

Research Article

**ANALYSIS OF TRANSMETATARSAL AMPUTATION IN DIABETIC FOOT USING
THE NEW PRINCIPLE AND PRACTICE OF DIABETIC FOOT**

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ABSTRACT

Aim – To analyze transmetatarsal amputation in diabetic foot through the new classifications for diabetic foot complications.

Methods And Materials - A retrospective analysis was carried in a single surgical unit of St John's medical college, Bangalore. The study period was from December 2008 to April 2014.

Results – 25 patients were included in this study. 76% of males underwent transmetatarsal amputation. Around 76% of patients with TMA had Type 1 diabetic foot complication. Wet gangrene [52%] was the most common cause for TMA. Around 20% of the patients with TMA had osteomyelitis out of which Type 1 C and Type 1 D were the commonest type of the osteomyelitis. 40% of the patients who underwent TMA had past history of some form of amputation. 20% of TMA patients ended up in below knee amputation in the same hospital admission. All patients with TMA who had scores between 16 - 20 belonging to high risk category invariably ended in major amputation.

Conclusion – Transmetatarsal amputation is a foot salvage procedure that provides independent ambulation to the patients and is preferred over below knee amputation. Our series shows that most patients with TMA had Type 1 diabetic foot complications. All TMA patients who belonged to high risk category of the new scoring system invariably ended up in major amputation. This is a unique study due to the fact that the transmetatarsal amputation was for the first time evaluated through the new principle and practice of diabetic foot and this study provides a detailed data on transmetatarsal amputation in diabetic foot from the Indian subcontinent.

Key words: Diabetic foot, Transmetatarsal, Amputation, Classification, Scoring, Grading

INTRODUCTION

India is considered to be one of the countries with a high prevalence of diabetes in the world and it is predicted that it is likely to increase to 120.9 million by 2030¹.

Diabetic foot is one of the serious complication of diabetes which is associated with prolonged hospitalization and risk of lower limb amputation². The increase in incidence of diabetic foot problems is due to rise in diabetic population as well as increase in lifespan of the people³. The risk of lower extremity

amputation is 18-30 times higher among those with diabetes in comparison to general population⁴.

In India, around 45,000 legs are estimated to be amputated every year³. Majority of the diabetic foot lesions are infective and neuropathic in origin^{3,5}.

Transmetatarsal amputation is one of the partial foot amputations which is preferred over major amputation as it has low mortality⁶. Further, being a salvage procedure, it provides a distal weight bearing residuum⁶.

Transmetatarsal amputation prevalence ranges from 8% to 11% in India in patients with diabetic foot problems^{7,8}.

It is astonishing to notice that being a foot salvage procedure, there are hardly any studies done to evaluate its outcome in India. The author in its literature search did not find even a single series on transmetatarsal amputation in diabetes from India over last one decade.

This study aims to provide our experience on transmetatarsal amputation in diabetic foot patients.

We did this study using the primary author's new classifications for diabetic foot leading to the new principle and practice of diabetic foot^{9, 10, 11, 12, 13, 14} that aims at improvising and standardizing the practice of diabetic foot. This unique study is first of its kind that evaluates transmetatarsal amputation in more depth.

MATERIAL AND METHODS

A retrospective analysis was carried out in the Department of Surgery in Unit '3' of St John's medical college, Bangalore, India, which is a tertiary care referral centre of repute in the country. Our patients come from more than 4 different states as it's a premiere medical college. The study period was from December to 2008 to April 2014. The surgeries were done by different surgeons based on their duty. The following were the inclusion and exclusion criteria.

Inclusion Criteria

- 1] All diabetic patients with foot complication
- 2] All the patient admitted and operated in our unit

Exclusion Criteria

- 1] All non-diabetics
- 2] Patients of other surgical units
- 3] Post traumatic patients
- 4] Patients with incomplete data for study were also excluded

OBSERVATION AND RESULTS

A total of 25 patients who fulfilled the above criteria were included in this study. The surgeries were done by different surgeons based on their call duty.

19 patients [76%] were males and 6 patients [24%] were females [Table 1]. The average age for males was 58.9 years with a range from 36 -80 years and

54.67 years for females with a range from 45 -62 years.

Sl No	Sex	Number	Percentage
1]	Males	19	76%
2]	Females	6	24%
	Total	25	100%

Table 1- showing distribution of TMA patients according to the sex

15 patients [60%] had TMA on right side, 9 patients [36%] had on the left side and one patient [4%] had bilateral TMA [Table 2].

