



To analyze type of surgery done, multi-disciplinary surgical procedure, anti-microbial used and post op care in patients with diabetic foot infection

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Abstract

Aim: To determine the type of surgeries done in diabetic foot, the solution used, frequency of dressing and offloading method employed. To also estimate the roles of other specialist like plastic surgery, orthopaedics, etc. in diabetic foot management.

Methods and Materials: A descriptive analysis was done in department of surgery of Rajarajeswari medical college, Bengaluru, India. The study period was 6 months. SPSS 18 was used as analysis. An IEC approval was taken for this study.

Results: 37 patients were included in this study. 78.4% were males. Only 5.2% had diabetes of more than 20 years. Overall, majority of the patients had type 1 diabetic foot complications. Diabetic foot ulcer was the commonest entered diagnosis in the case sheets followed by wet gangrene. Toe amputation was the commonest surgical procedure and 16.2% ended up in major amputation. Most of the surgeries were done by postgraduate residents accounting for 40.5% of the cases. There was significant association with pathological diagnosis and amputation (P-0.025*). There was also significant association between operating surgeon and amputation (P-0.076).

Conclusion: Diabetic foot is a known neglected entity and this study shows that majority of cases were wet gangrene and most of the surgeries were done by junior faculty. An awareness of quality management of diabetic foot is needed as they are associated with amputation which affects the quality of life of the patients.

Keywords: diabetic foot, amputation, ulcers, wet gangrene, India

Introduction

One of the biggest challenges in health today is diabetes mellitus as it poses a huge burden across the world [1,2] It is estimated that the number of people with diabetes will double by 2030 and by 2040, there is likely that 642 million people will have diabetes if it is not prevented [2,3]. Further, there are various complications in diabetes of which diabetic foot is one of the distressing complications [4]. It is believed to be one of the most expensive complications to treat [5]. It is estimated that the total annual cost of managing diabetic foot ulcer exceeds 1.32 billion dollars in UK and around 9-13 billion dollars in USA [6].

It is known that around 15% of diabetic patients will develop foot ulcers [7]. Around 58% of ulcers will get infected leading to increase in morbidity like hospitalization and cost of treatment [8]. Once diabetic foot patient is admitted, he is likely to undergo multiple procedures, may have other surgical specialist involved too and may even have amputation being done.

We conducted this study to determine the cause for which diabetic foot patients were admitted, surgical procedures done, dressing and solution used and offloading used in hospitalized patients. We also wanted to estimate the role of other specialist in diabetic foot management.

Methods and Materials

A descriptive retrospective analysis was done in Department of surgery of Rajarajeswari medical college, Bangalore, India which is a tertiary care teaching institute catering rural patients. The

study period was for 6 months from January 2017- June 2017. The following were the Inclusion and Exclusion criteria.

Inclusion criteria

1] All patients with type 2 diabetics and foot infections admitted in the department of Surgery in Rajarajeswari medical college.

Exclusion criteria

1] Diabetic foot patients who refused surgeries
2] Diabetic foot patients operated elsewhere and admitted for further care in our hospital
The study was approved by Institutional ethics committee (RRMCH-IEC/164/2016-17)

Data analysis [9, 10, 11, 12]

Data was analyzed using statistical software SPSS 18.0 and R environment ver.3.2.2. Microsoft word and excel were used to generate graphs and tables. Both descriptive and inferential statistics were carried out in the study. Results on continuous measurements were presented on Mean \pm SD (Min-Max) and results on categorical measurements were presented in number (%). Significance was 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≤0.01).

Results

A total of 37 patients were included in this study. There were 29 male patients (78.4%) and 8 female (Figure 1) patients (21.6%).

