

Analysing Diabetic Foot Amputations through Amit Jain's Extended SCC Classification

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ABSTRACT

BACKGROUND

Foot amputations are common in diabetic patients and they are either minor or major. We conducted this study to analyse minor amputations done in diabetic patients through this new Amit Jain's extended "SCC" classification for foot amputations.

METHODS

A descriptive retrospective study was conducted in Department of Surgery of Raja Rajeswari Medical College, Bengaluru, Karnataka, India, which is a tertiary care teaching hospital. The study period was from January 2018 to December 2019. This study was approved by institutional ethics committee.

RESULTS

32 patients were included in this study with majority of patients being above 40 years. 78.1 % of them were males. Infected ulcers in the foot accounted for 34.4 % of the cases and were the commonest cause for amputation. 96.9 % of the patients who underwent minor amputation were of type 1-foot amputation. 6.3 % ended up in major amputation in the same hospitalisation. There was no in-patient mortality in this study.

CONCLUSIONS

Diabetic foot amputations are common in clinical practice and they often cause increased morbidity and add financial burden to patients and their family. Toe amputations, which are type 1-foot amputations, are the commonest amputations performed. Type 3-foot amputations are rarely done as they are complicated and require expertise. Amit Jain's extended SCC classification for foot amputation is a simple, easy to understand and practical classification that categorises the minor amputation into 3 simple types. This is the first such classification exclusive for foot amputation.

KEYWORDS

Diabetes, Amputation, Foot, Amit Jain, Osteomyelitis, Gangrene, Ulcer

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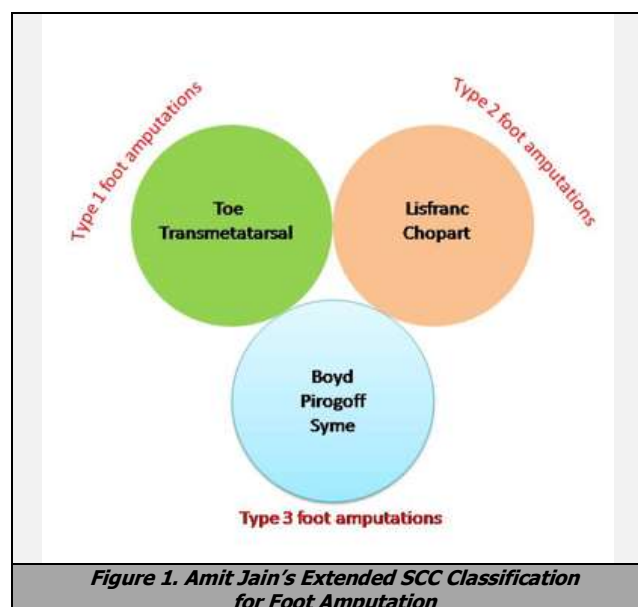
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BACKGROUND

It is estimated that in 2017, there were around 25 million people with diabetes, and it is likely to rise to 628 million by the year 2045.¹ One complication that is of distressing nature is diabetic foot. The global prevalence of diabetic foot is around 6.3 %.² A person with diabetes has 15 - 20 % lifetime risk of developing an ulcer.³ Diabetic foot ulcer leads to increased morbidity, high treatment costs and high risk for amputation.⁴ Diabetic patients are 10 times at high risk of lower extremity amputations compared to those without diabetes.⁵ A lower limb amputation decreases the quality of life and adds to the financial burden of a family.⁶ However, in case an amputation is to be done, then it is advisable to prefer the distal most amputation for successful foot salvage and one can climb the amputation ladder for proximal amputations only if necessity arises.⁷

A new classification was recently proposed for minor amputations which is an extended Amit Jain's "SCC" classification wherein the foot amputations can be placed into 3 simple types namely simple (type 1), complex (type 2) and complicated foot amputations (type 3).⁸ To describe in a straight forward manner, all the types of amputations done in forefoot regions are classified as simple amputation, all types of mid-foot amputations are classified into complex type and amputations in hind-foot are complicated type of foot amputations.⁸ Hence, it is a triangle of foot amputations that provides options available in foot amputations and serves as a good teaching tool, these 3 types of amputations occupy the 3 corners of a triangle and a clinician can choose the most appropriate amputation to be done in the foot.⁷

We conducted a study to analyse minor amputations through this new Amit Jain's extended "SCC" classification for foot amputations (Figure 1).



