Research Paper Medical Science

Major Limb Amputations- A Study of Hundred Cases

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ABSTRACT

INTRODUCTION: The loss of limb often has profound economic ,social, and psychological effects on the family. The deciphering of major causes of amputations in any given area is an important step in starting a programme to help minimize these mutilating surgeries and minimize post amputation rehabilitation costs.
AIM OF STUDY- The aims of this study were to find out major causes of amputations in drainage area of hospital , to find out the morbidity and mortality associated with amputations, to find out the frequency of various major amputations at various limb levels and their success rate and to find out the rehabilitation percentage in the patients undergoing amputations.
MATERIAL AND METHODS:- This prospective randomised study was conducted for two yrs period, all patients admitted and requiring major amputation by orthopaedic ,general and plastic surgeon were included in this study .
OBSERVATIONS : Diabetes related amputations were the leading cause followed by Peripheral vascular disease and trauma
CONCLUSION – Diabetes with its complications like vasculopathy, neuropathy and infection account for vast majority of limb amputations and this can be prevented by diabetes control and proper foot care

KEYWORDS

INTRODUCTION

The loss of limb often has profound economic ,social,and psychological effects on the family. In many situations , however , amputating a limb, ie resection through either the diaphysis or the metaphysic of a long bone , is the only effective option to save life of the patient .

This is for a simple reason, that the goals of patient care in case of limb trauma, vascular disease , diabetic complications ,infections, neoplasms are to optimize patient function and minimize morbidity , which might involve amputation as a better option for the patient,surgeon and the medical community instead of a tissue reconstructive [procedure

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Aims of study

The aims of this study were to find out major causes of amputations in drainage area of hospital , to find out the morbidity and mortality associated with amputations, to find out the frequency of various major amputations at various limb levels and their success rate and to find out the rehabilitation percentage in the patients undergoing amputations.

MATERIAL AND METHODS

This prospective randomised study was conducted for two yrs period from may , all patients admitted to and requiring major amputation by orthopaedic ,general and plastic surgeon were included in this study .

A simple Performa was designed to record the particulars of the patient as well as detailed history , clinical diagnosis , indication , level of amputation , post operative complication and number of post operative deaths

The level of amputation was determined by clinical consideration and in some cases supported by specialized investigation.

SURGICAL TECHNIQUES[1]

Below Knee Amputations

Design of the skin flap for below knee amputation depends on the distribution of gangrenous or infected tissue, the presence of surgical scar , documented ischemia. Three basic skin flap designs are utilized in the vast majority of below knee amputation.

Equal length anterior & posterior flaps

Creation of long posterior myocutaneous flap based on the underlying gastrocnemius & soleus muscles.

Creation of equal length medial and lateral flap via sagittal incision.

Long posterior flap technique is most commonly used owing to theoretical consideration related to the marginal blood supply to ischemic leg because the blood supply of posterior myocutaneous flap is more than the anterior compartment of leg

For routine below knee amputation, the level of tibia transaction is generally 10 to 12 cm below the tibial tuberosity; when indicated by local disease process this can be shortened.

Absolute minimum length of Tibia for below knee amputation is just below the tibial tuberosity because the insertion of patellar tendon must be preserved for knee extension. Skin incision should be placed 1 cm distal to planned level of tibial transaction.

Skin incision is begun on the anterior surface of the leg and is carried down to the tibia. It then follows the marked outline laterally &medially before turning distally initially penetrating only the skin & superficial fascia. The muscles of anterior compartment are then divided & the anterior tibial neurovascular bundle is identified, suture ligated proximally and divided. Following circumferential scoring of the periosteum of the tibia, a periosteal elevator is used to mobilize the periosteum to a point just proximal to the site of planned bone division. The tibia is then divided in a steep level to avoid pressure on the

overlying skin. The fibula is then transacted to a point 1 to 2 cm proximal to the tibial stump.

Once the bony structures are divided the posterior tibial and common peroneal neurovascular bundles are identified. The arteries, veins and nerves are suture ligated and divided. The posterior flap is then created, leaving the gastrocnemius and the soleus muscles at the base of the myocutaneous flap. The posterior muscle mass may require additional tailoring to form a flap that may be readily rotated anteriorly to appose the anterior skin over tibia. This levelling of the muscle flap must remove enough muscle so that end of the stump is not bulbous but caution must be exercised not to thin it so much that the tibia will have inadequate soft tissue coverage. The distal tibia is then bevelled at a 45-60 degree angle and all bony surfaces are smoothed with a rasp.