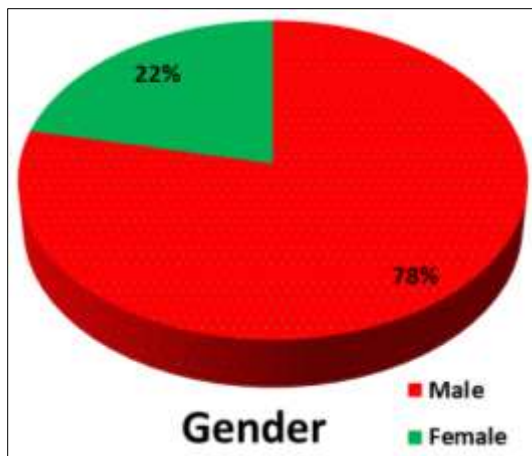


Fig 1: showing distribution of gender

The average age of the patients was 56.92+/- 11.6 years.

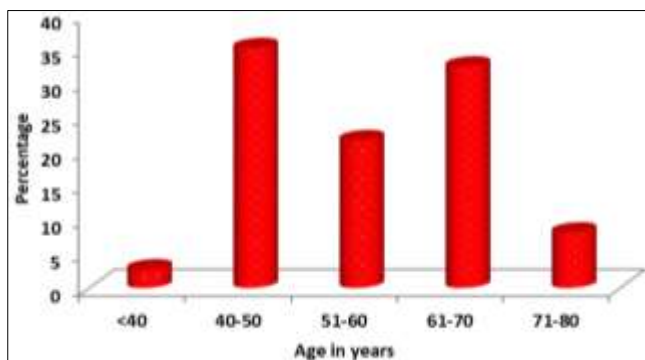


Fig 2: showing the age distribution of the patients

The most common diagnosis (Table 1) entered in case sheets was diabetic foot ulcer (37.8%) followed by wet gangrene (29.7%). 16.2% had abscess.

Table 1: showing the diagnosis distribution of patients studied

Diagnosis	No. of patients	%
Abscess	6	16.2
Wet gangrene	11	29.7
NSTI (Necrotizing soft tissue infection)	6	16.2
Diabetic foot ulcer	14	37.8
Total	37	100.0

Most patients (54.1%) had diabetes of 1- 10 years duration (Figure 3). Only 5.4% had diabetes of more than 20-year duration.

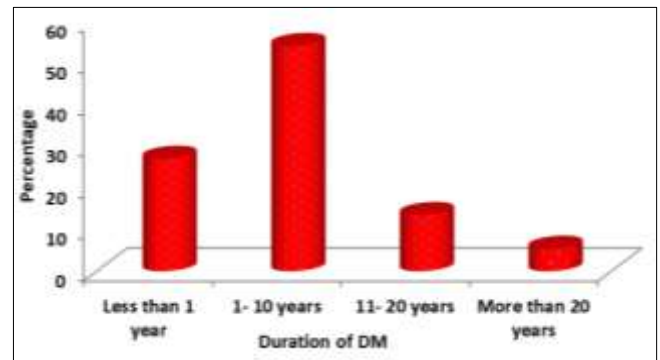


Fig 3: showing distribution of duration of diabetes mellitus (DM)

Toe amputation (45.9%) was the most common surgical procedure (Table 2) followed by debridement (32.4%).

Table 2: showing the surgeries done on diabetic foot patients

Final Surgery Diagnosis	No. of patients	%
Debridement	12	32.4
Toe amputation	17	45.9
TMT	1	2.7
BKA	3	8.1
AKA	3	8.1
Lumbar sympatectomy	1	2.7
Total	37	100.0

21.6% of the diabetic foot patients had split skin grafting done in the same admission. A total of 67.6% patients in the study underwent amputation. 6 patients (16.2%) underwent major amputation (Figure 4).