Sl No	Side	Number	Percentage
1]	Right Foot	15	60%
2]	Left Foot	9	36%
3]	Bilateral	1	4%
	Total	25	100%

Table 2- showing distribution of cases according to the side involved

In 21 patients [84%], a primary (direct) transmetatarsal amputation[Table 3] was done without any preceding surgery. In 4 patients [16%], a secondary transmetatarsal amputation was done and it was preceded by either a debridement or a toe amputation before TMA was performed. 2 patients [8%] had preceding debridement and 2 cases [8%] had preceding toe amputation.

19 patients [76%] who underwent TMA had Type 1 diabetic foot complication, 1 patient [4%] had type 2

diabetic foot complication and 5 patients [20%] had type 3 diabetic foot complication [Table 4].

Sl No	Type Of TMA	Number	Percentage
1]	Primary	21	84%
2]	Secondary	4	16%
	Total	25	100%

Table 3- showing the distribution between primary and secondary TMA

Sl No	Type Of Diabetic Foot Complication	Number	Percentage
1]	Type 1 Diabetic Foot Complication	19	76%
2]	Type 2 Diabetic Foot Complication	1	4%
3]	Type 3 Diabetic Foot Complication	5	20%
	Total	25	100%

Table 4 -showing the distribution of TMA patients according to Amit Jain's classification of diabetic foot complication.

TMA was done in 13 patients [52%] with wet gangrene, 5 patients [20%] with non-healing ulcer having osteomyelitis, 2 patients [8%] with acute forefoot abscess (Figure 1), 4 patients with infected ulcers and 1 patient [4%] who had deformed toes along with ulcer [Table 5]. In this case TMA was done for biomechanical reasons.

22 patients [88%] with TMA had open stump (Figure 2) whereas 3 patients [12%] had a closed stump. 1 patient with closed stump got infected who later underwent debridement and open stump. 3 patients [12%] with TMA had simultaneous debridement

performed. 2 patient [8%] had grade 3 debridement and 1 patient [4%] underwent grade 4 debridement.

Sl No	Type Of Lesion	Number	Percentage
1]	Wet Gangrene	13	52%
2]	Ulcer With Osteomyelitis	5	20%
3]	Infected Ulcer [S/P Surgery Outside]	4	16%
4]	Ulcer With Deformed Foot	1	4%
5]	Acute Abscess	2	8%
	Total	25	100%

Table 5 showing the type of lesions resulting in TMA

Of the 5 patients [20%] with osteomyelitis, 2 patients [8%] had type 1 D osteomyelitis, 2 patients [8%] had type 1 C osteomyelitis and 1 patient [4%] had type 1 B osteomyelitis. TMA was done in Type 1 B osteomyelitis for biomechanical reason.

Sl No	Prior Amputations	Number	Percentage
1]	Ipsilateral Toe Amputation	6	24%
2]	Contralateral Toe Amputation	3	12%
3]	Contralateral Tma	1	4%

Table 6 showing TMA patients having prior amputation

6 patients [24%] who had undergone TMA had past history of ipsilateral toe amputation in past 5 years, 3 patients [12%] had contra lateral toe amputation and 1 patient [4%] had contra lateral transmetatarsal amputation [Table 6]. Hence 10 patients [40%] who underwent transmetatarsal amputation had prior

history of toe amputation, out of which 8 patients had these amputation within preceding 5 years of transmetatarsal amputation.

Sl No	Risk Category	Scores	Number	Percentage
1]	Low Risk	< 10	11	44%
2]	Moderate Risk	11-15	11	44%
3]	High Risk	16-20	3	12%
4]	Very High Risk	21-25	0	0%
5]	Inevitable Amputation	>26	0	0%
	Total		25	100%

Table 7 showing the distribution of TMA patients according to the Amit Jain's scoring system for predicting the risk for major amputation

5 patients [20%] ended up with major amputation in the same admission out of which 4 underwent below knee amputation and 1 patient underwent above knee amputation. 2 patients [8%] ended up in transtarsal amputation and 2 patients [8%] required further multiple debridement. Thus 9 patients [36%] who underwent transmetatarsal amputation required some form of surgery further after TMA.

2 patients [8%] had underlying peripheral arterial disease. They had undergone peripheral angioplasty. 1 patient did not show improvement and required below knee amputation.

