (Table 4).

Table 4: Mode of presentation.

Mode of presentation	No. of Patients	Percentage
Ulcer	52	52%
Gangrene	12	12%
Abscess	16	16%
Cellulitis	20	20%

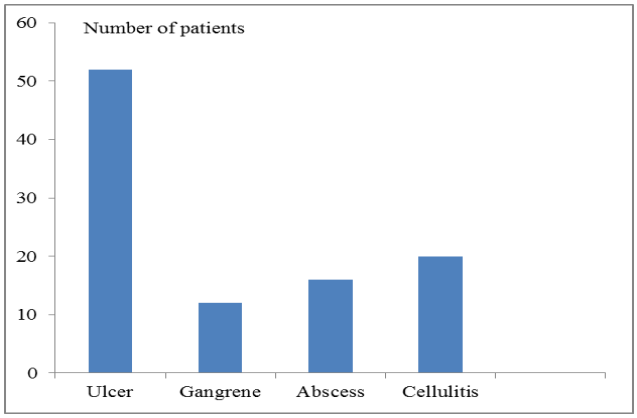

Figure 3: Mode of presentation.

Culture and sensitivity

Out of 100 patients, 83 samples reported organisms in culture and sensitivity reports. Staphylococcus Aureus (41%) was found in majority of cases of septic lesions on culture of pus. Other organisms isolated were- Pseudomonas (10.8%), Klebsiella (22.9%), E.Coli (14.5%), Proteus (7.2%) and Streptococci (3.6%) (Table 5).

Table 5: Culture of sensitivity.

Cultured Bacteria	No. of cases	Percentage
Staphylococcus Aureus	34	41%
Pseudomonas	9	10.8%
Klebsiella	19	22.9%
E. Coli	12	14.5%
Proteus	6	7.2%
Streptococci	3	3.6%

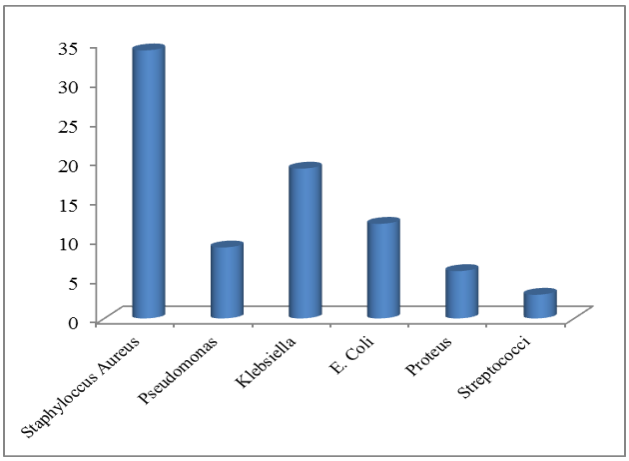

Figure 4: Culture of sensitivity.

History of trauma

A history of some kind of trauma (injury) before the onset of lesion was reported by majority of cases (68 patients in this series). Preceding trauma is most often cause for problem due to:

1. A patient is unaware of trivial injury due to neuropathy, results in loss of sensation and patient will unaware of injury and neglects it.
2. Poor blood supply leads to diminished healing due to ischemia of the part which is traumatized will be under perfused.
3. A state of hyperglycemia acts as a good source for infection

DISCUSSION

Hundred cases were undertaken for the present work "Clinical study, Surgical Management of Diabetic Foot and its Complications" The analysis of the above study is being mentioned below as follows:-

Table 6: Comparison of age of patients in this study with other researchers.

Study	Youngest patient	Oldest patient
Wheel, Rock & Root Study (1969)	32	89
M Madan et al(2012)	30	75
Present study	30	71

Figure 5: Non Healing ulcer in sole of foot with Gangrene second toe.

Figure 6: Forefoot gangrene.

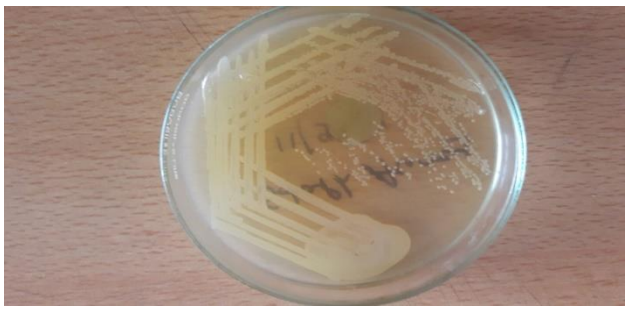

Figure 7: Culture plate showing growth of staphylococcus aureus on nutrient agar.

