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Current Trends in the Management of Lower Limb Amputations

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Abstract

Background: Lower limb amputation is a major but preventable public health problem in a developing nation such as India. It is a burden for the patients as well as their families not only economically but also socially and psychologically. The duration of treatment lasts from a few days to several months and depends on the extent of disease, level of amputation and patient's comorbid status. The purpose of this study is to outline the demographics, various indications and the complications of lower limb amputations, the newer interventions in the management of lower limb amputations and to evaluate our experience in managing such patients presenting at a tertiary care hospital in South India.

Methodology: This is a prospective study done between the period of December 2019 and December 2020 at Sapthagiri Medical College and Research Centre, Bengaluru, Karnataka, India. All patients undergoing lower limb amputation during this time period were included in the study.

Results: A total of 50 patients were included into the study. Majority of the patients were males (72%). The most common indication for major limb amputation is peripheral arterial occlusive disease (PAOD) 50% and Diabetic foot in 36.96%. Below knee amputation was the most common procedure performed in 52.17%. The most common additional procedures performed were wound debridement in 23.91%, secondary suturing in 19.57%. Revision amputation rate was 8.7%. Post-operative complication rate was 39.13% and surgical site infection was the most common complication accounting for 17.39%. 8% of the patients underwent vascular interventions which prevented major limb loss.

Conclusion: Diabetic foot and PAOD of lower limbs that progressed to gangrene are the most common indications for lower limb amputations, majority of which can be prevented by health education and early presentation. Appropriate management by applying newer trends such as vascular intervention can help in reducing morbidity.

Keywords: Lower Limb, Comorbid Status, Vascular Intervention, Diabetic Foot.

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Introduction

Lower Limb amputation is one of the most ancient of all surgical procedures with a history of more than 2500 years dating back to the time of Hippocrates.[1,2,3] India is a vast country with a large number of individuals in the community with various disabilities. It had been estimated that there are roughly 0.62 amputees in India per thousand population.[4,5] According to the census of India 2011, out of the total population having disabilities, 20.3% belong to the category of disability in movement. The most common indications for amputation vary

from study to study. Trauma, complications of diabetes mellitus and peripheral vascular disease are some of the most common indications that are recorded.[6] Complications of diabetes mellitus is widely accepted as the most common cause for major limb amputation with figures ranging from 25% to 90% depending on the study.[7]

This is followed by non-diabetic vascular insufficiency and trauma.[8-10] Lower Limb amputation is considered the last resort when limb salvage has failed or when the limb is non-functional or endangering the patient's life i.e., sepsis.[2] The loss of a limb for any individual, has profound economic, social and psychological effects on the patient and their family.[11-14]

Risk factor modification, optimal medical therapy, and supervised exercise are the first line therapies for patients with intermittent claudication. However, revascularization is a critical component of treatment for individuals with severe symptoms or CLI. The different treatment goals of intermittent claudication and CLI have direct implications for the timing and choice of vascular interventions.[15]

This study focuses on the various indications, demographics and complications of lower limb amputation as well as newer strategies in the management of lower limb amputation at a tertiary care hospital in south India.

Methodology

It was a prospective study done between the period of October 2019 and December 2020 at Sapthagiri Medical College and Research Centre, Bengaluru, Karnataka, India. All cases of lower limb amputation done in the Department of General Surgery during this time period were included in the study.

Patients were recruited into the study after the decision to amputate the limb was made by the attending surgeon. The decision to amputate the limb, indications and levels of amputation were decided by the attending surgeon based on clinical evaluation and radiological investigations such as X-ray, CT Angiogram and doppler studies. A portion of the patients underwent lower limb revascularisation procedures. All patients' informed consent was taken before enrolling them into the study.

All surgeries were conducted under spinal anaesthesia. Above knee amputations were carried out using fish-mouth incision and below-knee amputations were carried out by the Burgess technique (long posterior myocutaneous flap) drains were placed in all cases and slab was applied. On post-operative day 4; dressing was removed and patient was made to mobilise and dressing done. Regular dressings were done in the post-operative period and in case of any post-operative complications like surgical site infection, stump gangrene or wound dehiscence, necessary measures were taken. Patients were subjected to regular physiotherapy in the post-operative period. All patients were followed for 3 months post discharge.

Results

A total of 50 patients underwent lower limb amputations during the period of this study. The age group ranged from 21 years to 75 years. Maximum number of amputations were done in the 40-60 years age group (56%) followed by 60-80 years age group (36%), (Table 1). Of these, 36 patients (72%) were male and 14 (28%) were female (Figure 1).

Table 1: Age Distribution.

