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## A study of diabetic foot patients in a tertiary care premier teaching hospital

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### Abstract

**Aim:** To analyze diabetic foot patients treated in surgical ward of tertiary care teaching hospital and evaluate the surgical outcomes.

**Methods & Materials:** A descriptive retrospective analysis was carried out in Department of Surgery of St John's Medical College, Bangalore, India. The study period was from July 2014 to December 2014. Statistical analysis was done using SPSS 18.0. The study was approved by the institution ethics committee.

**Results:** A total of 30 male patients were studied. Right foot was most commonly affected in 63.5% of the cases. Type 1 diabetic foot complications were the most common complications in this study accounting for 76.7% followed by type 3 diabetic foot complication (20%). The most common lesion seen was Wet gangrene (40%) followed by abscess (20%) both of which accounted for 60% of the cases and belonged to type 1 diabetic foot complication ( $P < 0.001$ ). Toe amputation was the commonest surgical procedure done. Wet gangrene accounted for 50% of amputation ( $P = 0.017$ , statistically significant). Most cases were operated by junior team members of the surgical units. There was one mortality in this study.

**Conclusion:** Diabetic foot is a serious complication of diabetes mellitus and is often a neglected entity. Our study showed that Amit Jain's type 1 diabetic foot complication, which are acute in nature and infective complication, are the most common cause of hospitalization in teaching hospital. Majority surgeries are performed on them in late evening as emergencies.

**Keywords:** Diabetic foot, Amit Jain, amputation, gangrene, ulcer

### Introduction

Diabetes mellitus is a serious complex disease that occurs globally with a reported prevalence of 4-6.5% [1, 2]. It affects almost all vital organs of the body leading to increase morbidity and mortality [1, 3].

Foot problems remain one of the disturbing complications and are common cause of hospitalization in diabetic patients [2, 4].

Around 15-20% of patients with diabetes will develop foot ulcer during their lifetime [1, 4, 5, 6]. These ulcers are likely to be chronic, recur and can get infected thereby leading to amputation [1, 2]. There is a well-known difference in diabetic foot geographically and also among different cities and hospitals.

We conducted a descriptive study in our hospital on diabetic foot to analyze how it is dealt and to study various different outcomes.

### Methods and Materials

A retrospective descriptive study was conducted in department of surgery at St John's medical college, Bangalore, India. This is a tertiary care premiere teaching hospital. There are 4 different functional surgical units in surgery department. The study period was from July 2014 to December 2014. The following are the inclusion and exclusion criteria.

### Inclusion criteria

1. All the patients admitted and treated in male surgical ward in 3 different surgical units of the department. This ward was chosen as there were well maintained register and most diabetic foot patients are admitted in this ward.

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**Exclusion criteria**

1. Patients admitted and treated in other departments or private wards.
2. Patients from author’s surgical unit.
3. Patients who refused treatment
4. Patients with incomplete records/data needed for the study

This study was approved by the institutional ethics committee [IEC STUDY No 12/2015]

**Data analysis:** [7, 8, 9, 10] Data was analyzed using statistical software SPSS 18.0 and R environment Ver.3.2.2. Microsoft word and excel were used for general graphs and tables. Both descriptive and inferential statistical analysis was carried out in this study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance.

**The following assumption on data is made**

- Dependent variables should be normally distributed,
- Samples drawn from the population should be random
- Cases of the samples should be independent

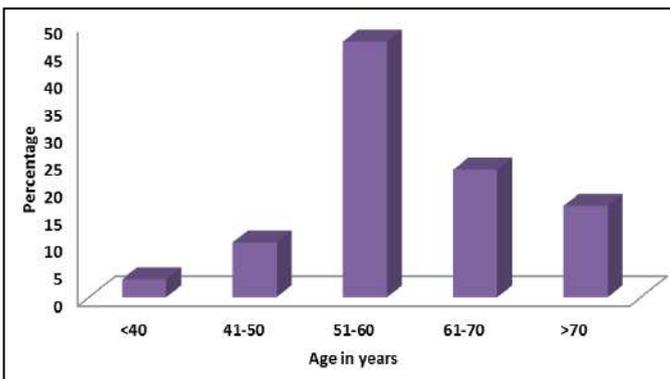
Chi-square/Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, Non-parametric setting for Qualitative data analysis. Fisher exact test was used when samples were very small.

**Significant figures**

- + Suggestive significance (P value:  $0.05 < P < 0.10$ )
- \* Moderately significant (P value:  $0.01 < P < 0.05$ )
- \*\* Strongly significant (P value:  $P \leq 0.01$ ).