METHODS

A descriptive retrospective analysis was conducted in Department of Surgery of Raja Rajeswari Medical College,

Bengaluru, Karnataka, India. This is a tertiary care teaching hospital that caters patients who are mostly from rural zones. The study period was from January 2018 to December 2019. This study was approved by institutional ethics committee (RRMCH-IEC / 11 / 2020 - 21).

Inclusion Criteria

1. All patients with diabetic foot problems who initially underwent foot amputations in Department of Surgery.
2. Patients treated elsewhere and came for further management in surgery department were also included.

Exclusion Criteria

1. Patients operated in other departments.
2. Patients who underwent direct major amputations were excluded.
3. Patients who were discharged against medical advice.
4. Patients with incomplete records.
5. Patients with road traffic accidents or malignancy.

Statistical Analysis

Data was analysed using statistical software Statistical Package for the Social Sciences (SPSS) 22.0. Chi-square / Fisher's exact test has been used to find the significance of study parameters on categorical scale between two or more groups. A P-value of less than 0.05 was considered significant.

RESULTS

	Clinical Variables	Number	Percentage
Age	< 40	1	3.1
	40 - 50	6	18.8
	51 - 60	9	28.1
	61 - 70	7	21.9
	71 - 80	9	28.1
Gender	Male	25	78.1
	Female	7	21.9
Duration of diabetes mellitus	< 12	21	65.6
	12 - 18	8	25.0
	> 18	3	9.4
Hypertension	Yes	9	28.1
	No	23	71.9
Ischemic heart disease	Yes	5	15.6
	No	27	84.4
Side of foot involved	Right	20	62.5
	Left	12	37.5
Diagnosis	Wet gangrene	9	28.1
	Abscess	9	28.1
	Infected ulcer	11	34.4
	Infected dry gangrene	2	6.3
	Cellulitis	1	3.1

Table 1. Demographic Profile and Clinical Variables of Patients

A total of 32 patients were included in this study who fulfilled the inclusion and exclusion criteria. 96.9 % of patients who underwent foot amputations were above 40 years of age (Table 1). 25 patients (78.1 %) were males. 65.6 % of patients had diabetes for less than 12 years. 28.1 % had hypertension and 15.6 % had ischemic heart disease. Right foot (62.5 %) was most commonly involved foot, infect ulcer (34.4 %) was the commonest cause of foot amputation

followed by equal number (28.1 %) of wet gangrene and abscess.

31 patients (96.1 %) had type 1-foot amputations (simple amputations) of which 28 patients had toe amputations and 3 had transmetatarsal amputation and only 1 patient (3.1 %) had type 2-foot amputation (complex amputation) and it was Lisfranc's amputation (Table 2). 12.3 % of the patients had peripheral arterial disease (PAD) and 9.4 % had osteomyelitis. 93.8 % of the patients had open stump after amputation and 3.1 % had stump complication (infection) and they were in closed stump patients. 6.3 % of patients had past history of amputations. A total of 43.8 % had some form of re-surgeries like debridement, proximal amputation in the same period of hospitalisation. 2 of the patients who were in type 1-foot amputation ended up in major amputation in same hospital stay (Table 2).

Clinical Variables		Number	Percentage
Type of foot amputation	Type 1	31	96.9
	Type 2	1	3.1
	Type 3	0	0
Presence of PAD	Yes	4	12.5
	No	28	87.5
Osteomyelitis	Yes	3	9.4
	No	29	90.6
Re-surgeries	Yes	14	43.8
	No	18	56.3
Stump status	Open stump	30	93.8
	Closed stump	2	6.3
Stump complications	Yes	1	3.1
	No	31	96.9
Post amputation	Yes	2	6.3
	No	30	93.8
Major amputation	Yes	2	6.3
	No	30	93.7

Table 2. Clinical Variables Studied in the Patient

There was no association of re-surgeries and major amputation with any particular type of foot amputation (Table 3).