Complete haemostasis is essential followed by thorough irrigation with an antibiotic solution. A drain is usually not needed for amputations of an ischemic limb.

Posterior muscle flap is then rotated anteriorly and the fascia of the posterior flap is sutured to the anterior fascia using interrupted absorbable suture materials. Skin edeges are then approximated using interrupted vertical mattress monofilament sutures.

Use of rigid post operative dressing that incorporates the knee is ideal regardless of whether an immediate postoperative prosthesis is planned. A rigid dressing helps minimize edema , promote healing ,protect the stump in the vulnerable immediate post op period and prevent development of a flexion contracture.

2. Above Knee Amputations:
There are three general levels for amputation of the lower extremity above the knee. Owing to the inherent loss of the knee joint, the length of the residual femur is crucial, because of its function as the lever arm during prosthetic ambulation. In general, the longer the femoral shaft, lesser the energy required for prosthetic ambulation. Two basic incision designs are applicable to above knee amputation: the circular incision and the fish mouth incision.

Circular incision is placed 2-3 cm distal to the proposed site for femur transaction. Fish mouth incision has defined anterior and posterior skin flaps that are equal in length. Proximal extent incision lies at the level of bone transaction. The length of both flaps is at least half of anteroposterior diameter of thigh at the level of femur transaction.

Skin incision is carried out through skin, subcutaneous tissue, and deep fascia. Retraction of the skin and fascia superiorly allows division of the thigh muscles at more proximal level. Femoral arteries and veins are identified in the sub-sartorial canal and are individually controlled and suture ligated. All remaining muscles of anterior, medial and lateral position of thigh are transacted allowing their proximal retraction to see femur exposed.

At the site planned for bone transaction the periosteum is scored circumferentially and is elevated superiorly allowing transaction of femur well above the skin incision. The sciatic nerve is isolated, ligated and divided while gentle traction is applied over it and then allowed to retract after its division. Now the posterior musculature is divided.

Roughened edges of femur are smoothened. Thorough irrigation of wound with antiseptic solution is then done. Proper haemostasis achieved and Negative suction drain is placed

Wound is closed in layers. Muscles are sutured with each other over the distal end of femur. Skin is closed with interrupted monofilament suture.

3. Forearm Amputations (Transradial):
In amputations through the forearm, as elsewhere, preserving as much length as possible is desirable. However, when circulation in the upper arm extremity is severely impaired, amputations through the distal third of the forearm are less likely to heal satisfactorily than those at a more proximal level because distally the skin is often thin and the subcutaneous tissue is scant .Furthermore, the underlying soft tissues distally consist primarily of relative avascular structures such as fascia and tendons.

OBSERVATIONS
The study conducted with 100 patients as subjects in GG hospital, Jamnagar provided the following statistics for the amputation related cases. The statistics provided below are also compared with the studies conducted in other parts of the world.

TABLE 1
Age and sex distribution of major limb amputation

Age	Male	Female	Total
< 20	2	0	2
21-30	4	4	8
31-40	8	1	9
41-50	15	4	19
51-60`	19	10	29
61-70	16	5	21
71-80	6	2	8
>80	0	4	4
Total	70	30	100

In the study conducted 100 patients underwent major limb amputations, 70 of them being male (70% of total patients) and 30 females (30 % of total patients)

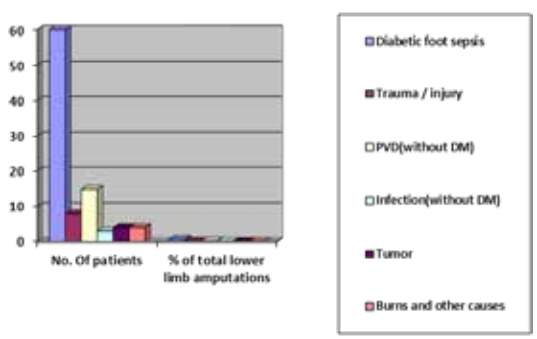
Maximum number of patients were in the age group 51-60 years with mean age being 51.4 years for males and 56 years for females.

Table 2
Socio economic status :

Socio economic status	No of patients	% of total
Lower class	88	88
Lower middle class	10	10
Upper middle class	2	2

A look at the socio economic status of the patient undergoing amputations shows that majority i e 88% belonged to lower class and 10% belonged to lower middle class and 2% belonged to upper middle class.

