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# Epidemiological and Angioscanographic Study of Arterial Obliterative Diseases of the Lower Limbs in Kati

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## Abstract

**Introduction:** Peripheral artery disease is a public health problem. It is responsible for high morbidity and mortality rates. Computed tomography angiography is the examination of choice, especially in the context of limited resources. This study aimed to evaluate the contribution of computed tomography angiography to the diagnosis of lower limb arterial occlusive disease. **Materials and Methods:** This study was a cross-sectional descriptive study carried out at University Hospital Center of Professor Bocar Sidy SALL of Kati from January 1, 2023 to January 31, 2024. A 16-bar scanner was used for exams, Siemens brand equipped with an automatic injector. All cases of obliterative arterial disease of the lower limbs diagnosed during the study period were included. Data analysis was done using SPSS software. **Results:** A total of 52 patients with lower limb arterial disease were included among the 2747 CT scans and 83 lower limb angiograms performed, representing 1.9% of all CT scans and 62.65% of lower limb angiograms performed in the department. The average age was 52 years. Men accounted for the majority of patients (63.5%). The most common risk factor was diabetes (69.3%). Half of the patients suffered from gangrene (50%). CT angiography revealed diffuse involvement in 41.3% of cases. The lesions were stenotic in 71.2% of cases and occlusive in 28.8% of cases due to atherosclerotic plaques in 55.8% of cases, causing soft tissue necrosis in 22% of cases. **Conclusion:** Occlusive arterial disease of the lower limbs is relatively common. Older men are most affected. The predominant risk factor is diabetes. CT angiography is the preferred examination for

management.

## Keywords

Occlusive Arterial Disease, Lower Limbs, CT Angiography, Kati University Hospital

## 1. Introduction

Peripheral arterial disease (PAD) is characterized by a narrowing of the arteries supplying the lower limbs, leading to a loss of hemodynamic pressure, with or without clinical manifestations, the best indicator of which is a drop in the ankle-brachial index (ABI) [1]. The ABI is the ratio of ankle systolic pressure to brachial systolic pressure, measured by Doppler ultrasound [1].

It is underdiagnosed, even though studies have shown prevalences of asymptomatic PAD ranging from 7% to 43%. This demonstrates the importance of systematic screening in all at-risk patients [2] [3]. Rare before the age of 50, the prevalence of PAD increases exponentially from age 60, reaching 20% after age 80 [4]. Nearly two-thirds of the population with PAD presents with its asymptomatic form [4]. It is the result of a chronic process and consists of atherosclerotic obstruction of the arteries located between the abdominal aorta and the distal arteries supplying the lower limbs [4].

In recent years, MR angiography of the lower limbs with injection of gadolinium chelates has become established as a non-invasive technique and tends to replace catheter-based arteriography. Helical CT angiography is already widely used for arterial exploration [5].

This study is the first in Kati aimed at investigating the contribution of CT angiography in the management of PAD.

## 2. Materials and Methods

This was a descriptive cross-sectional study with prospective data collection conducted at the BSS University Hospital in Kati from January 1, 2023, to January 31, 2024, a period of 13 months. It focused on patients referred to the medical imaging department for lower limb CT angiography. The variables studied were: age, sex, socio-demographic categories, medical and surgical history (diabetes, hypertension, heart disease, stroke, thrombosis, surgery), lifestyle habits (smoking, alcohol, sedentary lifestyle, tea) and CT angiography data (for each limb):

- The presence of atherosclerotic plaques.
- The impact on the vascular caliber (non-stenosing, stenosing), stenosis was defined as a reduction in caliber greater than 50%.
- Vascular permeability; it was defined by arterial opacification.
- Vascular occlusion; defined by the absence of vascular opacification.
- The level of stenosis or occlusion.

- The presence of sufficient collateral circulation (if total arterial re-permeability), insufficient (if there is no total re-permeability).
- Condition of soft tissues.

We used a 16-slice Siemens CT scanner equipped with an automatic injector. Precautions related to the injection were taken for each patient. The examination began with the acquisition plan, ensuring sufficient anatomical coverage from the umbilicus to the toes. The examination was performed in helical mode before and after injection. We acquired millimeter-scale images with synchronous injection of iohexol (Omnipaque) 350 mg iodine/ml at a rate of 1.5 ml/kg at a flow rate of 3.5 to 4 ml/s via a secure intravenous line (18G catheter). All cases of peripheral arterial disease (PAD) diagnosed during the study period were included.

