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A Study of Diabetic Foot Ulcer Manifestations and Management

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Abstract:*Diabetic foot ulcers are a serious complication of diabetes mellitus which increases the patient morbidity and also have significant socioeconomic impact.This is one of the common presentations of diabetic foot. The diabetic foot may be defined as a group of syndromes in which neuropathy, ischemia and infection lead to tissue breakdown, resulting in morbidity and possible amputation (World Health Organization, 1995). The objective of the present study was to evaluate the various presentations of diabetic foot ulcer like, resistant deep infections, ulcer with cellulitis, severe ischemia leading on to gangrene and to study percentage of surgical intervention like debridement, minor/major amputation. 60 patients of diabetic foot ulcer admitted in the department of general surgery at Rajendra Institute of Medical Sciences (RIMS), Ranchi during the period of May 2016 to May 2017. The highest number of patients was seen in the age group of 56-65 years. The male to female ratio was approximately 1.5:1. Surgical complications are more common in men commonest presenting lesion was ulcers. Commonest site of lesion was toes. Trivial trauma is the initiating factor in about 71.66% of the cases. Most of the patients had history of diabetes mellitus between 6 to 10 years. Most common microorganisms grown from culture taken from the lesion was Staphylococcus aureus Management includes conservative, disarticulation, amputation and skin grafting. There was no mortality in present study. Conclusions ismanagement of the surgical patient with diabetes should be based on knowledge of the path physiology of diabetes and on an assessment of its chronic complications.*

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I. Introduction

Diabetes is a serious chronic disease that requires special attention and is also described as "Global Epidemic". About 415 million people have diabetes globally which accounts to 1 in 11 people. India has world's second largest diabetic population with approximately 69 million people with diabetes. Diabetic foot ulcer is one of the common presentations of diabetic foot. The diabetic foot may be defined as a group of syndromes in which neuropathy, ischemia and infection lead to tissue breakdown, resulting in morbidity and possible amputation (World Health Organization, 1995) 5 Foot problems remain very common in people with diabetes throughout the world, affecting up to 15% of diabetic patients during their lifetime.[1,2] Diabetic foot ulcers increases morbidity, high expenditure for therapeutic management and precede amputations in about 85% of patients. Frequency of lower limb amputations can be lowered by 49-87% by preventing the development of diabetic foot ulcers.[3,4]The number of people with diabetes worldwide was estimated at 131 million in 2000; it is projected to increase to 366 million by 2030.[5]Previous studies have indicated that diabetic patients have up to a 25% lifetime risk of developing a foot ulcer.[6]The annual incidence of diabetic foot ulcers is ~3%,and the reported incidence in U.S. and U.K. studies ranges as high as 10%.[7] According to epidemiological studies, the number of patients with DM increased from about 30 million cases in 1985, 177 million in 2000, 285 million in 2010, and estimated if the situation continues, more than 360 million people by 2030 will haveDM.[8-10] According to Wilman et al, diabetic foot ulceration is a worldwide health problem approximately 15% of the 10 million diabetic patients in USA will develop foot ulcer at some time in their life time.[11]The foot ulcer in this population is extremely debilitating and dramatically increases the risk of lower extremity amputation. According to the Diabetes Atlas 2013 published by the International Diabetes Federation, the number of people with diabetes in India currently is 65.1 million, which is expected to rise to 142.7 million by 2035.[12]The clinical study of diabetic foot ulcer is undertaken to assess the various presentations of diabetic foot ulcer like, resistant deep infections, ulcer with cellulitis, severe ischemia leading on to gangrene and to study percentage of surgical intervention like debridement, minor/major amputation.

II. Material AndMethods

This study was conducted comprising of, 60 patients of diabetic foot ulcer admitted in the department of general surgery at Rajendra Institute of Medical Sciences (RIMS), Ranchi during the period of May 2016 to May 2017.This was a hospital based prospective observational study.

Study Design: Prospective observational study

Study Location: This was tertiary care teaching Hospital based study done in Department of General Surgery, at Rajendra Institute of Medical Sciences (RIMS), Ranchi.

Study Duration: May 2016 to May 2017.

Sample Size: 60 patients.

Inclusion criteria

1. All patients with diabetes mellitus suffering from foot ulcers and infections of all age groups.
2. Incidental diagnosis of diabetes on admission with diabetic foot ulcer.
3. Patients with gangrenous foot, complicated by diabetes.

Exclusion criteria

1. Exclusion criteria were patients with foot infections without diabetes mellitus.
2. Patients with gangrene foot of aetiology other than infection of foot complicated by diabetes.
3. Patients whose treatment could not be completed.

