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ORIGINAL ARTICLE

Vascular Surgery of Limbs in Antananarivo: Indications and Outcomes

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ABSTRACT

Background : The aim of this study was to describe the indications and outcomes for vascular surgery of limbs in Antananarivo.
Methods: This was a retrospective and descriptive study for a period of 6 years (01 January 2015 to 31 December 2020), performed at Joseph Ravoahangy Andrianavalona Teaching Hospital Antananarivo, including all patients underwent arterial procedures of limbs. Demographic data, surgical indications, cardiovascular risk factors and history of cardiovascular disease, reason of admission, diagnostic imaging, surgical procedures and outcomes were analyzed.
Results : One hundred eighty-nine patients were recorded, including 141 males (74.60%) and 48 women (25.39%). The average age was 48.27years old. The commonest indications of surgical vascular procedures were trauma (33.86%), diabetic peripheral arteriopathy (38.09%) and peripheral arterial disease (12.16%). The most common modifiable risk factors for cardiovascular disease were diabetes mellitus (53.43%), high blood pressure (51.85%), smoking (33.86%). Fourty-one patients (21.69%) had a history of cardiovascular disease. Gangrene (46.03%) and external bleeding (32.27%) were the commonest reason of admission. Surgical procedures were amputation (51.85%), arterial repair (32.80%), Fogarty thromboembolectomy (8.99%), ligation (13.15%) and popliteal cyst excision (3.17%). All revascularization procedures were performed by an open surgery. The overall limb salvage rate was 96.82%.
Conclusion: Trauma and diabetic peripheral arteriopathy were the commonest indication of vascular surgery of limbs. Open repair surgery remain the surgical procedure to perform vascular surgery of limbs in our context.
Keywords: Peripheral arterial. Trauma. Gangrene. Amputation. Revascularization. Surgery

INTRODUCTION

Cardiovascular disease is a major public health problem, and the main cause of death. Vascular surgery practice remain challenge in Sub-Saharan African countries which the rate of vascular surgeon is still low in many countries [1]. In Madagascar, vascular surgery was often practiced by general surgeon in many district. In the past two decades, a number of researchers have been published their procedures and outcomes of peripheral vascular surgery. But, few researchers has been described the surgical procedures of peripheral vascular surgery in Sub-Saharan African countries [2, 3]. If in United States and European countries, the majority of surgical revascularization has been performed by an endovascular procedures, open surgery remain the only procedures for peripheral revascularization in the majority of Sub-Saharan African countries such as Madagascar. The aim of this study was to describe the indications and the surgical procedures for arterial surgery of limbs in Antananarivo.

METHODS

We conducted a retrospective and descriptive study for a period of 6 years from January 2015 to December 2020, performed at Cardiovascular surgical Unit in Joseph Ravoahangy Andrianavalona (JRA) Teaching Hospital in Antananarivo, including all patients underwent an arterial surgery of limbs due to vascular-related pathology. Cardiovascular Surgical Unit in JRA Teaching Hospital is one of the reference vascular surgery units in Antananarivo, receiving all patients requiring vascular surgery.

Demographic data, surgical indications, cardiovascular risk factors, history of cardiovascular disease, perioperative medication, reason of admission, diagnostic imaging, surgical procedures and postoperative outcomes were analyzed

RESULTS

A total of 189 patients (29.53%) were recorded in 640 patients underwent cardiac and vascular surgical procedures in this six-year-period. The average age was 41.98 years-old (from 17 to 78 years old). Population study was 141 male (74.60%) and 48 women (25.39%), giving a sex ratio of 2.93. The most common indications of surgical procedures were trauma (33.86%), diabetic peripheral arteriopathy (38.09%) and peripheral arterial disease (12.16%) (Table 1). The most modifiable risk factors for cardiovascular disease were diabetes mellitus (53.43%), high blood pressure (51.85%) and smoking (33.86%). Forty-one patients have a history of cardiovascular disease that 21 peripheral artery disease, 7 acute coronary syndrome, 6 transient ischemic attack, 4 carotid artery stenosis and 3 abdominal aortic aneurysm (Table 2). Perioperative medication were antihypertensive (49.73%), antidiabetic drugs (53.43%), statins (14.81%), vitamin K antagonists (19.04%), platelet antiaggregation (34.39%) and new oral anticoagulant drugs (1.58%).The reason of admission were 87 gangrene (46.03%), 61 external bleeding (32.27%), 38 limb pain (20.10%), 13 limb swelling (6.87%), 1 arteriovenous fistula (0.05%). The diagnostic has been performed by using duplex ultrasound in 66.13% of patients and computed tomographic angiography in 13.75% of patients. In our study, 148 patients (78.3%) underwent an acute vascular procedure and 41 patients (21.69%) underwent an elective vascular procedure. All revascularization procedures were performed by an open surgery. Surgical arterial procedures were amputation (51.85%), arterial repair (32.80%), thromboembolectomy by using Fogarty (8.99%), ligation (13.15%) and popliteal cyst excision (3.17%) (Table 3). Surgical procedures were performed by using general anesthesia in 83 patients (43.91%) and regional anesthesia in 106 patients (56.08%). The overall postoperative limb salvage rate in 30-day was 96.82% (Table 3). Twelve patients (6.34%) have been presented an early postoperative complications: 8 surgical site infections and 4 postoperative bleeding. The mortality rate was 3.20%.

