

“A Clinical Study of Etiopathogenesis of All Lower Limb Amputation

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I. Introduction:

The word amputation is derived as (amputates: Latin) means to cut off. Amputation in medicine is surgical removal of all or a part of a limb or a projecting part / process of the body. Amputation should be considered when a part of a limb is dead, deadly or a dead loss.

Indications for amputations:

- Dead limb: Gangrene
- Deadly limb: Wet gangrene
- Spreading cellulitis
- ArterioVenous fistulas
- Others (eg: malignancy)
- Dead loss limb: Severe rest pain with un-reconstructable critical limb ischaemia
- Paralysis
- Others (e.g.: contractures, trauma)

The patient must be medically evaluated completely before doing amputation, so that post-operative complications and recovery can be anticipated.

Amputation is a life changing surgery. AIMS AND OBJECTIVES

AIM:

The present study was undertaken to study the various etiological factors and pathogenesis of all lower limb amputation.

OBJECTIVES:

1. To study various risk factors and etiological factors.
2. To study the usefulness of investigations including Doppler.
3. To study the post-operative complications of lower limb amputations.

II. Materials And Methods:

The study will be a prospective, hospital based, time bound descriptive study. Cases available during the period from November 2020 to October 2021 in our hospital satisfying the inclusion criteria will be taken into consideration.

Expected number of cases 50.

INCLUSION CRITERIA:

1. All the patients of age group between 30-70 years
2. Patients of both sexes are included
3. Patients who are admitted under emergency and electively in surgical wards and planning for amputation in Siddhartha Medical College and Government General Hospital, Vijayawada
4. Patients who gave consent for different lower limb amputations and are willing to participate in the study

EXCLUSION CRITERIA:

1. Traumatic amputations.
2. Amputations due to malignancy like bone tumors and soft tissue tumors.

3. Amputations due to electrical injury.
4. Patients who are not willing for amputation and consent for study.
5. Post CABG / major health problems.
6. Minor amputations which are done on OP basis are not taken into this study.

METHODS:

The patients who came to hospital with complaints of wound / pain / blackish discoloration of lower limb were assessed thoroughly by a detailed history, clinical examination and relevant investigations.

The following details were collected by a questionnaire apart from name, age, sex, educational status, address. Presence of comorbidities like DM, HTN, CAD, CVA, Hypo/Hyperthyroidism.

Duration of diabetes if present.

Any habituations especially smoking.

Patient was clinically assessed for anaemia and hypoproteinaemia, and then limb was assessed for peripheral vascular disease (by non-palpability of one or more foot pulses in the effected limb and Doppler.)

III. Observation And Results:

From the present study the following results were observed. Etiology and risk factors associated with amputations in lower limb are

1. AGE INCIDENCE :

Total no of patients : 50 Age range : 30-70 years

The mean age of patients undergoing amputation : 55.08 years

Age group (in years)	No of subjects
30 – 40	5
40 – 50	10
50 – 60	20
60 – 70	15
Total	50

Table no 1: Showing various age groups in the present study subjects.

Lower limb amputations were most commonly done in the age group of 50-60 years followed by 60-70 years. The low rate of amputations in the older age group is mostly probably they will not present to the hospital immediately.

2. SEX INCIDENCE :

Total number of patients : 100 Males 35 , Females 15

Sex	No of subjects
Male	35
Female	15
Total	100

Table no 2: Showing sex distribution in the present study Male to female ratio in the present study is 2.2 : 1 Amputations were most common in males compared to females.

3. SMOKING :

Smoker	No of subjects
Yes	18
No	32
Total	50

Table no 3: Showing smoking status in the present study subjects

37% of the study subjects are smokers, which is a significant percentage. 3% of them are females. 63% of the study subjects are non-smokers.

4. DURATION OF DIABETES :

Table no 5 : showing duration of diabetes in diabetics

Duration of diabetes	No of subjects
Denovo	3
≤ 10 years	8
11-14 years	11
≥ 15 years	13
Total	35

Prolonged duration of diabetes is major risk factor for the development of complications and might land up the patient with amputation. However, the actual duration of diabetes may vary because of the delay in the diagnosis / presentation. Out of 71 diabetics 69.01% of them had diabetes from more than 10 years.