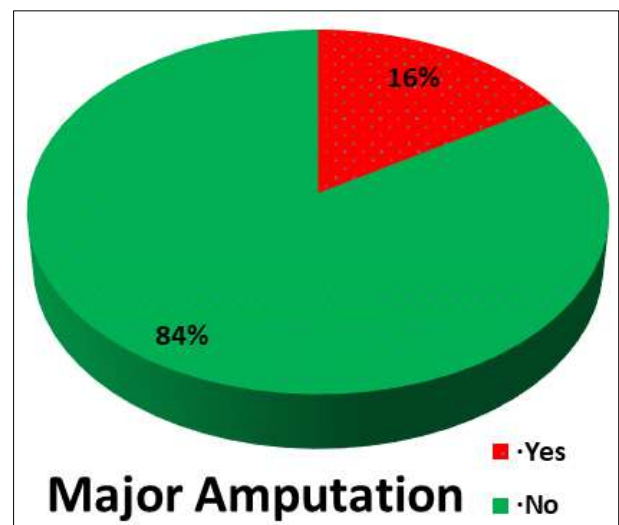


Fig 4: showing major amputation done in diabetic foot

Majority of the surgeries were done by post graduates (40.5%) followed by senior residents (32.4%). Not a single surgery was done by senior staff consisting of Associate professor/ Professors (Table 3).

Table 3: showing the distribution of surgeries done by surgeons

Operating Surgeon	No. of patients	%
Postgraduates	15	40.5
Senior residents	12	32.4
Assistant Professor	9	24.3
Professor	0	0.0
House surgeon	1	2.7
Total	37	100.0

59.5% of the surgeries were done on emergency basis (Figure 5).

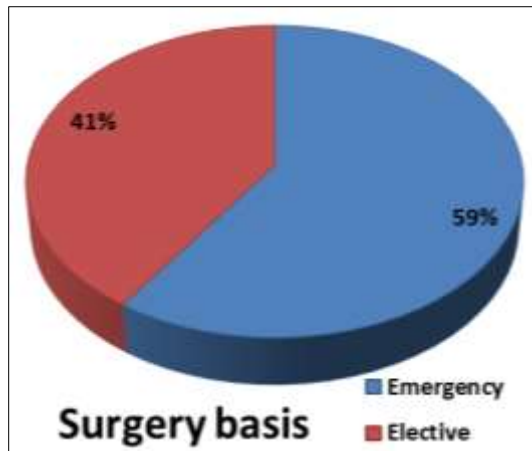


Fig 5: showing the distribution of surgeries on basis of emergency/elective

64.9% of the patients underwent multiple surgeries in the same admission.

94.6% of the charts did not have a mention of the solutions used for cleaning the wounds (Figure 6).

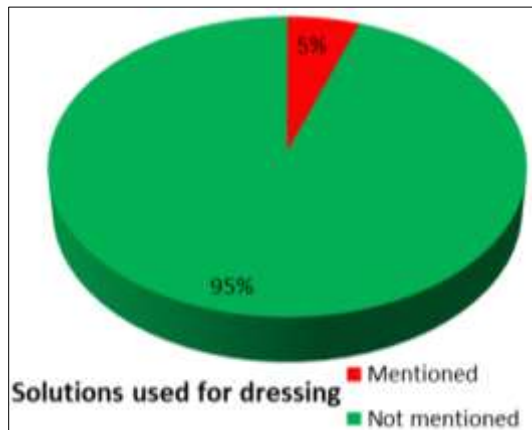


Fig 6: showing the distribution of cases wherein solution used where mentioned or not

Only 8.1% of the patients had modern dressings done for their wounds. In 94.6% of the patients, the frequency of change of the dressings was not mentioned. None of the patients had any offloading / footwear prescription mentioned in the charts. In 18.9% of the patients, opinion was sought from other surgical

specialities (Cross consultation). Plastic surgery opinion was sought in 6 patients (16.2%) and vascular surgery opinion in 1 patient (2.7%). None of the patients were intervened surgically by these specialities.

There was no correlation between gender and amputation (Table 4).