Method of collection of data

Detailed history taking, thorough physical examination, routine investigations, relevant special investigations, choosing the appropriate line of treatment.

III. Result

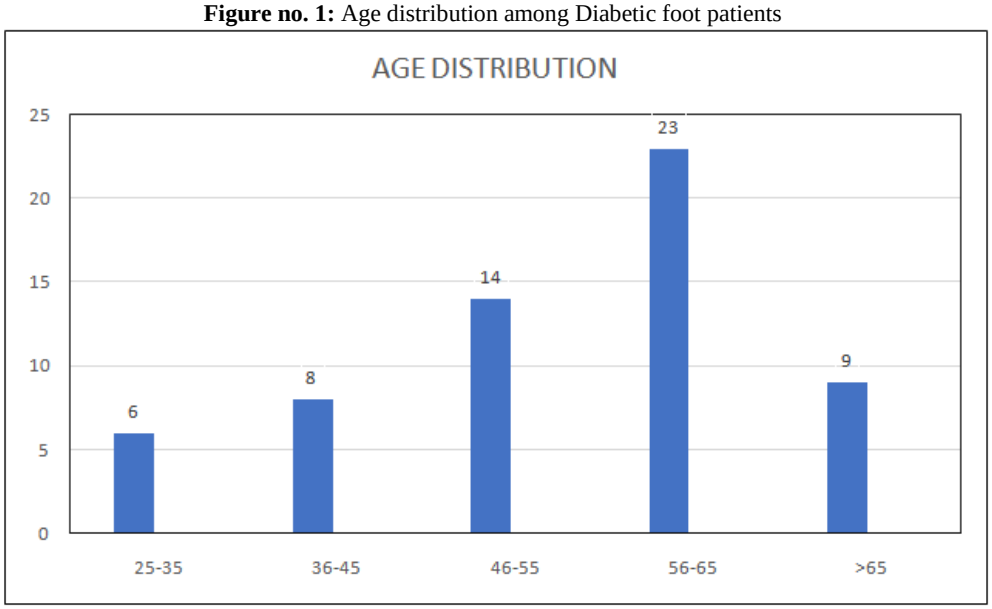
This study was conducted comprising of, 60 patients of diabetic foot ulcer admitted in the department of general surgery at Rajendra Institute of Medical Sciences (RIMS), Ranchi during the period of May 2016 to May 2017.This was a hospital based prospective observational study.

Distribution of patients according toage: Of 60 cases studied, most of the diabetic patients were in the age group of 56-65 (38.33%) followed by 46-55 (23.33%). Out of 60 patients 76.67% of the patients were above the age of 45 years. The youngest patient was of 31 years and the oldest was of 91 years.

Tableno. 1: Age wise distribution

Age (years)	No. (Percentage)
25-35	6(10.00%)
36-45	8(13.33%)
46-55	14(23.33%)
56-65	23(38.33%)
>65	9(15.00%)

Figure no. 1: Age distribution among Diabetic foot patients

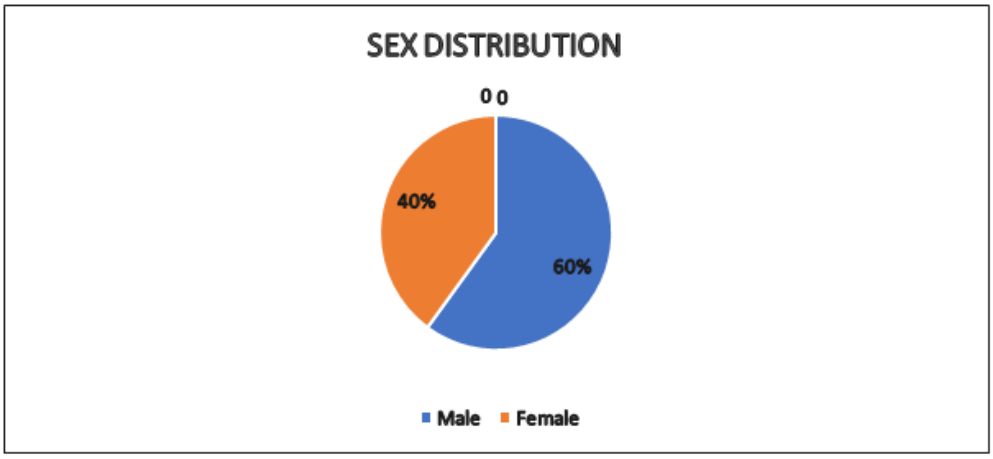


Sex distribution: In present study out of 60 patient 36 were male and 24 were females. It shows male predominance. 36 (60%) were male patient and 24 (40%) cases were female. Ratio of male: female was 1.5.

