

Major Amputations of Limbs in Vascular Surgical Unit of Cenhosoa Antananarivo

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Abstract

Background: Major amputations of limb are a major surgical procedure, associated with profound economic, social, and psychological effects on the patient and family. The aim of this study was to describe etiology and outcomes of major limb amputations in Vascular Surgical Unit of Cenhosoa Antananarivo.

Materials and Methods: This was a retrospective and descriptive study for a period of 10 years from January 2011 to December 2020, performed at Vascular Surgical Unit of Cenhosoa Antananarivo, including all patients underwent major amputation of limbs. Demographic data, surgical indications, cardiovascular risk factors, level of amputation, surgical procedures, and outcomes were analyzed.

Results: Eighty-seven patients were recorded, including 72 males (82.75%) and 15 women (17.24%). The average age was 56.34 years old. The reason of amputations was diabetic gangrene (62.06%), peripheral arterial disease (20.68%), embolism (9.19%), trauma (5.74%), and tumors (2.29%). The most risk factors of cardiovascular disease were male older (72.34%), high blood pressure (81.60%), diabetes mellitus (62.06%), and smoking (52.87%). Amputations were located in the lower limb for 85 patients (97.70%) and in the upper limb for 2 patients (2.29%). The most common levels of amputation were the thigh (55.17%) following by the leg (42.52%). Amputations were performed using regional anesthesia (72.34%) and general anesthesia (17.56%). The hospital mortality rate was 6.89%.

Conclusion: Diabetic gangrene was the most indication of major amputation of limb. Early detection and management of diabetes mellitus and other cardiovascular risk factors could reduce amputation rate in our patients.

Keywords: Amputation, Diabetes mellitus, Gangrene, Limb, Peripheral arterial disease

INTRODUCTION

Major amputation is common surgical procedures in vascular surgery, defined as the loss in the transverse anatomical plane at or above to the ankle or wrist joint. Amputation constitutes the latest therapeutical alternative in vascular or orthopedic surgery, used if the limb's salvage attitudes have been exhausted. The lower extremity amputation represents a significant burden on global health systems. There are nearly 2 million people living with limb loss in the United States and

the main causes are vascular disease (54%), trauma (45%), and cancer (<2%).^[1] In Europe, the average annual incidences of major lower limb amputations are approximating 30/100,000 population in the Central and Eastern European countries and 20/100,000 population in Western European countries.^[2] The truth prevalence of major lower limb amputation in African countries remain unknown. However, few studies have been reported the prevalence of hospital of major limb amputation in sub-Saharan African literature. The aim of this study was to describe etiology and outcomes of major limb amputations in Vascular Surgical Unit of Cenhosoa Antananarivo.

MATERIALS AND METHODS

Study Design

We conducted a retrospective and descriptive study for a period of 10 years from January 2011 to December 2020,

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including all patients underwent major amputation of limbs.

Study Setting

This study was conducted in Vascular Surgical Unit of Soavinandriana Hospital Center (Cenhosoa) Antananarivo. Soavinandriana Hospital Center is one of teaching hospital in Antananarivo, belongs to the Ministry of National Defence, and receiving all civilian or military patients. Vascular Surgical Unit in Cenhosoa is one of the reference vascular surgery units in Antananarivo, receiving all patients requiring vascular surgery.

Inclusion Criteria

All patients underwent major limb amputations and performed in Vascular Surgical Unit of Soavinandriana Hospital Center were included in this study.

Data Collection and Analysis

Data were collected from patients folders stored in Vascular Surgical Unit of Cenhosoa. We established questionnaires before collecting data, including all parameters: Demographic data, surgical indications, cardiovascular risk factors, location, and level of amputation and outcomes. Data collected were analyzed using SPSS® 21 statistics software program.