Graph 1
Indications of major lower limb amputation



In the study conducted 94 patients underwent major lower limb amputations for varying indications.

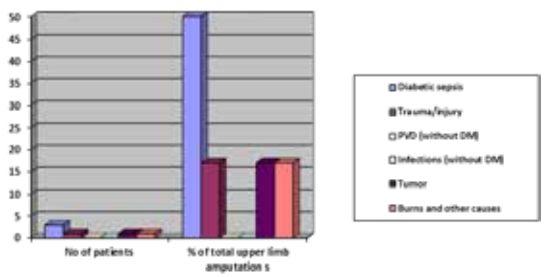
Maximum no of amputation were performed for diabetic foot sepsis. In the study 60 patients both male and female underwent major lower limb amputations for diabetic foot sepsis. This amounted to 63% of total lower limb amputations.

Peripheral vascular disease without diabetes was second among the indicators for lower limb amputations amounting for 16% of total lower limb amputations.

Trauma accounted for 9% of total lower limb amputations with 9 patients loosing their limbs because of trauma.

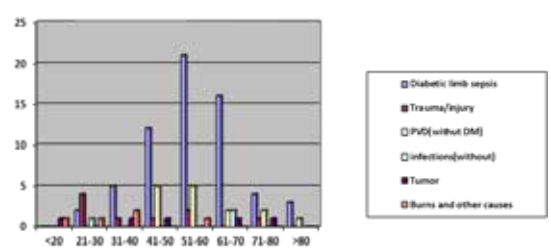
Rest of the 8 cases of amputations were equally distributed among tumors and burns as their cause.

Graph 2
Indications of major upper limb amputation



Few major upper limb amputations were performed during the study period with major chunk of upper limb amputation being performed for diabetic upper limb sepsis ; this amounted to 3 out of total 6 upper limb amputation (50%). Rest of the major upper limb amputations had trauma, tumors, and burns as their causes, each contributing equally.

Graph -3
Age incidence of various causes of amputation



Diabetes : most of the diabetic amputations were performed in the age group of 51-70 years. 58% of the amputations due to diabetic sepsis were performed in this age group involving 63 patients out of total 100 patients.

Trauma : 50% of amputation due to trauma occurred in age group 21-40yrs

PVD without DM: 67% of amputations related to PVD occurred in age group of 41-60 years with 10 out of total 15 patients having PVD belonging to this age group .

Table -3
Type of diabetic lesions

Lesion	No of patients	% of total diabetic foot lesions
Infection	75	75
Vasculopathy	8	8
Neuropathy	6	6
Mixed	11	11

Table 4
General complications of limb amputations

General complication	No of patients	% of total
Deaths	10	10
Malnutrition	22	22
Decubitus sacral ulcer	3	3

Table 5
Local complications of limb amputations

Local complication	No of patients	% of total
Wound infection	70	70
Flexion contracture	9	9
Reamputation	13	13

Table 6
Comparison with study at Trinidad

Indicator	Present study	Trinidad
Male to female ratio	2.3:1	1.4:1
Mean age of male	51 yrs	64 yrs
Mean age of female	56 yrs	73 yrs
Indications Diabetes PVD Trauma Tumours Burns	 63% 16% 9% 4% 4%	 57% 13% 3% 1% 0%
Final amputation level (lower limb) Below knee Above knee	 56% 44%	 37% 63%

DISCUSSION

According to Metz, the global prevalence of disability is 4% in developing countries and 7% in industrialized countries[2] The prevalence of disability in India according to a census report in 2001 is 1.8-2.2%.[3]

The overall result of the study presents a disturbing trend. Overall there has been an increase in incidence of DIABETES related amputations, even in today's era of improved asepsis, better control of infection with antibiotics, better glycaemic control with oral anti diabetic drugs, as well as insulin preparations and availability of vascular reconstructive procedures.

The other major causes have been PVD leading to ischemic gangrene / non healing ulcer; and trauma, be it vehicular or accidental. This is a sequel of improved lifestyle and fast life.

The present study shows predominance of male sex, with 70% of patients undergoing amputations being male and 30% female. On comparison, the study at Ghana[4] put the male patient percentage undergoing amputation at 72% and female at 28%, while the study at Trinidad[5] showed figures of 58% for males and 42% females.