Table 1: Surgical indications

Surgical indications	No. of Patients (Total=189)	Percentage (%)
Trauma of limbs	64	33.86
Diabetic peripheral arteriopathy	72	38.09
Peripheral arterial disease	23	12.16
Arterial embolism of limbs	8	4.23
Peripheral arterial aneurysm	8	4.23
Peripheral arterial pseudoaneurysm	7	3.70
Post traumatic arteriovenous fistula	1	0.52
Popliteal cyst excision	6	3.17

Table 2: Cardiovascular risk factors, history of cardiovascular disease and perioperative medication

Cardiovascular risk factors, history of cardiovascular disease and perioperative medication		No. of Patients (Total=189)	Percentage (%)
	Male>50years / Female >60years	106	71.05

Cardiovascular risk factors	Diabetes mellitus	101	53.43
	High blood pressure	98	51.85
	Smoking	64	33.86
	Dyslipidemia	28	14.81
	Sedentarity	9	4.76
	Obesity	2	1.05
History of cardiovascular disease (n=41)	Peripheral artery disease	21	11.11
	Acute coronary syndrome	7	3.70
	Transient ischemic attack	6	3.17
	Carotid artery stenosis	4	2.11
	Abdominal aortic aneurysm	3	1.58
Perioperative medication	Antihypertensive	94	49.73
	Antidiabetic drugs	101	53.43
	Statins	28	14.81
	Vitamin K antagonists	36	19.04
	Platelet Antiaggregation	65	34.39
	New oral anticoagulant drugs	3	1.58

Table 3: Surgical arterial procedures and outcomes

Surgical procedures and outcomes		No. of Patients (Total=189)	Percentage (%)
Arterial repairs	Lateral arteriorrhaphy	28	14.81
	End-to-end anastomosis	22	11.64
	Saphenous vein graft interposition	10	5.29
	Bypass graft	2	1.05
Fogarty thromboembolectomy		17	8.99
Amputations	Primary amputation	92	42.85
	Secondary amputation	6	3.17
Ligation		6	3.17
Popliteal cyst excision		6	3.17
Outcomes	Immediate postoperative successful	171	90.47
	Early postoperative complications	12	6.34
	Death	6	3.20

DISCUSSION

Vascular surgical procedures remain challenge in sub-saharan african countries. In Madagascar, there is always a lack of number of vascular surgeon and no protocol has been established for to treat a peripheral vascular related pathology. Few researchers in sub-saharan african countries have been described their experience in peripheral vascular procedures such as in Edaigbini's study in Zaria Nigeria [2], in Adeoye's study in Nigeria [3], in Mwambu's study in Uganda [4]. One of the most important of this topic that the study showed simultaneously multiples procedures to manage 189 cases of peripheral vascular related pathology. Some researchers in sub-saharan african countries have been describe their surgical vascular procedures to treat a peripheral vascular related pathology such as in vascular trauma of limbs in Dieng's study [5], in peripheral arterial disease in Chisala's study [6], in diabetic peripheral arterial disease in Chalya's study [7], in ischaemia of limbs in Nebyou's study [8] and in peripheral arterial pseudoaneurysm in Randimbinirina's study [9].

In our population's study, there was 141 male (74.60%) and 48 women (25.39%). There was too a predominance of male in all patients who underwent a peripheral vascular procedures in Edaigbini's study (61,6%) [2] and in Adeoye's study (74,4%) [3]. Many sub-saharan african studies have been showed this predominance of male in patient underwent peripheral vascular surgery : 88% in Randimbinirina's study [9], 67% in Nebyou's study [8], 88% in Dieng's study [5]. This predominance of male could be explained by the higher incidence of cardiovascular disease in men population than in women [10].