Age

It is found that there is no much difference in youngest and oldest age group when it was compared with Wheel, Lock and Root Series.[11] When compared with the recent study of M Madan et al, age difference was almost similar with the present study conducted on hundred patients (Table 6).[12]

Sex

It is found in the present study that the male to female ratio is 2.8:1 (74 males as compared to 26 females. Male incidence is higher and the possible reasons may be males are exposed more to trauma during heavy manual work. Smoking habits are higher in males, may cause peripheral arterial disease that may coexist with diabetes which flare up the lesions. This was almost similar to study conducted by M Madan et al where 70% of males were affected as compared to 30% of females.[12] Even study conducted by Vinod kumar et al showed males were affected more than females (M:F=1.6:1) and also male to female ratio was similar to our study in a tertiary hospital in Nigeria which was 2.3:1.[13,14]

Mode of presentation

Ulcer (52%) was the most common mode of presentation observed in the present study of cases among diabetic foot. This was followed by cases of cellulitis (20%) and cases of abscess (16%). Patients with gangrene were the least common mode of presentation (12%). Even in studies conducted by M Madan et al and Mummidi et al ulcer was the most common presentation in cases among diabetic foot with 66% and 44% cases respectively.[12,15] The data of the present study was quite similar with study conducted by Tanveer et al where ulcer was the chief presentation (41.6%) followed by cases presenting with gangrene (22%), cellulitis (19.4%) and abscess (13.8%) respectively.[16] Also in a recent study by Shah J V et al in 2015, ulcer (30%) was the most common presentation in diabetic foot patients with abscess was found in least number of patients (9.5%) (Table 7).[17]

History of trauma

A proceeding history of some kind of trauma. i.e. injury to foot and leg before the development of symptoms was reported in 68% of cases in the present study. This data is also similar to data obtained by Ngim et al and Tanveer et al where trauma was the initiating factor in 53% and 80% of cases of diabetic foot respectively.[14,16]

Table 7: Comparison of various modes of presentations in this study with other researchers.

Mode of presentation	Present study (%)	M et al (%)	Munnidi et al (%)	Tanveer et al (%)	Shah JV et al (%)
Ulcer	52	66	44	41.6	30.0
Gangrene	12	16		22.0	
Abscess	16	10		13.8	
Cellulitis	20	8		19.4	

Table 8: Comparison of organisms isolated in this study with other researchers.

Organism isolated	Present Study (%)	Amir A.H. et al (%)	Madan M. et al (%)	Munnidi et al (%)	Tanveer et al (%)	Shah J.V. et al (%)
Staphylococcus aureus	41.0	46.0	32.0	30.0	41.6	42.5
Pseudomonas species	10.8	5.0	20.0	18.0	38.8	15.0
Klebsiella species	22.9	0	12.0	18.0	38.8	15.0
E. Coli	14.5	10.0	17.0	10.0	8.3	12.5
Proteus species	7.2	5.0	9.0	6.0	2.7	7.5
Non haemolytic Streptococcus species	3.6	0	2.0	4.0	0	5.0
MRSA	0	9.0	0	0	0	0
Others	0	0	0	0	4.2	0

Organism causing the septic lesions

In the present study, Staphylococcus Aureus (41%) was the commonest organism found in majority of cases of septic lesions on culture of pus. Other organisms isolated were Pseudomonas (9%), Klebsiella (22.9%), E.Coli (14.5%), Proteus (7.2%) and Streptococci (3.6%). Even in a study conducted by Amir AH et al, Staphylococcus aureus was commonest pathogen on pus culture which was found in 46% of patients, followed by E.Coli 10%, MRSA 9%, Pseudomonas 5% and Proteus 5%. [18]

In a study by Madan M et al, Staphylococcus aureus was the commonest organism (32%), followed by Pseudomonas and E. coli with 20% and 17% respectively and Streptococci being the least with 2%.[12] Even Staphylococcus aureus was the commonest pathogen found in study conducted by other researchers like Mummidi et al, Tanveer et al and Shah JV et al with the percentage being 30%, 41.66% and 42.5% respectively in those studies (Table 8).[15-17]

A study by Vinod kumar et al showed Pseudomonas as an emerging pathogen in diabetic foot infections which were detected in 54 out of 310 patients on pus culture specimens (17%).[13] This present study also showed pseudomonas in 10% of pus culture specimens. Also in a study conducted by Tiwari S et al, it was found that E.Coli was the most common organism followed by Staphylococcus aureus and other pathogens.[19]

CONCLUSION

Patients with diabetes are at increased risk of developing foot ulcerations. The consequences of persistent and poorly controlled hyperglycemia leads to neuropathic and vascular abnormalities and this further complicates diabetic foot in form of abscess, cellulitis, gangrene etc. Further, the presence of infections should be determined by clinical findings and appropriate wound cultures and thus treatment should be based on culture reports. Sometimes culture reports are negative and in such cases molecular techniques may help in identifying microorganisms and thus helps in treatment. Patient education, proper care of feet and a multidisciplinary approach is essential for diabetic patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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