Ethical aspect: The data was collected after informed consent from the patients, in strict compliance with anonymity.

The data were entered using Microsoft Word 2013 and analyzed using SPSS version 25 and Excel 2019. The references were sorted using Zotero software.

## 3. Results

In total, we collected data on 52 patients with lower limb arterial disease out of 2747 CT scans and 83 CT angiograms of the lower limbs performed, representing a frequency of 1.9% of all CT scans and 62.65% of CT angiograms of the lower limbs in the department. The mean age was 52 years, standard deviation 17, with a range from 18 to 85 years. The most represented age group was 61 years and older (Table 1). Males were predominant at 63.5% (Table 1). The main risk factors most frequently implicated were diabetes (69.3%) and hypertension (26.9%). A sedentary lifestyle was found in 36.5% of cases (Table 2). Half of the patients suffered from gangrene (50%). On CT angiography, the involvement was bilateral in 43.3% of cases, diffuse in 41.3% of cases, and then affecting the anterior tibial and superficial femoral arteries in 12.5% and 11.5% of cases, respectively. These lesions were stenotic in 71.2% of cases and occlusive in 28.8% of cases, due to atherosclerotic plaques in 55.8% of cases. They caused soft tissue necrosis in 22% of cases (Table 3).

Table 1. Distribution of patients according to sociodemographic strata.

| Sociodemographic layers | Effective | Percentage |
|---|---|---|
| **Age (years)** | | |
| 15 - 30 | 6 | 11.5 |
| 31 - 44 | 4 | 7.6 |
| 45 - 60 | 13 | 25.0 |
| **61 and over** | **29** | **55.8** |
| **Sex** | | |
| Male | 33 | 63.5 |
| Female | 19 | 36.5 |

**Table 2.** Distribution of patients according to lifestyle habits and medical history.

| Lifestyle | Effective | Percentage |
|---|---|---|
| Tobacco | 10 | 19.2 |
| Alcohol | 2 | 3.8 |
| **Sedentary lifestyle** | **19** | **36.5** |
| Tea | 13 | 25.0 |
| Coffee | 8 | 15.4 |
| Medical history (MHI) | | |
| HTA | 2 | 3.8 |
| **Diabetes** | **24** | **46.2** |
| Stroke | 1 | 1.9 |
| Thrombosis | 1 | 1.9 |
| Hypertension + diabetes | 12 | 23.1 |
| Surgery | 2 | 3.8 |

These lesions were proximal in 19.2% of cases and distal in 39.4% of cases.

**Table 3.** Distribution of patients according to angiographic CT data.

| Radiological data | Effective | Percentage |
|---|---|---|
| **Atherosclerotic plaques** | **58** | 55.8 |
| **Side reached** | | |
| Right | 5 | 4.8 |
| Left | 9 | 8.6 |
| Both | 45 | 43.3 |
| **Localization** | | |
| Proximal | 10 | 19.2 |
| Distal | 20 | 39.4 |
| Proximal and distal | 22 | 41.4 |
| **Arterial territory reached** | | |
| Femoral artery | 12 | 11.5 |
| Popliteal artery | 8 | 7.7 |
| Anterior tibial artery | 13 | 12.5 |
| Posterior tibial artery | 8 | 7.7 |
| Fibular artery | 9 | 8.6 |
| Pedal artery | 9 | 8.6 |
| Plantar artery | 2 | 1.9 |
| Diffuse | 43 | 41.3 |
| **Type of injury** | | |
| Stenosis | 74 | **71.2** |
| Occlusion | 30 | 28.8 |
| Collateral without distal permeability | 23 | 22.1 |
| Collateral with distal re-permeability | 14 | 12.5 |
| Soft tissue necrosis | 23 | 22.1 |

**Iconography:** We present these iconographic images to illustrate our data (Figure 1, Figure 2).


Figure 1. Non-contrast CT scan in vascular reconstruction showing diffuse calcification of the vessel wall (diffuse mediacalcosis).