RESULTS

A total of 87 patients were recorded in this 10-year-period. The average age was 56.34 years old (from 26 to 71 years old). Population study was 72 males (82.75%) and 14 women (17.24%), giving a sex ratio of 4.80. The reason of amputations was diabetic gangrene (62.06%), peripheral arterial disease (20.68%), embolism (9.19%), trauma (5.74%), and malignant tumors (2.29%). Malignant tumors were osteosarcoma. The most risk factors of cardiovascular disease were male older (72.34%), high blood pressure (81.60%), diabetes mellitus (62.06%), and smoking (52.87%) [Table 1]. Amputations were located in the lower

Table 1: Surgical indications of amputation and cardiovascular risk factors

Indications		
Peripheral arterial disease	18	20.68
Diabetic gangrene	54	62.06
Embolism	08	09.19
Trauma	05	05.74
Malignancies	02	02.29
Cardiovascular risk factors		
Male>50 years/Female>60 years	68	78.16
High blood pressure	71	81.60
Diabetes mellitus	54	62.06
Smoking	46	52.87
Dyslipidemia	39	44.82
Sedentarity	9	10.34
Obesity	6	6.89

limb for 85 patients (97.70%) and in the upper limb for 2 patients (2.29%). The most common levels of amputation were above-knee (55.17%) and below-knee (42.52%) [Table 2]. Amputations were performed using regional anesthesia (72.34%) and general anesthesia (17.56%). Thirty-four patients (39.08%) have been presented local complications that the most common complications were surgical wound infection (12 cases) and wound hematoma (10 cases) [Table 3]. The hospital mortality rate was 6.89%. Causes for those deaths were three septicemia, two acute renal failure, and one pulmonary embolism.

DISCUSSION

Major limb amputation is a common surgical procedure performed by orthopedic, general, vascular, and trauma surgeons for a vast number of therapeutic reasons. Amputation could influence of psychological, economic, and social of the patients as well as their families. In 2015, there were approximately 150,000 non-traumatic lower-extremity amputations in the United States.^[3] Major amputation ranges from 5.6 to 600/100,000 in the population with diabetes and from 3.6 to 68.4/100,000 in the total population.^[4] The incidence of major amputation varies by country. In Europe, the average annual incidences of major lower limb amputations are approximating between 20 and 30/100,000 population.^[2] The truth prevalence of major amputation of limbs in sub-Saharan African countries remains unknown because all studies published the prevalence at a single teaching hospital. The prevalence of major amputation in sub-Saharan hospital was 172 cases for 2 years period in Cameroonian study by Alegebeye,^[5] 155 cases for 2 years period in Chadian study

Table 2: Location and level of amputation

Upper limbs (n=2)		
Above elbow	1	1.14
Below elbow	1	1.14
Lower limbs (n=85)		
Above knee	48	55.17
Below knee	37	42.52

Table 3: Outcomes and postoperative complications

Results		
Simple postoperative	47	54.02
Local complications	34	39.08
Death	6	6.89
Local Complications (n=34)		
Surgical wound infection	12	13.79
Wound dehiscence	5	5.74
Wound hematoma	10	11.49
Wound necrosis	7	8.04
Revision of amputation	7	8.04
Phantom pain	4	4.59

by Ouchemi *et al.*,^[6] 50 cases for 36 months period in Malian study by Touré *et al.*,^[7] 162 cases for 2 years in Tanzanian study by Chalya *et al.*,^[8] and 132 cases for 5 years period in Nigerian study by Ajibade *et al.*^[9] The prevalence of major limb amputation in our study was more lower than other studies. It could be explained that this result contained just all cases recensed in vascular surgical unit.