Age Group	Frequency	Percentage
20 - 40 yrs	4	8
40 - 60 yrs	28	56
60 - 80 yrs	18	36
Total	50	100

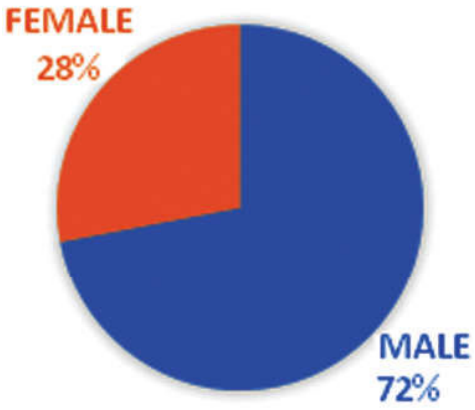


Fig. 1: Gender Distribution.

The most common procedure carried out was below knee amputation (52.17%). Above knee amputation was done in 21.74% of the cases, forefoot amputations in 4.35% cases, Ray's amputation in 8.7% cases and the remaining 13.04% cases underwent disarticulation of toes. (Figure 2).

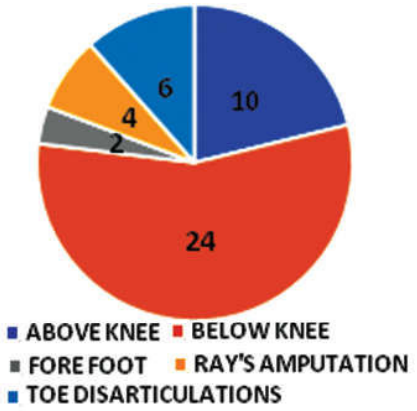


Fig. 2: Levels of Amputation.



Fig. 3: Picture: Dry gangrene of the right foot. On examination, dorsalis pedis artery, anterior tibial artery and posterior tibial artery pulsations were absent. Patient underwent below knee amputation.

Peripheral arterial occlusive disease (PAOD) was the main indication for the majority of the lower limb amputations in 25 (50%) patients, followed by complication of diabetes mellitus in 17 cases (36.96%) and trauma in 4 cases (8.70%). (Table 2)

Table 2: Indications for Amputation.

Indication	Frequency	Percentage
Paod	23	50
Diabetic Foot	17	36.96
Trauma	4	8.70
Other	2	4.35
Total	46	100

Out of the total number of amputees; 32 (64%) were tobacco consumers out of which 18 were tobacco smokers (bidis/cigarettes), 6 were tobacco chewers and 8 were both tobacco smoker and chewer. (Table 3)

Table 3: Tobacco Consumers.

Consumers	Frequency	Percentage
Smokers	18	56.25
Chewers	6	18.75
Both	8	25
Total	32	100

Post-op complications were seen in 18 cases (39.13%). The most common complication encountered was surgical site infection which was seen in 8 cases (17.39%). 4 patients (8.7%) developed wound dehiscence and 4 patients (8.7%) developed flap necrosis. 2 patients (4.35%) complained of phantom pain (Table 4). Pus from the surgical site was sent for culture sensitivity and the most common organism cultured was Staphylococcus aureus, seen in 66.67% of the cases. (Figure 4).

Table 4: Post-Operative Complications.

Complication	Frequency	Percentage
SSI	8	17.39
Flap Necrosis	4	8.7
Phantom Pain	2	4.35
Wound Dehiscence	4	8.7
None	28	60.87
Total	46	100

Additional procedures like wound debridement and secondary suturing were done in 23.91% and 19.57% cases respectively. Revision of stump was done in 4 (8.7%) cases and 6 patients (13.04%) underwent split skin grafting at a later stage. (Table 5).

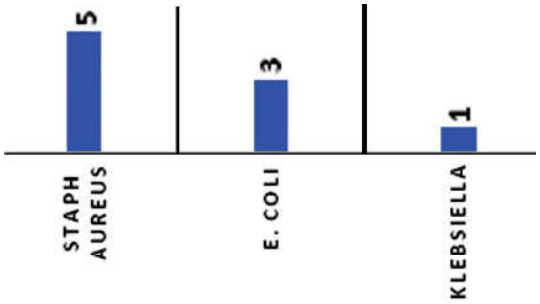


Fig. 4: Bacteriological Culture.

Table 5: Additional Procedures.

Additional Procedures	Frequency	Percentage
Stump Revision	4	8.7
Secondary Suturing	9	19.57
Split Skin Grafting	6	13.04
Wound Debridement	11	23.91
No Additional Procedures	16	34.78
Total	46	100

A total of 4 patients underwent revascularisation procedures. One patient underwent femoral artery thrombectomy, another underwent popliteal artery thrombectomy. Two patients underwent PTA. On follow up, the patients had good peripheral pulses and their symptoms were resolved (Table 6).

Table 6: Vascular Intervention.