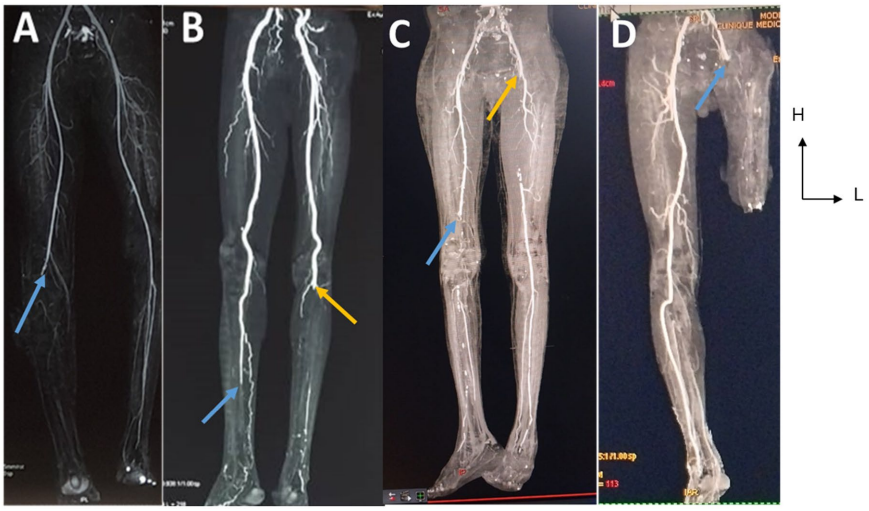


Figure 2. Vascular reconstruction CT angiogram showing arterial obstruction: right popliteal artery (A); left popliteal artery (yellow arrow) with re-permeability of the anterior tibial artery in places via collateral branches and a complete proximal stenosis of the right anterior tibial artery associated with a stenosis of the ipsilateral fibular artery (B); left superficial femoral artery from its bifurcation with satisfactory recanalization from the collaterals (orange arrow) right superficial femoral artery in its distal portion with partial recanalization via the collaterals (C); left femoral on amputation stump after one year (D) in a diabetic subject.

## 4. Discussion

### 4.1. Epidemiological Characteristics

Peripheral arterial disease (PAD) is one of the main manifestations of atherosclerotic disease, affecting the arterial tree from the aortic termination to the arteries of the foot [4]. Its frequency was 1.9% in our study. A frequency of 0.85% was observed by Cissé [6]. However, high frequencies have been observed in several African studies: 14.8% by Aboyans *et al.* [7], 16.7% by Menanga *et al.* [8], and 22.2% by Touani [9]. In this study, the average age was 52 years. The most affected age group was 61 years and older, accounting for 55.8% of cases. Several studies have shown that PAD is an age-dependent and rare condition before the age of 50. Its prevalence increases exponentially from age 60 onward, reaching 20% after age 80 [4]. In the Framingham study, the annual incidence increased with age, from 0.4 per thousand men aged 35 - 45 years to 6 per thousand men over 65 years [1] [10]. Similarly, Le Hello [11] demonstrated in her study that the prevalence of PAD is high in subjects over 70 years of age. A male predominance was observed in our study, at 63%, which corroborates data from the African literature [6] [8] [9]. However, in high-income countries, the prevalence is similar in women and men [4]. However, other studies have noted a female predominance [12]. In our context, this proportion could be explained by factors such as the advanced age of most patients, which, combined with a sedentary lifestyle, increases the risk of peripheral arterial disease.

### 4.2. Risk Factors for the Peripheral Artery Disease

Peripheral artery disease (PAD) has significant morbidity and mortality due to its dual potential: local, affecting the circulation of the lower limbs, and systemic, affecting other coronary, carotid, or aortic arterial territories. During its progression, PAD often remains asymptomatic for a long time, leading to an underestimation and undertreatment of the disease [12]. The main risk factors are smoking, diabetes, hypercholesterolemia, and, to a lesser extent, hypertension [11]. In our study, the risk factors were dominated by diabetes (46.2%), hypertension (3.2%), and comorbidity (hypertension + diabetes) (23.1%). Diabetes is a powerful and independent risk factor for the development of PAD. This association is even stronger when studying severe forms of the disease, particularly critical limb ischemia and the risk of amputation [13] [14]. In a study of 2146 asymptomatic patients at high vascular risk, hospitalized in cardiology, diabetology, geriatrics, internal medicine, and neurology departments, the prevalence of PAD was estimated at 41.1% [15]. Rada *et al.* [12] reported that 48.3% of subjects had diabetes, and 68% had hypertension, of which 58.3% were well controlled. This higher rate of hypertension may be explained by the fact that their study took place in a cardiology and vascular disease department. In Cameroon, 11.9% of patients were reported to have diabetes and 95.2% to have hypertension [8]. This high rate of hypertension can be explained by the high proportion of elderly subjects in our study.