**Results**

Around 30 patients were included in this study from male general ward. The age range was from 40 to 70 years [Figure 1] with mean age of  $57.87 \pm 13.15$ .



**Fig 1:** Showing age distribution

Right foot was affected in 63.5% of the cases [Table 1].

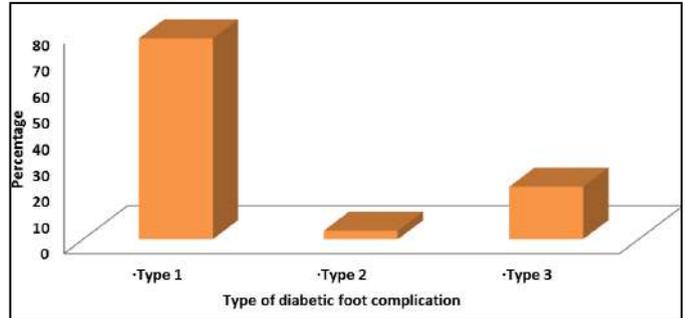
**Table 1:** Showing the side of foot affected

Side of foot	Number	percentage
Right	19	63.3
Left	11	36.7

Type 1 diabetic foot complication were the most common complication [Table 2] in this study accounting for 76.7% followed by type 3 diabetic foot complication (20%).

**Table 2:** Showing the distribution of cases according to Amit Jain’s classification for diabetic foot complication

Types of Diabetic foot complication	Number	Percentage
Type 1 Diabetic foot complication	23	76.7
Type 2 Diabetic foot complication	1	3.3
Type 3 Diabetic foot complication	6	20.0
Total	30	100



**Fig 2:** Showing the distribution of cases according to Amit Jain’s classification for diabetic foot complication

Wet gangrene was the most common pathological lesion seen (40%) followed by abscess (20%) both of which accounted for 60% of the cases [Table 3] and belonged to type 1 diabetic foot complication ( $P < 0.001$ ). Few patients were admitted as infected ulcers who had undergone incision and drainage few days earlier at another hospital. Their discharge summary showed diagnosis of an abscess and such cases were categorized by us in type 1 diabetic foot complications [Figure 2]. Many of them wrongly assume it to be infected trophic ulcers.

**Table 3:** Showing the distribution of pathological lesions

variables	Type of diabetic foot complication			Total (n=30)	P value
	Type 1 (n=23)	Type 2 (n=1)	Type 3 (n=6)		
Diagnosis					
Abscess	6(26.1%)	0(0%)	0(0%)	6(20%)	<0.001 **
Wet gangrene	12(52.2%)	0(0%)	0(0%)	12(40%)	
Necrotizing fasciitis	1(4.3%)	0(0%)	0(0%)	1(3.3%)	
Cellulitis	4(17.4%)	0(0%)	0(0%)	4(13.3%)	
Dry gangrene	0(0%)	1(100%)	0(0%)	1(3.3%)	
Infected ulcers [Trophic]	0(0%)	0(0%)	4(66.7%)	4(13.3%)	
Infected ulcer {Trophic} with gangrene	0(0%)	0(0%)	2(33.3%)	2(6.7%)	



**Fig 3:** Showing a patient admitted with infected ulcer. These patients are wrongly assumed as infected trophic ulcer. This patient had undergone incision and drainage for abscess over left foot just a few days ago at another hospital. He was admitted at our hospital with non-healing wound and pus discharge. This patient is categorized in Type 1 diabetic foot complication.

Around 20% of patient had infected trophic ulcer. 3 patients (10%) had underlying osteomyelitis and 6.6% had peripheral arterial disease. Around 80% of patients had some form of amputation being done [Table 4].

**Table 4:** Showing amputations done

Amputation performed	Number	Percentage
Yes	24	80.0
No	6	20.0
Total	30	100%

The most common surgical procedure that was performed was toe amputation [43.3%]. 20% of the patients underwent major amputation [Table 5].

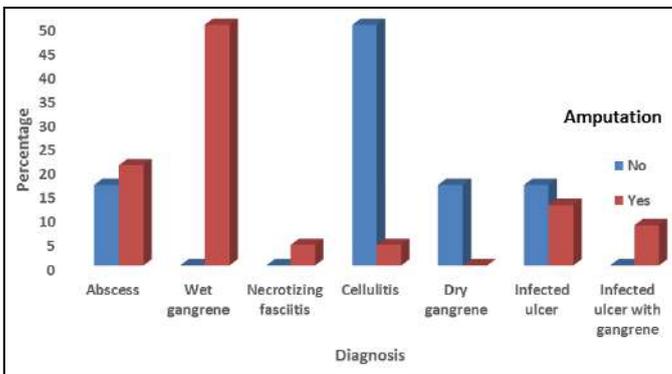
**Table 5:** Showing distribution of surgeries done.