5. RANDOM BLOOD SUGAR :

Table no 6 : Showing Random blood sugars at the time of admission in the study subjects

RBS at the time of admission	No of subjects
< 140 mg/dl	12
140-200mg/dl	15
>200mg/dl	23
Total	50

In this study 45% of study subjects had a blood glucose level of more than 200 at the time of admission.

6. HBA1C VALUES :

Table no 7 : Showing HBA1C values in the diabetic patients

HBA1C values	No of subjects
< 6.5%	8
6.5% - 8%	12
>8%	15
Total	35

HBA1C values are measured in diabetic patients only. In the present study, out of 35 diabetic patients 76.05% of them had poor glycaemic control indicated by HBA1C of more than 6.5.

7.RENAL FUNCTION TESTS :

Table no 9 : showing serum creatinine levels in study subjects

	Serum Creatinine (mg/dl)	No of subjects
Normal patients	< 1.9	35
Patients with ARF	>1.9	10
K/C/O CKD patients	<3.9	3
K/C/O CKD patients	>3.9	2

19% of patients presented with acute renal failure and 12% of people are having chronic kidney disease.

8.ETIOLOGICAL FACTORS :

Table no 10 : Showing etiological factors leading to amputation

Etiology	No of subjects
Diabetic foot	23
Peripheral vascular disease	9
DM + PVD	13
Others like soft tissue infection, gas gangrene	5

Etiological factors like diabetic foot, peripheral vascular disease, soft tissue infections, gas gangrene are studied. Other causes like trauma, bone tumors and electrical injuries have been excluded. Diabetes has resulted

in amputations in 71% of cases. 44% people had peripheral vascular disease. Majority of the cases 26% had both diabetic and peripheral vascular disease as the cause.

9. ARTERIAL INSUFFICIENCY IN THE AFFECTED LIMB :

The arterial status of the affected limb was assessed by recording the ABPI

Table no 11 : Showing Ankle brachial pressure index distribution in study subject

ABPI	No of subjects
≤ 0.4	9
0.5 – 0.8	14
≥ 0.9	18
Total	41

In this study, out of 41 patients 21.95% of them had critical limb ischemia indicated by ABPI of less than or equal to 0.4.

10. DOPPLER STUDY :

Table no 12: showing various Doppler findings in patients undergoing amputation.

Doppler changes	Study subjects
DAC with no / 10-20% narrowing of vessels	12
DAC with 30-40% narrowing of vessels	10
DAC with 50% and above lumen narrowing	12
Other changes	16

DAC – Diffuse atheromatous changes

In this study 67% of patients had diffuse atheromatous changes indicating degenerative changes in vessels, but significant narrowing 30% and above is seen in 44% of patients. Patients with 50% and above narrowing of vessels landed up in major amputations. So with Doppler analysis appropriate treatment can be planned. In patients with significant narrowing of vessels we can directly go for major amputations as there is no role for conservative management (debridement, minor amputations) in such cases especially in places where advanced treatment like vascular / endovascular treatment is not available.

11. PROCEDURE DONE :

Table no 13 : showing the various procedure done in study subject

Procedure done	No of subjects
Toe disarticulation and Ray amputations	9
Fore foot amputation	1
Below knee amputation	25
Guillitone surgery	5
Knee disarticulation	0

Most commonly done amputation is below knee amputation followed by above knee amputation. Some patients does not get admitted and they were sent on OPD basis after doing a minor amputation like toe disarticulations and ray amputations. In this study only in-patients are taken into consideration. This is why minor amputations are less in this study Out of 5 Guillitone surgeries done, 3 cases were proceeded with Below knee amputation and 2 cases were proceeded with above knee amputation. 2 cases of post op below knee amputation were managed with conversion to above knee amputation. These are considered under above knee amputation group.