Mean age of patients underwent peripheral vascular surgery is different according the vascular pathology. Vascular trauma is always more in youger population than older. But, peripheral arterial disease is often higher in older population than younger. So, it's difficult to etablish a comparison of the mean age against other study. Our study showed a mean age of 41.98years-old in all patients undergoing arterial surgical procedures of limbs. However, the nigerian study of Edaigbini showed a similar result of our study with 43.5years-old of mean age in 73 patients undergoing vascular surgery for vascular-related pathologies [2].

The most common indications of arterial surgical procedures of limbs were trauma (33.86%), diabetic peripheral arteriopathy (38.09%) and peripheral arterial disease (12.16%). In the literature, trauma remain the commonest indication of vascular procedures of limbs in younger population. The average age of population underwent surgical procedures for an arterial trauma of limbs was 34.68years-old in Antananarivo [11]. In Edaigbini's study, the indications of surgical procedures were end-stage renal disease (49.3%), nontraumatic and posttraumatic aneurysms (17.8%), vascular trauma (16.4%), peripheral vascular disease (6.9%), congenital vascular malformations (5.5%), and thrombotic diseases (4.1%) [2]. The hospital rate of vascular trauma is often underestimated in sub-saharan african countries because the majority of victims were died before admission due to severe external bleeding. However, peripheral arterial disease is usually the most reason of amputation in diabetic or no diabetic older population. According Khan's study, 53.2% of patients who underwent lower limb amputations in South Africa have a history of peripheral vascular disease which 53.7% were diabetic and 56.3% were hypertensive [12]. All peripheral arterial pseudoaneurysm were due to trauma in our study.

Perioperative cardiovascular events are predictive risk for mortality in vascular surgery. Major adverse cardiovascular and cerebrovascular events occurred most frequently in patients undergoing vascular surgery (7.7%) [13]. Many studies showed the influence of cardiovascular risk factors on the outcome of patients undergoing peripheral vascular procedures. Our study showed a similar result of sub-saharan african studies on the predominance of diabete mellitus, high blood pressure and smoking in patients underwent peripheral vascular surgery. But, theses studies showed a few rate of obesity. Biccard's study showed a similar result in the predominance of high blood pressure (91%), diabete mellitus (62%) and smoking (57%) in south african patients undergoing vascular surgery [14]. In Nebyou's study, the commonest cardiovascular risk factors were high blood pressure (39%), diabete mellitus (31%) in patients undergoing surgical procedures for treatment of acute limb ischaemia according [8]. High blood pressure is a predictif risk factor for mortality in patients undergoing vascular surgery (p=0.086) [14]. However, diabete mellitus is risk factor for perioperative cardiovascular event in patients underwent elective major vascular surgery according Axelrod's study (p=0.001) [15]. So, Liapis suggested to make preoperative control of cardiovascular risk factors to reduce perioperative cardiovascular events and to decrease the mortality rate to patients undergoing vascular surgery [16].

Preoperative cardiovascular disease and their treatment could influence the outcome of a surgical arterial procedures. This hypothesis has been observed in several studies. Myocardial infarction is a risk factor for cardiac mortality after major vascular surgery. According Boersma's study, there was a significant risk factors for cardiac events after major vascular surgery in patients with a history of myocardial infarction or stroke (p<0.001) [17]. Good preoperative medical treatment could reduce morbidity and mortality rate in patients underwent an arterial surgical procedures of limb. In our study, patients were using antihypertensive medication (49.73%), antidiabetic drugs (53.43%), statins

(14.81%), vitamin K antagonists (19.04%), platelet antiaggregation (34.39%), new oral anticoagulant drugs (1.58%). Some authors has been demonstrated the effect of statins and platelet antiaggregants in preoperative time to the outcome in peripheral vascular surgery. Preoperative medication of statins and platelet antiaggregants could reduced mortality rate in 30-days and improved an absolute 18% 5-year survival after vascular surgery [18]. Perioperative anticoagulation treatment has been associated with 72.41% successfuls of limb salvage [19]. However, dual anticoagulant therapy expose patients to high risk of bleeding after arterial procedures of limbs. It must be stopped few days before vascular surgery.