Male older was the most common risk factor for vascular disease. The predominance of male gender in major amputation of limbs in vascular surgery publications is common.^[10,11] There was 82% of male in our study with 56.34 years old of average age. The predominance of male older in vascular amputation could be explained that male older is risk factor for cardiovascular disease. However, other studies showed the sex difference for the risk of amputation.^[12,13] The average age of major amputation of limb published in sub-Saharan African studies was younger: 32 years in Alegbeleye,^[5] 43 years in Ouchemi *et al.*,^[6] 38 years in Touré *et al.*,^[7] and 28 years in Chalya *et al.*^[8] The predominance of youth in population undergoing major amputation of limb published in these sub-Saharan African studies could be explained by the predominance of trauma etiology. The male predominance is still observed in major amputation of limb following vascular disease or after trauma. In Western countries, there was predominance of male older in major amputation of limb performed in vascular surgery.^[11,14]

If trauma and malignancies were most common indications for amputations in young adults, complications of diabetes mellitus and peripheral vascular diseases were the main indications in older patients. Peripheral arterial disease and diabetic peripheral arteriopathy are the most common cause of major amputation of limb in patients admitted in vascular surgery unit. Dysvascular disease constitutes 54% of reason of amputation in 1.6 million persons living with the loss of a limb in United States in the year 2005.^[1] In study by Ubayawansa *et al.*, the most indications of the lower extremity amputation were diabetic foot ulcer (37%) and peripheral vascular disease (31%) followed by trauma (7%).^[15] Peripheral arterial disease was the leading cause of the lower limb major amputation (82%) in study by da Rocha *et al.*^[16] The causes of major limb amputation published in sub-Saharan African studies varied from study to study. However, there was predominance of trauma in leading cause of major amputation of limb in sub-Saharan African studies. Trauma was the leading cause of major amputation of limb in study by Alegbeleye. (60%),^[5] in study by Thanni and Tade. (34%),^[17] in study by Ouchemi *et al.* (47%),^[6] in study by Touré *et al.* (26%),^[7] in study by Ajibade *et al.*,^[9] and in study by Souna *et al.*^[18] Diabetic arteriopathy was the leading cause of major amputation of limb in study by Chalya *et al.* (41%).^[8] In our study,

diabetic gangrene (62%) was the leading cause of major amputation of limb.

Many researchers have been determined the risk factors contributing to major amputation of limb in patient presented dysvascular disease. According study by Long *et al.*, diabetes mellitus is higher risk of major amputation than minor amputation in patients with peripheral artery disease (56.5% vs. 38.2%; $P < 0.001$).^[19] Diabetes mellitus is the most common risk factors of major amputation of limb, seen in over two-thirds patients undergoing major amputations secondary to dysvascular disease.^[1] There was higher considerable prevalence of major amputation of limb in diabetic population than non-diabetic. The prevalence of major lower extremity amputation ranges from 0.7 to 332.4/100,000 in the diabetic population and 3.0 to 76.1/100,000 in the general population.^[20] Hypertension (81%) and diabetes mellitus (79%) were the most common comorbidities in patients undergoing major lower extremity amputations in study by Chahrour *et al.*^[21] In our study, the most risk factors of cardiovascular disease were male older (72.34%), high blood pressure (81.60%), diabetes mellitus (62.06%), and smoking (52.87%). Hypertension is another most common risk factor for lower extremity amputations in patients undergoing peripheral arterial disease. Recent study showed that hypertension was the leading cardiovascular risk factor (75%) for 338 major amputations due to peripheral arterial disease.^[22] Smoking is considered to be a significant risk factor associated with the development of peripheral vascular disease. Smokers have more than double the risk for peripheral arterial disease compared to non-smokers.^[23] There was 52% of smokers in our study.

Lower limb is the most location of major amputation of extremity. Many researchers published major amputation of the lower extremity than the upper extremity. Major amputations were more located in the lower limb (97%) than in the upper limb (2%) in our study. Our result was similar in other sub-Saharan African studies. The rate of the lower extremity amputations published in sub-Saharan African studies was 57% in study by Alegbeleye,^[5] 74% in study by Ajibade *et al.*,^[9] 84% in study by Ouchemi *et al.*,^[6] 76% in study by Touré *et al.*,^[7] 86% in study by Chalya *et al.*,^[8] 75% in study by Ogundele *et al.*,^[24] and 84% in Nwosu.^[25] The predominance of the lower limb is still observed in other studies published in Western countries.