12. POST OP COMPLICATIONS:

Table no 14: Showing postoperative complications in study subjects

Complications	No of subjects
Wound infection	27%
Stump gangrene	7%
Phantom limb	1%
Death	2%

The most common post operative complication is wound infection which accounts for 27%. This high percentage is probably due to the severe wound infection that is there prior to the surgery and also because of the poorly controlled blood sugars.

Post operative phantom pain is probably due to inadequate pain control prior to surgery.

Out of 4 cases of below knee amputation stump gangrene, 3 cases were managed with revision amputation and the other 1 case was managed with conversion to above knee amputation.

We lost one case in the post operative period. One is post operative case of above knee amputation. He presented with gas gangrene right leg with acute renal failure with septicaemia with pulmonary edema. Another case is right diabetic foot ulcer with chronic kidney disease managed with right below knee amputation.

13. PUS FOR CULTURE AND SENSITIVITY :

Table no 15: Showing the cultured organism from wounds in study subjects

Organism identified	No of subjects
Proteus vulgaris	6
Pseudomonas	7
Klebsiella	1
Staphylococcus	1
Polymicrobial	3
Sterile	6

In 37% of patients an identifiable organism can be cultured, and majority of the cases are due to pseudomonas and proteus infections.

IV. Discussion :

In this study 50 cases of amputation were studied from November 2020 to October 2021 with various risk factors and etiological factors, pathogenesis, post operative complications are studied.

The present study had included patients with age range from 30-70 years with a mean age of 55.08 years is compared to Q. Alijarrar study, G. Kiran kumar et al study and Unnikrishnan E.P et al study.

The mean age of the population in this study was 55.08 years, which is relatively younger than that of other study populations in the literature. This can be explained by the fact that Diabetes mellitus is known to increase the risk of amputation at a younger age, especially when the individual had acquired Diabetes at a young age.

The low rate of amputations in the older age group is mostly because they will not present to the hospital immediately.

However, the present study is comparable with G. Kiran kumar et al study and it is slightly lower when compared with Q. Alijarrar et al and Unnikrishnan E. P et al study.

In the present study total 50 patients are studied out of which 35 patients were found to be males and 15 were females with a ratio of 2.2 : 1. This study was compared to other studies like Q. Alijarrar et al, G. Kiran kumar et al and Unnikrishnan E. P et al study with respect to sex distribution.

Smoking is an important risk factor for both Diabetes and peripheral vascular disease. 37% of study subjects are smokers out of which 3% are females. Out of 18 Smokers 12 patients had Diabetes mellitus and 15 patients had peripheral vascular disease. Out of 18 people, 3 people landed up in minor amputation, 10 patients in below knee amputation, and 5 people underwent above knee amputation. Overall smokers mostly (12 out of 18) landed up in major amputation. In this study 80% of people had primary schooling or lesser education. This is very high when compared to western studies. Education might have probably reduced the incidence of amputation because they can understand the knowledge regarding proper and adequate foot care to be taken in a better way than illiterates. The importance of regular health checkups, diabetes control is well understood by them, which will prevent the patient from landing up in amputation. The utility of the health care facilities is

also less likely (Adams AS et al).

Kumar, Walters, have found that increasing duration of diabetes is a risk factor for amputation. In this study, majority of the patients had long duration of diabetes. In the present study 71% had diabetes and 69.01% of them had diabetes from more than 10 years.

Studies by Carrington et al, showed that strict glycaemic control can prevent amputation in diabetic foot. In this study, 45% of the subjects had a blood glucose level of more than 200 mg/dl at the time of admission and 76.05% of diabetics had poor glycaemic control with HBA1C value of more than 6.5%.

According to Dickhaut SC et al study serum albumin level of > 3gm/dl is necessary for adequate wound healing to occur. In this study, 53% of the subjects had serum albumin value of < 3gm/dl which might be responsible for delayed wound healing and wound infection. Wound infection is the most common post operative complication because of the fact that the patients had severe sepsis that is there prior to amputation, poor glycaemic control, malnutrition indicated by low serum albumin levels and low haemoglobin concentration levels. So, pre operative improvement of the nutritional status by giving high protein diet, whole blood/packed cells transfusion, injection human albumin infusion helped to overcome sepsis to a certain extent and promoted wound healing post operatively.