The reason of hospitalization is variable following the pathology. In our study, the reason of admission in patients undergoing arterial procedures of limbs were 87 gangrènes (46.03%), 61 external bleeding (32.27%), 38 limb pain, limb swelling (6.87%), 1 arteriovenous fistula (0.05%). The clinical diagnosis is often evident for an open arterial trauma of limb with external bleeding or gangrenes. Sometimes, the diagnosis required a medical imaging such as doppler ultrasound or computed tomographic angiograph. In our study, duplex ultrasound was used in 66.13 of cases. It could largely be explained by the presence of vascular trauma (33%) that the majority of their mechanisms are an open injury. In our practice, duplex ultrasound remain the commonest diagnostic imaging for peripheral vascular disease due to availability and low cost than computed tomographic angiography. Others studies showed the similar results of our study by using duplex ultrasound to perform diagnostics of majority of patients who underwent a peripheral vascular surgery such as Mwambu TP [5] and Edaigbini SA [2].

In advanced countries, peripheral vascular surgery is more performed by an endovascular repair than open repair surgery. But, open surgery take more place in sub-saharan african countries such as Madagascar. Open repair surgery remain the only option of revascularization procedures in our practice because endovascular procedures is not available in our countries. In our study, 148 patients (78.3%) underwent an acute vascular procedure and 41 patients (21.69%) with an elective vascular procedure. In Harris's study, there was 67% of acute vascular procedure and 33% of an elective surgery [20]. The high rate of an acute vascular procedures in our study could be explained by the reason of admission. The majority of patients were admitted in our center for reason of external bleeding or gangrene that needed an emergencies surgical procedures. Many research has been concluded that elective procedures increased the risk of mortality in patients undergoing vascular surgery. This hypothesis has been demonstrated in Harris's study ($p<0.0001$) [20] and in Ambler's study ($p<0.001$) [21]. Amputations remain the most common surgical procedures in vascular surgery of limbs in our study (51.85%). Surgical repair for an arterial trauma of limbs is the second most common surgical procedures after amputations (32.80%). The higher rate of end-to-end anastomosis and lateral arteriorrhaphy in traumatic arterial surgical procedures is similar in other studies as in Randimbinirina's study [11], in Dieng's study [5]. Peripheral arterial pseudoaneurysm is the most reason of using saphenous vein graft interposition in our study (60%). In management of peripheral arterial pseudoaneurysm, Darbari's study showed a similar result with 63% of saphenous vein graft interposition following by 25% of vascular ligation [22]. Now, there was a lot of reaserch published the result of latest procedures to treat peripheral arterial pseudoaneurysm after an endovascular procedures as an ultrasound-guided compression repair or an ultrasound-guided thrombin injection for a femoral artery pseudoaneurysm after percutaneous procedures. Popliteal cyst procedures constitute 3.17% of arterial surgical procedures of limb in our study. Popliteal cyst excision has been performed by an elective surgery with direct excision of the cyst by posterior approach. Our popliteal cyst management is similar in Ouedraogo's study i Burkina Faso [23].

Vascular surgical procedures of limbs could be performed by using regional or general anaesthesia. In our study, surgical procedures were performed by using general anesthesia in 83 patients (43.91%) and regional anesthesia in patients (56.08%). Recently, researchers have shown an increased interest in the effect of anesthesia in the outcomes of vascular surgery. Latest research have been published that using regional anesthesia in vascular procedures is better than using general anesthesia. There was a higher risk of perioperative complications and mortality in patients who underwent peripheral vascular surgery performed by using general anesthesia in comparison of using regional anesthesia [24].

In recent years, there has been an increasing amount of literature on outcome of surgical vascular procedures of limbs. However, few research has been reported the outcome of an arterial surgical procedures of limb in sub-saharan african littérature. In our study, the overall postoperative success rate was 96.82% with 3.20% of mortality. In Edaigbini's study, there was 74% of postoperative successful and 2.7% of mortality [2]. However, Adeoye's study has been showed a superior rate of mortality than our result (7.1%) [3]. Open repair surgery is often prone to local complications such as hemorrhage and infection. Twelve cases of an earlier postoperative complications (6.34%) have been recensed in our study: 4 surgical site infections, 2 postoperatives bleeding. Local complications rate following open surgery was 5.5% in Edaigbini's study [2], 22% of infection and 8% of bleeding in Seyoum's study [25].

CONCLUSION

Trauma and diabetic peripheral arteriopathy are the most indications of vascular surgery of limb. Open surgery remain the only surgical theurapeutic option to perform vascular surgery of limb in our study. There was an overall limb salvage rate of 96.82%.

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