A look at the age distribution of amputated patients shows a peak at the age group of 51-60 yrs, with 19 male patients and 10 female patients in this age group undergoing amputations. Overall, the middle age group i.e. 41-70 years had the maximum concentration of patients undergoing amputations.

The mean age found to be 51.4 years for males and 56 years for females in the present study. Whereas, figures for the same were 52.4 years for male and 60.16 years for females at the study conducted at Ghana[4] and 64 years for males and 73 years for females at Trinidad.[5]

A look at the socio economic status of the patient undergoing amputations shows that majority i.e.88% belonged to lower class and 10% belonged to lower middle class and 2 belonged to upper middle class. This could have been due to higher number of patients belonging to poor socio-economic status getting admitted in our setting.

A look at the indications for lower limb amputations shows that the major chunk is related to diabetic foot lesions with 63% of patients having their lower limb amputated due to this. This is in similar contrast to study at Trinidad[5] where the diabetes related amputation rate was 57% and as per national health statistics of U.S.[6] a rate of 67% has been observed at U.S. The study at Ghana[4] put the statistics at 46% diabetes related amputations rate. The study at Nigeria[7] accounted for 26%. In a Study in Kenya[8] ,diabetes mellitus with its complications was as common as trauma, each accounting for 26.5% of major amputations.

A look at the underlying lesions amongst the diabetes related amputations shows a predominance of infective related amputations amounted by 75% of cases. Infections seem to play a central role in etiopathogenesis of diabetic foot lesions. Various presentations of infective lesions in the present study were ulceration, abscess or spreading infection.

Blackening of the toes was presenting features in 8% of cases due primarily to ischemia proximally.

Neuropathic ulceration was presenting feature in 6% of cases with non healing ulcer.

11% of patients had a combination of neuropathic, ischemic and infective components, accounting for diabetic foot lesions leading to limb amputation.

The other major contributor to lower limb amputation has been Peripheral vascular disease without diabetes. This accounted for 16% of total lower limb amputation in present study, while a rate of 13%was observed at Trinidad[5] and 11.8% at Ghana[4].

Lower limb trauma for 9% of total lower limb amputations, most of them being road traffic accidents. Trauma accounted for 3% of amputations in study at Trinidad[5] and 29.4% at Ghana[4]. Crushed Limbs are usually in jeopardy of being amputated, especially when the blood supply is compromised. These Limbs may be salvaged by revascularization and stabilization of fractures, but the procedure may not be successful. To This end, several systems have been devised to predict the success of limb salvage in crushed limbs.These Include the Mangled Extremity Severlty Score (MESS)[9] and the Mangled Extremity Syndrome Index (MESI).[10] A MESS Of three-to-six was associated with viable limbs, while a score of seven-to-12 ultimately required amputations[9].A MESI of 20 was the dividing line below which limb salvage was probable and above which limb amputation was 100%.[10] The Predictive value of MESS has been confirmed.[11]

Tumour like Sq. Cell carcinoma osteosarcoma, lymphangiosarcoma accounted for 4% of total lower limb amputations, while a rate of 1% was observed at Trinidad[5] and 8.8% at Ghana.[4]

Burns accounted for a lower limb amputation rate of 4% in present study.

A look at the statistics of upper limb amputations shows a major chunk of upper limb amputation being performed for diabetes related lesions. The rest of the causes of upper limb amputations were trauma, tumors and burns each contributing equally towards the total no of upper limb amputations.

A look at age-specific incidence for various indications of amputations shows that diabetes had the maximum concentration in the age group of 51-70 years, with 58% of total diabetes related amputation in this age group. However the study at Ghana[4] showed the age group with maximum number of amputations due to diabetes being 60-79 years.

Peripheral vascular disease without diabetes, as a cause of amputations was prevalent in 41-60 years age group.

Due to trauma, maximum numbers of amputations were performed in 21-40 years age group with 50% of trauma related amputations performed in this age group with a similar trend in study at Ghana.[4]

Amputations due to tumours were randomly distributed in various age groups. No specific age pattern for tumours was found with amputations for tumours even being performed in below 20 years age group.

Burns as a cause of amputations was found to involve mainly the relatively younger age group of 21-40 years with 4 amputations out of total 5 burns related amputations performed in this age group.

A look at final LLA level, a determinant of the energy expenditure and factor contributing to relative functional independence, showed a predominance of below- knee amputations with 56% of total lower limb amputations being below knee and 44% of total major lower limb limb amputations being above –knee leading to BK TO AK amputation ratio of 1.27:1.