The etiological factors responsible for / resulting in amputation may vary from place to place, but a definitive trend is followed in a geographic area. In this study diabetes, peripheral vascular disease, soft tissue infections were studied. Trauma, electrical injuries, bone tumours have been excluded. Out of the factors studied diabetes (71%) is the most common factor leading to amputations in lower limb.

Out of 35 diabetics 20 people underwent below knee amputation and 6 people landed in above knee amputation. Studies done in developed countries shown trauma as the leading cause for amputation.

In this study diabetes is the most common cause for lower limb amputations, which is in accordance with G. Kiran kumar et al study.

In the present study 56.09% patients (23 patients out of 41 had ABPI of less than 0.9) had arterial insufficiency. This is in accordance with studies conducted by Kumar et al and Walters et al., 21.95% patients in this study (9 patients out of 41 had ABPI of less than or equal to 0.4) had critical limb ischemia.

In this study 67% of patients had degenerative changes that is diffuse atheromatous changes in doppler, but significant narrowing (lumen narrowing of 30% and above) is seen in 44% of patients. If there is 50% or above narrowing of lumen the patients mostly landed up in major amputations. Out of 25 below knee amputation cases 8 patients (31.37%) had significant lumen narrowing of 30% and above in Doppler and out of 15 above knee amputation cases 9 patients (66.51%) had significant vessel narrowing in Doppler. So early Doppler analysis is helpful in planning the treatment. Patients with significant narrowing of major vessels like femoral and popliteal ended up with above knee amputation.

Post operative complications like wound infection, stump gangrene, phantom pain and death rate were studied and compared with other studies like G. Kiran kumar et al and Unnikrishnan E. P et al studies.

Out of various complications studied, wound infection (27%) is more common in present study which is in accordance with G. Kiran kumar et al and Unnikrishnan

E.P et al studies. The highest rate of wound infection is probably due to the severe sepsis the patient had before / prior to amputation.

18 patients had infective pathology, out of them 15 people were found to be diabetics. Majority of infections are due to pseudomonas and proteus. Based on the culture sensitivity report the patients were treated with appropriate IV antibiotics depending on the sensitivity of the organism. So timely treatment with appropriate antibiotic is also an important step in the post operative wound management.

V. Conclusion :

The mean age of patients undergoing amputations in the present study is 55.08 years. The majority of the patients undergoing amputation in the present study are males which accounts for about 69%, 37% of the study subjects were smokers. If the education status is less they are not aware of preventive steps to be taken and they will finally land up in amputations and land up in postop complications by not taking proper wound care and glycaemic control. Diabetics with poor glycaemic control had landed up in amputations which accounts for about 76.05% of Diabetics. Most of the people with peripheral vascular disease had landed up in major amputations. 71% of patients had metabolic derangement (DM), 67% had degenerative pathology (diffuse atheromatous changes) in arteries and 37% had infective pathogenesis. Majority of the patients with anaemia and hypo proteinemia landed up in amputation. 19% of the patients in the present study had acute renal failure due to severe sepsis like gas gangrene, diabetic foot and cellulitis. They are managed with intravenous fluids and diuretics depending on the patients condition. Patients with critical limb ischemia and arterial narrowing of 50% and above had landed up in major amputations. Majority of the infections are due to pseudomonas and proteus species. Below knee amputations are most commonly done surgery in 51% followed by above knee amputation 29% in this study. Wound infection is the most common post operative complication which

accounts for about 27% in this study. With advances in endovascular / vascular surgeries eventually the number of amputations carried out has decreased, but still many patients are landed up in amputations and for some people amputation is a lifesaving surgery. Major amputations especially in young people will have devastating effect on socioeconomic status of the family, and also on the mental health of the patient. With advances in prosthesis and rehabilitation facilities these problems can be minimized to some extent. But the most effective step should be towards the preventive aspect.

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