Procedure	Frequency	Perccentage
PTA	2	50
Thrombectomy	2	50
Total	4	100

Discussion

Limb amputation was first described by Hippocrates in 460–377 BC and has since been a common surgical procedure performed by orthopaedic, general, vascular and trauma surgeons for therapeutic reasons and to save patients lifes. However, it is associated with profound economic, social and psychological effects on patients as well as their families.[1,2,3] According to Metz[16], the global prevalence of disability is 4% in developing countries and 7% in industrialized countries. The prevalence of disability in India according to a census report in 2001 is 1.8-2.2%.[17,18]

The male preponderance among amputees in our study (72%) is in agreement agrees with the findings by other authors.[11,12,19-21]

Majority of our patients were in the 40-60 years age group (56%) which is comparable with other studies.[3,11,21-23] Other studies reported even lower peak age incidence[24,25] which may be due to variation in the cause and patterns of amputation which tend to vary between hospitals in the country and between countries.

The causes of amputation in different countries are influenced by the standard of medical care available.[18] In our study, PAOD progressing to gangrene was the most common indication for major limb amputation (50%), followed by complications of diabetic foot ulcer (36.96%). This is against the trend of complications of diabetic foot ulcers being the most common cause of lower limb amputations as reported in other series.[22,25-28] This may be because tobacco consumption rates are high in India. According to Global Adult Tobacco Survey (GATS) carried out in India by MOHFW for 2019-2020, 34.6% adults are tobacco consumers out of which 47.9%are males and 20.3% are females. Amongst these 14% adults are tobacco smokers and 25.9% adults are users of smokeless tobacco.

In agreement with other studies[3,11,18,24] below knee amputation was the most common procedure performed (52.17%). Many other studies reported above knee amputation as the most common procedure performed as compared to below knee amputation.[10,21,24,30] Late presentation with spreading gangrene or advanced diabetic foot gangrene or malignant lesions involving the underlying bones may be the reason to opt for a higher level of amputation.[3,26,31,32]

The complication rate (39.13%) in our study is lower in comparison to other studies by Essoh et al.[11], Unnikrishnan E. P et al.[10] Surgical site infection was the most common complication in the present study and Staphylococcus aureus was the most common organism cultured. Similar microbiological trend was also reported by other authors.[11,21]

Rate of re-amputation in our study was 8.7%. This was lower than the rate of re-amputation noted in studies by Essoh et al[11] (23%) and Chalya et al[3] (9.9%). These differences in re-amputation rates may be due to presentation at a late stage with advanced disease.

Advances in imaging and endovascular technologies have greatly expanded the treatment options for patients with advanced PAOD. Patterns of occlusive disease in these patients are typically categorized by anatomical location as aortoiliac, femoropopliteal or infrapopliteal PAOD. The technical challenges and expected outcomes of revascularization treatment are strongly influenced

by both disease severity and anatomical location. Revascularization of short lesions in large vessels yields more favourable outcomes than large lengths of occlusion, more distal (infrapopliteal) disease, and involvement of smaller calibre arteries.[15]

A study by Jahyung Kim et al[33] quoted that between 2011 and 2016, the proportion of minor amputations among patients who underwent vascular intervention significantly increased from 19.34% to 21.45%, while the proportion of major amputations significantly decreased from 9.88% to 4.27%. This indicates that endovascular intervention has a role to play in lowering the level of amputation from a more morbid major amputation to a more acceptable and better adjustable minor limb amputation.

Conclusion

Complications of vascular insufficiency and diabetes mellitus are the leading indications for lower limb amputations. Most patients present at a late stage when gangrene has set in and are in the need of amputation. Diabetic patients need to be educated at an early stage of their disease regarding the potential complications of diabetes as well as the need to maintain proper glycaemic control and the importance of protective footwear. Patients with vascular insufficiency should be educated regarding the problems associated with smoking and tobacco consumption and should be encouraged to discontinue the same. All these measures will help prevent major amputation in an otherwise salvageable lower limb.

The use of endovascular interventions has played a major role in decreasing the number of major lower limb amputations in recent times and play a key role in the management of symptomatic patients who present early with salvageable limbs.

In the acute post-operative period, complications like SSI and wound dehiscence lead to prolonged hospitalization or readmission causing delays in early rehabilitation and prosthetic fitting thus influencing the patient's abilities to perform daily activities. Negative Pressure Wound Therapy (NPWT) in such cases helps expedite wound healing. It acts as a soft tissue splint to reduce tension on the incision line, decreases post-operative tissue oedema and ultimately seroma and hematoma formation.

Following amputation, early physiotherapy and appropriate prosthesis application are needed to achieve early rehabilitation raising a person's capacities to the maximum, reducing dependencies and improving the quality of life after disablement.

Hence, majority of these lower limb amputations can be prevented by health education and early presentation and appropriate management by applying newer trends such as vascular intervention and post-operative wound care and early rehabilitation can help in reducing morbidity.

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