A comparison with the figures from other studies showed a 63% above –knee and 37% below –knee amputation rate at Trinidad[5].

The ratio of BK to AK at Trinidad was 1:1.27[5]

In upper limb 4 above elbow and 2 below elbow amputations were performed.

There were no major intraoperative complications.

Post operatively there were 10 deaths with 8 deaths occurring within 2 weeks of amputations and 2 deaths occurring in periods thereafter.

A look at the basic causes behind these deaths shows septicaemia being a major factor behind these with 7% of deaths occurring due to septicaemia leading to cardiovascular arrest and 3 % due to acute MI/cardiac condition.

Malnutrition was observed in 22% of patients undergoing amputation with psychological stress being a major contributing factor for this.

Decubitus sacral ulcers occurred in 3 patients due to prolonged immobilisation, due to psychological factors, excessive body weight which hindered mobilization and improper back care.

Wound infection occurred in 70% of patients undergoing various amputations. All in all 40 patients had minor wound infection which responded to daily dressing and antibiotics followed by either secondary closure/split skin grafting.

10 patients had refreshing of the amputation stump, while reamputation had to be performed for 13 patients, who initially underwent an amputation at below –knee level, due to uncontrolled infection. No below-elbow amputations had to be converted to above-elbow.

Rehabilitation statistics present a gloomy picture, with few patients undergoing physical rehabilitation. Only 37 out of total 100 amputees used crutches as rehabilitation measure, while prosthesis was used only by 21 patients. Rest of the patients used neither crutches nor prosthesis and were dependent on other for their living.

Effect of amputation on functional competence

Different prevalence rates for disability are available in India. According to the Census 2001[3], there were 21 million people with disabilities in India, who constituted 2.13 % of the total population; the total figure includes persons with visual, hearing, speech, locomotor, and mental disabilities. Prevalence rates have shown declining trends during 1991- 2002 for all

disability types except locomotor disability[12]. One of the major reasons for this might be increasing trends of amputation in India.

According to the guidelines and gazette notification issued by Ministry of Social Justice and Empowerment on June 13, 2001[13] , Permanent Physical Impairment (PPI) for various levels of amputation is as follows: below-knee amputation, 70%; through-knee amputation, 75%; above- knee amputation, 85%; below-elbow amputation, 70%; above-elbow amputation, 85%; through-hip amputation, 90%; through-shoulder amputation, 90%; and through-ankle amputation, 55%.

According to this classification, a person with lower limb amputation has a PPI of 70% and above (except for through-ankle and Syme's amputations). Compared with the general population, amputees were more likely to report a need for the help of another person in one or more activities of daily living

Hence, it can be concluded that lower limb amputation not only affects people's ability to walk, but may affect their participation in valued activities, their body image perception, and their quality of life, which is significantly associated with mobility. The reduced ability to walk with a prosthesis is associated with lower activities of daily living scores and a lower level of social activity

CONCLUSION

Diabetes has emerged as the first and foremost cause behind the Lower limb amputations with the infection playing a central role in the etiopathogenesis .Regarding the diabetes related amputations, it has been found that most important component in reducing their incidence lies in the old saying:-

"Prevention is better than cure".

That is to stress on foot care as the essential and most important step in reducing the incidence of diabetes related amputations.

Apart from diabetes, trauma specially in younger age people highlight the economic, social and health impact of major amputation in our country. Young, economically active men, may become dependent following an amputation. They are no longer able to support the older diabetics who may need even more social and economic support following a major amputation.

The need to halt this trend is self-evident as the resources to support dependent citizens are not available.

A look at the rehabilitation statistics again provide us with a picture which needs significant improvement; that is to educate people regarding the facilities available, making the prosthesis available at reasonable cost and improving the quality of prosthesis along with their functional abilities.

Large scale health education programmes are needed in four main areas:-

To improve diabetic control and foot care and thus reduce infection and progression to gangrene .

T0 reduce the number and severity of road traffic accidents and car crashes that lead to severe limb injuries.

To encourage healthy lifestyle as we discourage cigarette smoking thereby protecting our people against the risk of non – diabetic vascular insufficiency.

To educate amputees regarding the life after amputation and the rehabilitation facilities available.

Health educational programmes that stress behaviour change can reduce the incidence and complications of diabetes and other causes of amputations..This could be an inexpensive way of preventing amputation in our environment.

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