In this study, 19.2% of patients were smokers. Rada *et al.* found 9.5% of patients were smokers in their study. Smoking was present in 33.8% of cases, the majority of whom were men (98.4%). Smoking was either current (64.4%), quit within the last 3 years (29.6%), or a past habit (24%) [12]. All studies agree that smoking is probably the most significant risk factor for PAD; overall, smoking increases the risk of PAD by 2 to 3 times [16] [17]. In a French multicenter study, COPART, three-quarters of patients hospitalized for PAD were or had been smokers.

### 4.3. Clinical Aspects

In this study, the clinical findings were dominated by gangrene (50%). Diakité [18] found 48.9% trophic disorders and 8.5% cyanotic discoloration of the toes. Cissé [6] reported 5.6% of gangrene. The annual incidence of critical ischemia is estimated at 0.35% in the United States [19] and 0.02% in England [20]. This result could be explained by the fact that the disease is often diagnosed late, with treatment beginning at an advanced stage, exposing patients to a high risk of complications and limb loss.

### 4.4. Angio-CT Scan Aspects

In our study, the involvement was diffuse in 41.3% of cases, affecting the anterior tibial artery in 12.5% of cases, followed by the superficial femoral artery in 11.5% of cases. These lesions were proximal in 19.2% of cases and distal in 39.4% of cases. In the series by Diakité [18], this involvement was diffuse in 29.8% of cases, superficial femoral in 14.9% of cases, and anterior tibial in 12.9% of cases. Benoit [21] found stenosis in 48.05% of cases of superficial femoral artery stenosis, 36.36% of anterior tibial artery stenosis, and 23.37% of cases of dorsalis pedis artery stenosis. These results highlight a preferential diffuse and distal location of arterial lesions in the context of lower limb arterial disease (LLAD). Diabetic arteriopathies are characterized by lesions, often multifocal and bilateral, whose location, preferably distal, is considered one of the most distinctive features of the condition. The rarity of aortoiliac involvement and the predominance of leg involvement have been documented by arteriography by several authors [22]. Distal arterial involvement was present in 100% of cases and severe in 75% of cases, according to the morphological abnormalities of the Doppler curves [21]. The involvement was stenotic in 71.2% of cases and occlusive in 28.8% of cases, due to atherosclerotic plaques (55.8%). Cissé [6], in his study, noted 72.2% of stenoses caused by atherosclerotic plaques in 94% of cases. These considerable rates of stenosis in African studies may be due to limited access to early care, with late detection favoring more advanced forms of the disease. We noted the presence of collateral circulation in 35.6% of cases; this collateral circulation was effective with distal recanalization in 12.5%. Diakité [18] found ineffective collateral circulation in 53.8%. Soft tissue necrosis was observed in 22% of cases, leading to amputation. Benoit [21] found 12.8% soft tissue necrosis. Amputation is indicated in the following cases:

- Irreversible tissue damage.

- Of chronic permanent ischemia without possible revascularization, which does not respond favorably to medical treatment or whose general repercussions pose a life-threatening risk to the patient [1].

These results show, on the one hand, the high frequency of infrapopliteal lesions, often associated with severe forms of AOMI, and, on the other hand, the advanced nature of the disease, which can worsen the functional prognosis.

## 5. Strengths and Limitations of the Study

This study is the first of its kind in our context (Kati). The single-center nature of the study, the referral-based sample, and the relatively small number of patients may limit the generalizability of the results.

## 6. Conclusion

Peripheral arterial disease (PAD) of the lower limbs is relatively common. Individuals in their sixth decade or older are most affected, particularly men. Diabetes and hypertension are the most frequently implicated risk factors. CT angiography is the preferred diagnostic tool in our setting. Systematic screening for PAD by calculating the ankle-brachial index (ABI) in at-risk patients would improve the prognosis of this disease through the early initiation of appropriate treatment.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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