Table 4: showing correlation between genders of patients studied in relation to amputation done

Gender	Amputation done		Total	P value
	Yes	No		
Male	21(84%)	8(66.7%)	29(78.4%)	P = 0.394
Female	4(16%)	4(33.3%)	8(21.6%)	
Total	25(100%)	12(100%)	37(100%)	

There was a statistically significant correlation (Table 5) between diagnosis and amputation (Figure7), with 44% of patients with wet gangrene undergoing amputation (P = 0.025*, significant).

Table 5: showing correlation between diagnosis and amputation

Diagnosis	Amputation Done		Total	P value
	Yes	No		
Abscess	3(12%)	3(25%)	6(16.2%)	P = 0.025*
Wet gangrene	11(44%)	0(0%)	11(29.7%)	
NSTI	3(12%)	3(25%)	6(16.2%)	
Ulcer	8(32%)	6(50%)	14(37.8%)	
Total	25(100%)	12(100%)	37(100%)	

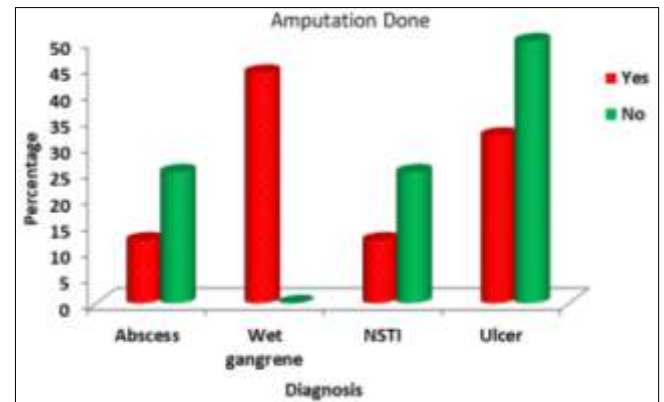


Fig 7: showing relation of amputation with pathological diagnosis

There was also significant association (P=0.076+) between amputation (Figure 8) and the operating surgeon (Table 6).

Table 6: showing correlation between amputations and operating surgeon

Operation Surgeon	Amputation Done		Total	P Value
	Yes	No		
PG	9(36%)	6(50%)	15(40.5%)	P = 0.076+
SR	11(44%)	1(8.3%)	12(32.4%)	
AP	4(16%)	5(41.7%)	9(24.3%)	
PROF	0(0%)	0(0%)	0(0%)	
INTERN	1(4%)	0(0%)	1(2.7%)	
Total	25(100%)	12(100%)	37(100%)	

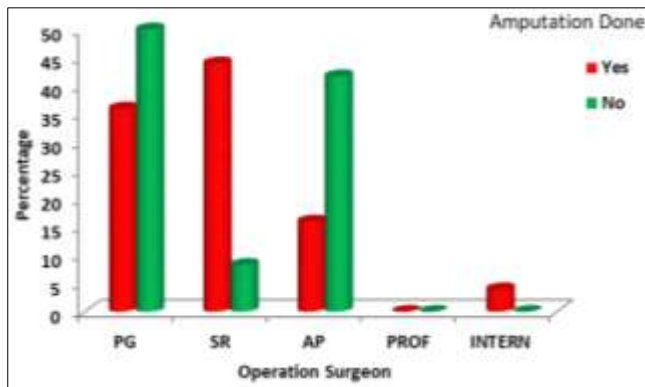


Fig 8: showing amputations done among surgeons

There was no correlation between other speciality consulted and multiple surgeries with major amputation (Table 7).

Table 7: showing correlation between clinical variables and amputation

Multiple surgeries	Major Amputation Done		Total	P value
	Yes	No		
Yes	4(66.7%)	20(64.5%)	24(64.9%)	P = 1.000
No	2(33.3%)	11(35.5%)	13(35.1%)	
Total	6(100%)	31(100%)	37(100%)	
Other specialties				P = 0.571
Yes	0(0%)	7(22.6%)	7(18.9%)	
No	6(100%)	24(77.4%)	30(81.1%)	
Total	6(100%)	31(100%)	37(100%)	

Discussion

Diabetic foot is a triad consisting of infection, neuropathy and ischemia [5]. The diabetes patients are likely to have 10 times higher risk for amputation when compared to non-diabetics [13]. Around 85% of all ulcers used to precede amputation [14]. 40% of patients of diabetic foot who presents to hospital will require some form of amputation [4].