Table no. 2: Sex distribution

Sex	No. of patients	Percentage
Male	36	60.00%
Female	24	40.00%

Figure no. 2: Sex distribution among Diabetic foot ulcer patients



Clinical presentation: Out of 60 cases 42 (70%) patients presented with ulcer, 2 cases presented with abscess and 4cases presented with osteomyelitis and 12(20%) cases presented with gangrene. Ulcer was the most common presentation.

Table no. 3: Mode of clinical presentation

Presentation	No. of patients	Percentage
Ulcer	42	70%
Abscess/osteomyelitis	6	10%
Gangrene	12	20%

Table no. 4: Site of lesion

Site of lesion	No. (Percentage)
Toes	24(40.00%)
Dorsum of foot	18(30%)
Multiple ulcer	0(0%)
Lateral aspect of foot	4(6.67%)
Dorsum and toes	3(5%)
Whole foot	1(1.67%)
Plantar	10(16.66%)

Site of lesion: The most common site of lesion was toes found in 24 patients (40.00%) followed by dorsum of foot involved in 18 patients (30%). The least was whole foot involvement found in 1 patient (1.67%).
History of trauma: In present study history of trauma (thorn prick, shoe bite, nail prick, wood piece prick etc. as a precipitating factor was present in 43 patients making a total of 71.66%.

Table no. 5: History of trauma

History of trauma	No. of patients	Percentage
Positive	43	71.66%
Negative	17	28.33%

Pathology: Out of 60 patients 44 (73.33%) patients had neuropathy, 11(18.33%) had vasculopathy and in 2 (3.33%) both neuropathy and vasculopathy was there. In 3 patients (5%) pathology couldn't be identified.

Table no. 6: Pathology

Pathology	No. (Percentage)
Neuropathy	44(73.33%)
Vasculopathy	11(18.33%)
Both	2(3.33%)
No neuropathy and vasculopathy	3(5%)

Duration of diabetes mellitus: In present out of 60 patients, 4 were diagnosed on date of admission and 56 patients were known diabetic. There were 28 (46.67%) patients with duration of diabetes between 6 to 10 years. In this a patient aged 91 years has history of diabetes for last 27 years.

Incidence of different causative organisms: The most common organism grown on culture of pus was Staphylococcus aureus in 18 (30%) patients followed by enterococcus in 12 patients (20%)Streptococci in10(16.66%), Proteus in 6 patients, E coli in 4 patients, Klebsiella in 4 patients and Pseudomonas in 3 patients.In 3(5%) patients the growth was polymicrobial.

Table no. 7: Incidence of different causative organism

Organism	No. (Percentage)
S. aureus	18(30%)
Enterococcus	12(20%)
Streptococci	10(16.66%)
Proteus	6(10%)
E. coli	4(6.66%)
Klebsiella	4(6.66%)
Pseudomonas	3(5%)
Polymicrobial	3(5%))

Treatment given to patient: In the present series conservative treatment was given to 42 patients (debridement) was done, major amputation was done in 8 patients, disarticulation wasdone in 8 patients and drainage of pus was done in 2 patients. Split skin grafting was done in 10patients as a final treatment.

Lesion outcome (prognosis): Out of 60 patients 34 (56.66%) patient's lesion healed by primary healing (re-epithelialisation) by means of regular dressing, 10(16.66%) patients needed skin grafting as final treatment and 16(26.66%) patients needed amputation/ disarticulation.

Table no. 8: Lesion outcome (prognosis)

Lesion outcome	No. (Percentage)
Primary healing	34(56.66%)
Amputation/ disarticulation	16(26.66%)
Skin grafting	10(16.66%)
Death	0(0%)

Duration of hospital stay: The average duration of hospital stay was 41 days with minimum days of stay of 8 days and the maximum days of stay being 166 days. Maximum number of patientswere in the range of 21-40 days.

IV. Discussion

Sixty cases were studied from May 2016 to May 2017 at Rajendra Institute of Medical Sciences (RIMS), Ranchi. The analysis of the study is as follows. The youngest patient was of 31 years and the oldest was of91 years similar to studies by Wheel Lock et al, there is not much differences in youngest and oldest group.[13] In the study of Mummidi et al, the youngest was 31 years and the oldest was 80 years, they studied 100 patients from Jan 2013 to June 2014.[14]

Age Distribution

The major age group presented with diabetic foot ulcer was 56-65 years which is also the common age group in Mayfield et al study.[15] This study indicates that diabetic foot ulcer usually occurs in the elderly, as 86.99% of the patient presenting with diabetic foot ulcer were above 45 years of age.