Major lower extremity amputation is a life-changing procedure of patients. There was an adverse social implications of and effects on the capacity to work, quality of life, and self-image are devastating. Level of the lower extremity amputation could be transfemoral (above the knee, between the knee joint and the hip joint)

or transtibial (below the knee, between the ankle joint and the knee joint). In our study, the majority of patients have been amputated below knee (55%). Level of the lower extremity amputation published in sub-Saharan study was disparate, varied among study. Major lower extremity amputation was most performed above knee in study by Nwosu *et al.* (42%),^[25] by Alegbeleye (33%),^[5] and by Touré *et al.* (34%).^[7] However, major lower extremity amputation was most performed below knee in study by Ogundele *et al.* (45%),^[24] by Ajibade *et al.* (36%),^[9] by Ouchemi *et al.* (50%),^[6] and by Chalya *et al.* (46%).^[8] In Western countries, level of amputation was most performed below knee in study by Aulivola *et al.* (73%)^[26] and by Ploeg *et al.* (55%).^[27] Some researchers have been determined outcomes of major lower extremity amputation following level of amputation. The study by Ploeg *et al.* showed higher risk of wound infection in below knee amputations (10%) than above knee amputations but above knee amputations have higher risk of hospital mortality than above knee amputations (17.8% vs. 9.1%).^[27] Furthermore, transtibial amputation was an independent factors reducing mortality in study by Ambler *et al.* ($P < 0.001$).^[28]

In recent years, there has been an increasing interest in outcomes of major amputation of limb following type of anesthesia. The use of general anesthesia versus regional anesthesia for performing major lower extremity amputation is an area of ongoing debate. In our study, amputations were more performed using regional anesthesia (72%) than general anesthesia (17%). The study by Moreira *et al.* concluded that there is not significant effect on perioperative outcomes after major lower extremity amputation in the functionally impaired geriatric population according mode of anesthesia.^[29] Other study showed too no difference in outcomes between regional or general anesthesia techniques in patients undergoing lower extremity amputation.^[30,31]

A number of researchers have reported the outcomes of major amputation of limb. There were many studies published the results of major amputation of limb in sub-Saharan African study. In sub-Saharan African studies, the hospital mortality rates varied from study to study: 8% in study by Touré *et al.*,^[7] 16% in study by Chalya *et al.*,^[8] 15% in study by Ouchemi *et al.*,^[6] and 2% in study by Ajibade *et al.*^[9] The mortality rate was 6% in our study. The truth mortality rate of major amputation of limbs in sub-Saharan African countries remain unknown because these studies have been recensed the hospital mortality rate at a single teaching hospital. In Western countries, the mortality rate after major amputation of limbs was decreased from 19.8% in 2005 to 17.4% in 2015 in Germany,^[32] 10% in Spain.^[33] However, there is an increasing of mortality rate in years following major amputation of limb. This hypothesis has

been demonstrated by others researchers. According study by Stern *et al.*, the overall mortality rate after lower extremity amputation was, respectively, 47%, 61%, 70%, and 62% at 1, 2, 3, and 5-year following major amputation.^[34] Mortality rate varied, respectively, 33% and 65% at 1 and 4 years after major lower extremity amputation in recent Italian study by Cascini *et al.*^[35]

Limitations

There are limitations in this study that could be addressed in the future research. First, the study focused on all cases of major amputation of limb recensed in Vascular Surgical Unit. Hence, the frequency of major amputation of limb in this study could not represent the truth prevalence of major amputation of limb in this hospital center because all cases due to trauma in Orthopedic Traumatology Unit do not include in this study.

CONCLUSION

Diabetic gangrene and peripheral arterial disease were the most common surgical indications of major limb amputation. Early detection and management of diabetes mellitus and other cardiovascular risk factors are more important to prevent risk of amputation.

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