		Type of Foot Amputation		Total (N = 32)	P Value
Variables		Class 1 (N = 31)	Class 2 (N = 1)		
Re-surgeries	Yes	13 (41.9 %)	1 (100 %)	14 (43.8 %)	0.438
	No	18 (58.1 %)	0 (0 %)	18 (56.3 %)	
Major amputation	Yes	2 (100 %)	0 (0 %)	2 (6.3 %)	0.156
	No	29 (96.7 %)	1 (3.1 %)	30 (93.7 %)	

Table 3. Association of Important Variables in Relation to Type of Foot Amputation of Patients Studied

DISCUSSION

Amputation is one of the oldest surgical procedure.⁹ It is performed for various different reasons like trauma, malignancy, infection, etc.¹⁰ In today's world, diabetes is a leading cause of amputation in clinical practice. Even in developed countries like United States, it was noted that in the year 2005, around 1,85,000 people underwent lower limb amputation.¹⁰ It was also observed that an ulcer in foot precedes in more than 80 % of the cases of amputation in diabetics.¹¹ A study from India showed the prevalence of diabetic foot ulcer to be around 10.4 %.¹² Foot ulcers in diabetes along with various other foot complications can lead to increase morbidity and mortality. In fact, patients

who develop foot complications end up spending higher percentage of their income in comparison to those diabetic patients who do not develop foot complications.¹³

The problem with foot ulcers is that they can get infected.¹⁴ As high as 56 % of diabetic foot ulcers get infected and which may lead to amputation.^{14,15} Amputation leads to emotional and social burden apart from financial burden in diabetic patients.¹⁶ Amputees often are prone for depression.⁹ Amputations are associated with increased hospital admissions, increased cost of treatment, high failure rates and also increased mortality.^{5,16,17}

The amputations in diabetes are either minor or major amputations.¹⁸ Patients who undergo amputation through or distal to ankle are considered as minor amputations whereas amputations proximal to ankle are major amputations.¹⁹

Minor amputations include toe / digital amputation, transmetatarsal amputation, Lisfranc's, Chopart, Boyd, Pirogoff's and Syme's amputation.²⁰ Toe amputations are the commonest amputations done in foot.^{20,21} It can be for single toe or more than one toe. The issue with toe amputation is that the biomechanics of diabetic foot is disturbed, and pressure is transferred to other toes which can lead to ulcers and deformities.²² This can lead to higher risk of amputation.²² A study showed that 60 % of patients who underwent hallux and first ray amputation underwent second amputation at a mean of 10 months after the surgery.²³

Transmetatarsal amputation is another forefoot amputation procedure aimed to salvage the foot. It involves removal of all 5 toes. This procedure allows a good weight bearing residuum.²⁴ Transmetatarsal amputation has its own problems and it is seen that the re-amputation rate is around 26 to 30 % after the surgery.¹¹

However, the 5-year survival rate of transmetatarsal amputation is better compared to major amputation and it allows patients to walk on their own residual feet.^{24,25}

Procedures like Lisfranc's, Chopart, Boyd, etc. are rarely performed and they have high failure rates though when successful²⁶ can allow the patients to ambulate on residual limb.

Major amputations are associated with higher mortality.²⁶ A study showed that 80 % of patients with minor amputation were still alive after 2 years, whereas 52 % of patients, who underwent major amputation, died within 2 years.²⁶ The 5-year mortality rate after major limb loss was around 48 %²³ and 15 % of the below knee amputations end up in above knee amputation.⁵ 25 % of diabetic patients who underwent amputation will require contralateral amputation.²⁷

Foot complications in diabetes are usually common after 40 years of age.⁴ In our series, almost 97 % of the patients were above 40 years. Studies have shown foot amputation to be higher in males.^{4,28} In this study too, males were more commonly involved.

In Ozan et al. series,⁴ 91.5 % of diabetic foot patients had diabetes duration of at least 5 years. In our study, majority (65.6 %) had diabetes for less than 12 years.

In a study by Viswanathan et al., it was seen that 70.9 % had minor amputation and 29.9 % had major amputation.²⁹ In one of the earlier series by Jain et al.,¹⁸ it

was seen that 83.8 % had minor amputation and 16.2 % had major amputation and 100 % of minor amputations were simple foot amputations (type I) consisting of toe amputations and transmetatarsal amputations.¹⁸

In Ozan et al. series,⁴ ray amputation (57 %) was the commonest amputation done and 16.8 % had major amputation. In this series, 96.9 % had Type I-foot amputation belonging to simple type with majority being toe amputation. 6.3 % of patients who had foot amputation initially ended up in major amputation in the same admission. There was no mortality in this series.

CONCLUSIONS

Foot amputations are frequently performed surgical procedures in diabetes. This study shows that majority of foot amputations are type I amputations (simple) and toe amputation is the commonest type. Complicated amputation (type 3) done for hind foot are rarely performed. 6.3 % of the foot amputations end up in major amputation in the same hospital admission. This new Amit Jain's classification for foot amputation that categorised foot amputation into 3 types is simple, practical and easy to remember classification in clinical practice.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

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