Sex Distribution

Like Mayfield et al study, the present study had more number of male patients (36) suffering from diabetic foot lesions than females (24).[15] The present study had ratio of male:female as 1.5 where as in Mayfield study male:female ratio was almost equal.[15] In Mummidi et al study the male predominance was there in there study 78% patients were male.[14] Male predominance has no clear explanation but may be due their occupational and recreational activities there is more stress on the feet.

Clinical presentation

Like Apelquist et al, the most common presentation was ulcer which included 42 patients out of 60 patients.[16]The ulcer included both the superficial and deep. The commonest presentation is ulcer followed by gangrene and abscess/osteomyelitis which is comparable with the study of Apelquist et al.[16]Similarly in study conducted by Qari the most common presentation was ulcer and it was found in 59% of patients.[17]

Site of lesion

In the present study out of 60 patients the most common site of involvement was toes which were found in 24 patients and this was comparable with Apelquist et al and Reiber et al study in which the most common site was also the toes.[16,18] But in Apelquist et al and Reiber et al , the second most common site of involvement was plantar (metatarsal heads ,mid foot and heal) where as in the present study it was the dorsum of foot.[16,18]

History of trauma

In present study out of 60 patients, 43 cases were having history of trauma, it accounts for 71.66% of the present study. This is compared with Reiber et al series in which 77% of ulcer pathways include trauma.[18]

Pathology

Sensory neuropathy can cause loss of variety of sensations like touch, pressure, temperature, vibration, position and pain. When the sensation of pain is lost it gives rise to an insensate foot, resulting in repetitive unrecognized trauma and abnormal distribution of pressure on the feet and hence emerge as the principal factor in causing foot ulcer.

In present study out of 60 patients 44 patients (73.33%) had neuropathy which is comparable with Reiber et al in which neuropathy was there in 78% of the patients.[18]The majority of the patients having neuropathy/vasculopathy had history of diabetes of more than 5 years.

Incidence of different causative organism

In the present study the most common organism cultures is S. aureus followed by Enterococcus which is comparable with Gibbons et al and Wheta et at study.[19,20]

Treatment given

In the present series conservative treatment was given to 42 patients (debridement)was done, major amputation was done in 8 patients, disarticulation was done in 8 patients, and drainage of pus was done in 2 patients. Split skin grafting was done in 10 patients as a final treatment.

Proper control of diabetes is very important in diabetic foot management, fasting and post prandial blood sugar estimation were well under control.

Initially the patients were started on broad spectrum antibiotic and if required it was changed depending on the culture and sensitivity report.

In the present study out 60 cases studied56.66% had good prognosis which healed by re-epithelialisation which is comparable with Apelquist et al and Reiber et al study.[16,18] In the present series all the patient recovered finally there was no mortality and 13.33% underwent amputation.

Out of 60 patients 4 were diagnosed of diabetes mellitus on date of admission. Most of the patients had history of diabetes mellitus between 6 to 10 years. All most all the patient had infection (only in 4 patients the culture was sterile) in addition to neuropathy and ischemia. This study shows that all three are can be there in diabetic foot ulcer. Minimum duration of stay in hospital was 8 days and maximum 166 days. Most common microorganisms grown from culture taken from the lesion was S. aureus followed by Enterococcus.

Conservative treatment consists of control of diabetes with human actrapid / human mixtardlente/Glargine insulin along with appropriate oral or iv antibiotics along with simple dressing was effective few cases. Wound debridement, slough excision, followed by dressing with povidone-iodine, metronidazole, collagenase, L- lysine, mupirocin, etc. dressings resulted in healing of ulcers. Split skin grafting, disarticulation, bellow knee amputation, and above knee amputation, were the other modes of treatment. There was no mortality in present study.

V. Conclusion

Diabetes is a lifelong problem, and the incidence of diabetic foot complications increases with age and duration of the disease. Diabetic patients at risk for foot lesions must be educated about risk factors and the importance of foot care, including the need for self -inspection and surveillance, monitoring foot temperatures, appropriate daily foot hygiene, use of proper footwear, good diabetes control, and prompt recognition and professional treatment of newly discovered lesions. They take a tremendous toll on the patient's physical and mental well-being as well as impose a substantial economic burden, often removing the patient from the workforce and placing a financial drain on the health care system.

The management of the surgical patient with diabetes should be based on knowledge of the Pathophysiology of diabetes and on an assessment of its chronic complications.

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