Surgery Done	Number	Percentage
Debridement	5	16.7
Toe amputation	13	43.3
TMT	5	16.7
BKA	5	16.7
AKA	1	3.3
Conservative	1	3.3
Total	30	100%

Wet gangrene accounted for 50% of amputation (P=0.017, statistically significant) [Table 6].

**Table 6:** Showing amputation being done or not for different pathological lesions [\*significant]

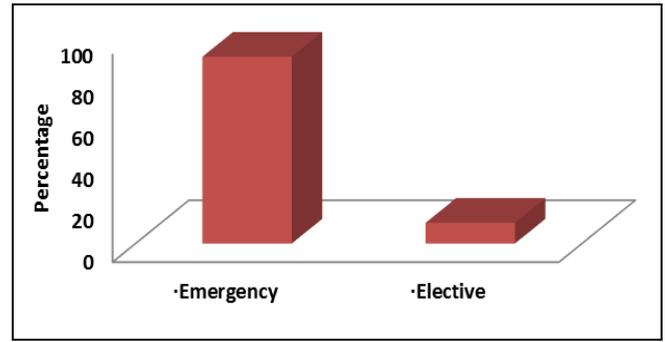
Diagnosis	Amputation		Total	P value
	No	Yes		
Abscess	1(16.7%)	5(20.8%)	6(20%)	P=0.017*
Wet gangrene	0(0%)	12(50%)	12(40%)	
Necrotizing fasciitis	0(0%)	1(4.2%)	1(3.3%)	
Cellulitis	3(50%)	1(4.2%)	4(13.3%)	
Dry gangrene	1(16.7%)	0(0%)	1(3.3%)	
Infected ulcer	1(16.7%)	3(12.5%)	4(13.3%)	
Infected ulcer with gangrene	0(0%)	2(8.3%)	2(6.7%)	
Total	6(100%)	24(100%)	30(100%)	



**Fig 4:** showing distribution of amputation done in different pathological lesions

Majority of the patients (90%) underwent emergency surgery [Figure 4] with 73.3% of the patients being operated within 24 hours [Table 7] and 56.7% of patients surgeries being done between 5pm to 11.59 pm [Table 8]. 20% of the patients had

surgeries being done between 12.01am to 9am. There was no significant association of timing of surgery in relation to amputation done (P=0.167).



**Fig 5:** showing distribution of cases among elective versus emergency surgery

**Table 7:** Showing Date of Surgery distribution of patients

Date of Surgery	No. of patients	%
Within 24 hours	22	73.3
1-3 days	6	20.0
More than 3 days	2	6.7
Total	30	100.0

**Table 8:** Showing the timing of surgery

Timing of Surgery	Number	Percentage
00.01AM -9AM	6	20.0
9.01AM - 5PM	7	23.3
5.01PM - 11.59PM	17	56.7

Majority of diabetic foot cases were operated by postgraduate/senior resident accounting for 86.7% followed by Lecturer/Assistant professor (13.3%). None of the diabetic foot cases were operated by Associate Professor/Professors [Table 9].

**Table 9:** Showing the type of surgeon doing the surgery

Type of Surgeon operating	Number	Percentage
Postgraduate/ SR	26	86.7
Lecturer/AP	4	13.3
Associate Professor/Professors	0	0
Total	30	100

Majority of the patients (46.7%) had diabetes between 6 -12 years duration [Table 10] with 63.3% of them having associated co- morbidities.

**Table 10:** Showing duration of diabetes mellitus

Diabetes mellitus duration in years	Number	Percentage
<6	7	23.3
6-12	14	46.7
12-24	7	23.3
>24	2	6.7

60% had hypertension, 16.7% had ischemic heart disease and 13.3% had retinopathy and CKD each. 30% of the patients had past history of amputation with toe amputation being the commonest [20%]. 6.7% of patients already had a major amputation in the past.