11 Patients [44%] with TMA had scores less than 10 belonging to low risk category, another 11 patients [44%] belonged to moderate risk category. 3 patients

[12%] had score between 16- 20 belonging to high risk for major amputation category [Table 7].



Figure 1 -showing a patient who presented to us with acute forefoot abscess. Note the multiple incisions put over the foot to drain this abscess in another hospital. This patient ended up in transmetatarsal amputation. This is type 1 diabetic foot complication.



Figure 2 showing a patient with an open TMA stump.

All 3 patients with high risk scoring had major amputation whereas only 2 patient had in moderate risk had major amputation. All the patients with TMA belonging to high risk category actually ended up in major amputation. Only 2 patients [18.18%] out of 11

patients in moderate risk category actually ended up in major amputation.

DISCUSSION

Transmetatarsal amputation was popularised by McKittrick et al in 1949 as an alternative to below knee amputation^{6, 15}. It was originally performed for trench foot but recently it is being increasingly performed in diabetics and atherosclerotic patients with forefoot infection or tissue loss¹⁶.

A transmetatarsal amputation involves removal of the forefoot at the level of the metatarsal shaft with the aim of maximizing limb function by retaining a significant part of the foot¹⁵. The mid foot and the rear foot covered by the plantar load bearing tissues can maintain weight bearing and walking abilities¹⁷.

Patients with TMA maintain their independent gait^{15, 18} and have a functional result that is most superior in comparison to major amputation¹⁸.

Transmetatarsal amputation thus saves the increased energy expenditure by 25% in below knee amputees and 65% in above knee amputees¹⁷.

Despite the fact that transmetatarsal amputation is preferred over a below knee amputation, it is associated with significant failure rates and numerous complication that can result in more proximal amputation^{6, 19}. Various studies indicate a failure rate of TMA between 17-76%⁶.

Majority of our patients who underwent transmetatarsal amputation had type 1 diabetic foot complication. We compared our series with various other series on transmetatarsal amputation

In Mwiapatayi et al series²⁰, transmetatarsal amputation was performed in 62.8% of the diabetic patients whereas in Thomas et al series 78% were diabetics. In Thomas et al series¹⁶, the most common indication for TMA was gangrene [76%] followed by unhealed ulceration [24%]. Around 7.31% of their patient had osteomyelitis. Even in our study, wet gangrene {52%} was the commonest cause of TMA. 20% of our patient had underlying osteomyelitis with type 1 D and 1 C osteomyelitis being the commonest type of osteomyelitis requiring TMA.

8% of our TMA patient had underlying peripheral arterial disease and they had undergone peripheral angioplasties. In Thomas et al series¹⁶, 48.8% required arterial revascularization in TMA. The reason for this high prevalence is that they included both diabetics and non-diabetics in their study. Further, peripheral arterial disease is more common in western patients than in Indian patients.

In Thomas et al series¹⁶, 46% patient underwent primary closure of the TMA whereas in our study only 8% had primary closed stump.

The long term results of partial foot amputation are known to have a high failure rate that end in a more

proximal reamputation in 52% of the cases¹⁷. Upto 20% of people with diabetes who undergo some form of amputation return to the hospital for another amputation within a year²¹.

In Brown et al series²², 9.5% patients with transmetatarsal amputation required a further reamputation whereas in Dudkiewicz et al series²³, 26% with TMA needed higher amputation level and another 21.74% needed wound revision. In our study, 36% with TMA required some form of further surgeries with 20% of them ending in major amputation in the same hospital admission.

The mortality in transmetatarsal amputation ranges from 2-3%¹⁶. In our series there was no inpatient mortality.

CONCLUSION

As a salvage procedure, transmetatarsal amputation in diabetic foot patients requires importance and attention. Wet gangrene is the most common cause for transmetatarsal amputation in our series. Majority of the transmetatarsal amputation occurred in patients with type 1 diabetic foot complication. 44% of the patients had a score of less than 10 and another 44% had a score ranging from 11-15, thereby belonging to moderate risk category. 20% of patients with TMA ends up in major amputation in the same hospital admission. This study for the first time evaluates an

amputation using the new classification system that would improvise and standardize the practice of diabetic foot around the world.

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**INTERNATIONAL JOURNAL OF CLINICAL AND
SURGICAL ADVANCES**

ISSN-2321-9351

www.ijocsa.in