In Jain *et al* series on hospitalised diabetic foot patients [15], type 1 diabetic foot complications were most common cause for admission with significant number of patients admitted with wet gangrene followed by abscess [15]. In this series, 62.1% had type 1 diabetic foot complication. Ulcer was commonest diagnosis followed by wet gangrene (Figure 9). In viswanathan *et al* series [16], most common cause for amputation was infection wherein 90% had infection. In their series on amputation exclusively, 70.9% had minor amputation and 29.7% had major amputation [16]. Amputations distal to ankle joint are considered minor amputation whereas amputations proximal to ankle are considered major amputation [17]. Minor amputation often has better prognosis. 80% of them are alive after 2 years in comparison to below knee amputation wherein 52% died within 2 years [18].



Fig 9: showing wet gangrene of the toe of the left foot

In Jain *et al* series [15], 80% had some type of amputations with toe amputation being common (43.3%). Major amputation accounted for 20% cases. Wet gangrene was significantly associated with amputation in hospitalized patient in their series [11]. In their series, 45.9% had toe amputation which was common surgical procedure done on diabetic foot. 16.2% had major amputation. In this series too, wet gangrene accounted for significant cause for amputation.

There are studies which shows that majority of amputations are often given to be done by junior doctors who had little experience [19]. Even in debridement of diabetic foot, which most doctors underestimate even today, it is often left on resident on duty who should complete the said procedure [20]. In Jain *et al* series [15], 86.7% of diabetic foot cases were operated by junior staff consisting of Postgraduate Residents and Senior Resident. No surgery on diabetic foot was done by senior staff like Professors or Associate Professor [15]. 90% of diabetic foot were treated as emergency surgery. In this series, 59.5% were done as emergency surgeries, 72.9% of surgeries were done by junior staff with postgraduates doing most surgeries (40.5%). None of the surgeries were done by senior staff like professors even in this series. We noted significant association between amputation and operating staff being junior surgeons.

Often in west, diabetic foot is treated by many specialists as a multidisciplinary approach. However, it was seen in Jain *et al* series [21] that there was no role of orthopaedic surgeon or infectious disease on regular management of diabetic foot whereas 2.097% of patients underwent vascular and endovascular intervention each. There were no free flaps done by plastic surgeon in their series [21]. In this series too, though 18.9% of patients underwent cross consultation with plastic surgeon and vascular surgeon, none of the patients underwent any peripheral bypass procedure or free flap. The limb salvage rate in Jain *et al* series [21] was 87% and in our series, it was around 84%.

In Jain *et al* series [21], 25.5% of diabetic foot patients received modern wound dressings postoperatively. In this series, only 8.1% received modern dressings.

Topical antimicrobial solutions like Povidone Iodine, Chlorhexidine, Cadomer Iodine, Hydrogen Peroxide, etc are commonly used in wounds postoperatively by most surgeons in clinical practice. In this series, it was seen that 95% of the cases there was no record on type of antimicrobial solution used. In Jain *et al* series^[21], 8.3% of patients received offloading. In this series, none of the patients received offloading or footwear advice. There was no mortality in this series.

Conclusion

Diabetic foot is a common condition seen in developing countries like India. In spite of knowing the outcome like amputations which can affect the quality of life of the patients and their family, it is undervalued by treating surgeons. Majority of diabetic foot cases were operated by Junior staff, 95% of cases did not have any record of antimicrobial solutions used on wounds and also the frequency of change of dressings were missing in the records. There was no offloading or footwear advice given to any diabetic foot patients. There is urgent need to sensitize the surgeons on adequate quality of diabetic foot care.

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