60% of the patients stayed in the hospital for less than a week

and 13.3% of patients had to stay for more than 2 weeks [Table 11]. There was no relation between timing of surgery [Table 12 and Figure 12] with amputation ( $P=0.167$ )

**Table 11:** showing hospitalization in day's distribution of patients studied

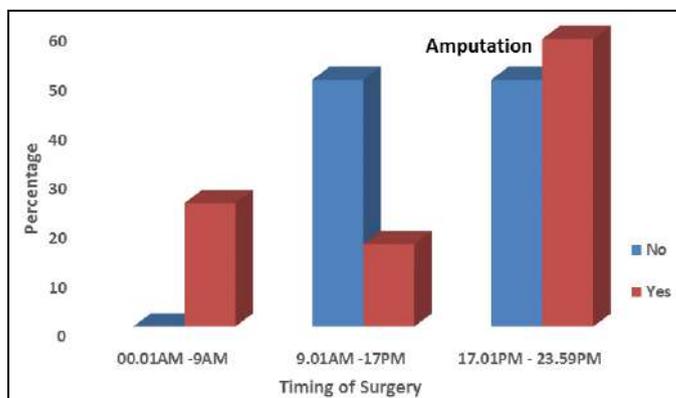
Hospitalization in days	Number	Percentage
Less than 7 days	18	60.0
8-14 days	8	26.7
More than 2 weeks	4	13.3
Total	30	100.0

Only 8 patients (26.6%) had documented neuropathy/sensation being tested and 20% had contra lateral limb being examined. There were 12 patients who had wounds on plantar aspect (ulcer plus postoperative debrided wounds) and only one (8.3%) of them received offloading (bohrer iron cast). There was one mortality in this series.

**Table 12:** Showing timing of surgery in relation to amputation of patients studied

Timing of Surgery	Amputation		Total
	Yes	No	
00.01AM -9AM	0(0%)	6(25%)	6(20%)
9.01AM -17PM	3(50%)	4(16.7%)	7(23.3%)
17.01PM - 23.59PM	3(50%)	14(58.3%)	17(56.7%)
Total	6(100%)	24(100%)	30(100%)

$P=0.167$ , Not Significant, Fisher Exact Test



**Fig 6:** Showing relation between timing of surgery with amputation being done

**Discussion**

Diabetic foot is often a feared complication of diabetes in view of it resulting in amputation and mortality [11]. Some of the known factors leading to diabetic foot amputation are ulceration, infection, neuropathy, ischemia, deformities etc. [2].

It is well known that treatment of diabetic foot and amputation are costly [11]. In developing countries like India, patients affected with diabetic foot complications spend 32.3% of their income towards its treatment [12].

Often over years, it is observed that most researchers have viewed Diabetic foot as “*Diabetic foot ulcers*” very frequently. Various studies have been done through Wagner’s and University of Texas classification which were meant only for ulcers which is a focal entity [4, 13].

Recently, a new simple descriptive classification for diabetic foot was proposed that looked diabetic foot beyond ulcers and it included most lesion in diabetic foot seen universally [13, 14]. In Kalaivani *et al.* series, it was seen that 91.06% of patients who were treated for diabetic foot as inpatients had type 1 diabetic

foot complications with wet gangrene being the commonest lesion affecting 35.75 of the patients [14]. In this study also, type 1 diabetic foot complications accounted for 76.6% of the cases and wet gangrene was the commonest pathological lesion affecting 40% of the patients. Type 1 diabetic foot complications are often acute complications requiring intravenous antibiotics and urgent surgical intervention. It is evident in this study where 90% of patients underwent emergency surgeries with majority of them being operated within 24 hours of admission especially in evening time of the day.

It was often stated that diabetic foot and amputation were most of the time left to the junior most member of the surgical team who may have little experience especially in amputation [15]. Astonishingly, even in our study, majority of the cases [86.7%] were operated by Postgraduate trainee/senior resident who are the junior most member of the team. No surgeries were performed by any senior faculty in this study.

In Kalaivani *et al.* series [14], debridement was the most common surgical procedure [53.66%] followed by the toe amputation [25.20%]. In this study, toe amputation was the commonest surgical procedure being done in 43.4%. There was one mortality in this study.

**Conclusion**

Diabetic foot is a neglected entity both by patients and health care professionals leading to increase morbidity and amputations. Our study shows that type 1 diabetic foot complications are the commonest cause of hospitalization. Wet gangrene was the commonest pathological lesion in this study and toe amputation was the commonest surgical procedure done. Most surgeries were done as emergency and majority were done by the junior most team members. Further, only 26.6% of patients had their foot sensation being evaluated and only 20% of them had the contra lateral limb being examined. Only 8.3% of them received some offloading advice. Our study also showed a lower prevalence of ischemia which affected 6.67% of the cases and around 10% of patients had underlying osteomyelitis.

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**Conflict of interest:** None

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