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# Diabetic Foot: Epidemiological, Radiological, and Therapeutic Aspects at Donka University Hospital 2022

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## Abstract

**Introduction:** Type 2 diabetes is a chronic disease that can lead to multiple complications (coma, kidney failure, foot lesions, etc.). These lesions and their sequelae are among the most common reasons for hospitalization in diabetics. The overall objective was to determine the contribution of radiography in the monitoring of foot lesions in diabetics. **Methodology:** This was a descriptive and analytical case-control study, conducted in the endocrinology department of Donka National Hospital March 1, 2022 to August 30, 2022. The cases consisted of patients with diabetic foot lesions, while the controls consisted of patients with non-diabetic foot lesions. The two groups were compared to identify cardiovascular risk factors and degenerative complications associated with diabetes. The variables studied included epidemiological data, the clinical and radiological characteristics of the lesions, and the surgical treatment modalities. **Results:** Of the 72 patients enrolled, 20% developed foot lesions, including 97.19% elementary lesions, 45% joint lesions, and 48.6% soft tissue lesions. The most common locations of these lesions were: the phalanges with 60.53%, followed by the metatarsals with 27.59%. Amputation was performed in 27.77% of cases, followed by flattening (54.16% of cases) and disarticulation in 18.05%. **Conclusion:** Foot injuries in diabetics represent a serious medical,

social, and economic health problem that must be taken into account in their care.

## Keywords

Diabetes, Injuries, Foot, X-Ray

## 1. Introduction

Diabetes is a chronic disease that can develop over many years without the person affected being aware of their condition [1], which can lead to multiple complications, such as comas, kidney failure, and foot injuries. Worldwide, an amputation of the lower limbs due to diabetes is performed every 30 seconds [2]. Diabetes is the leading cause of non-traumatic amputation, accounting for 40% to 60% of cases. Numerous studies have been conducted on this subject around the world and in most African countries [3]. A study conducted at Brazzaville University Hospital on 247 diabetic patients with foot lesions hospitalized in the metabolic and endocrine diseases department found that 97 patients (39.2%) received medical treatment and 106 (42.2%) received surgical treatment [4]. In Guinea, out of 360 patients hospitalized in the diabetes department of Donka National Hospital in 2000, 69 had foot lesions, representing 19.16% [5]. Radiography remains the first-line examination for diagnosing foot lesions.

The overall objective of this study was to determine the contribution of radiography in monitoring foot lesions in diabetics.

## 2. Materials and Methods

**Study setting:**

This was a descriptive and analytical case-control study conducted in the endocrinology department of Donka National Hospital, the radiology department, and the trauma department of the same hospital March 1, 2022 to August 30, 2022.

**Inclusion criteria**

All consenting diabetic patients with foot lesions were included. A comparison was made between the controls, which included patients with non-diabetic foot lesions, cardiovascular risk factors (high blood pressure, smoking, and obesity), and diabetes complications (peripheral neuropathy, lower limb arteriopathy, coronary insufficiency, and stroke). The variables studied were epidemiological, descriptive of radiological lesions, and types of surgical treatment.

**Exclusion criteria**

All patients with foot lesions who did not undergo foot X-rays due to their clinical condition (coma) were excluded. X-rays were systematically performed on all patients selected for the study and interpreted on the basis of a pre-established questionnaire codifying all responses on the X-ray of foot injuries. Another form was created in which trauma surgeons described the injuries and the surgical pro-

tocols applied.

**Limitations of the study**

The limitations of our study were the small sample size and the short study period, especially for outpatients. Follow-up appointments had to be scheduled to collect all the necessary information, including clinical examination, trauma consultation, and foot X-rays.

**Statistical analysis**

All data were analyzed using EPI-INFO software version 6.

The comparison between the different variables was performed using the chi-square test and Student's t-test.

The differences observed were considered significant when P was less than 0.05.

## 3. Results

After analyzing our data, the following results were found:

The average age was 55.44 ± 12.024 with a sex ratio of 0.71 and a female predominance of 58.33%. (Table 1), with a length of hospital stay ranging from 14 to 100 days. (Table 1) The average duration of diabetes was less than 5 years for the majority of patients (Figure 1). The following cardiovascular risk factors were observed: hypertension was noted in 30.6% of cases compared to 43.1% in the control group, smoking was recorded in 18.1% of cases compared to 16.7% in the control group, and excess weight was reported in 22.2% of cases compared to 38. 9% in the control group. High blood pressure was not associated with the presence of foot lesions (p = 0.12). On the other hand, excess weight was significantly less frequent in cases than in controls (OR = 0.45; 95% CI [0.22 - 0.93]; p = 0.02). No statistically significant association was found for high blood pressure or smoking. (Table 2). Of the 72 patients enrolled, 20% developed foot lesions, including 97.18% elementary lesions, 45% joint lesions, and 48.8% soft tissue lesions (Table 3 and Table 4). The most common locations for these lesions were the phalanges (60.4%), followed by the metatarsals (27.6%) (Table 3). Amputation was performed in 27.77% of cases, followed by flattening in 54.16% and disarticulation in 18.05% (Table 5). Peripheral neuropathy was significantly more common in cases (81.9%) than in controls (41.7%), with a statistically significant association ($\chi^2$ = 24.74; p = 0.0007) and a 6.33-fold increase in risk (OR = 6.33; 95% CI: 3.00 - 13.36). Similarly, lower limb arteriopathy affected 72.2% of cases compared with 26.4% of controls ($\chi^2$ = 30.26; p < 0.001), with an OR of 7.30 (95% CI: 3.45 - 15.47). On the other hand, coronary insufficiency and stroke, although more frequent in cases, were not significantly associated (p > 0.05) (Table 6).

## 4. Discussions

This is a retrospective, descriptive case-control study on the epidemiological, radiological, and therapeutic aspects of diabetic foot in the diabetes department of Donka National Hospital, involving 72 diabetic patients who presented with foot lesions (cases) and 72 other patients with non-diabetic foot lesions (controls).

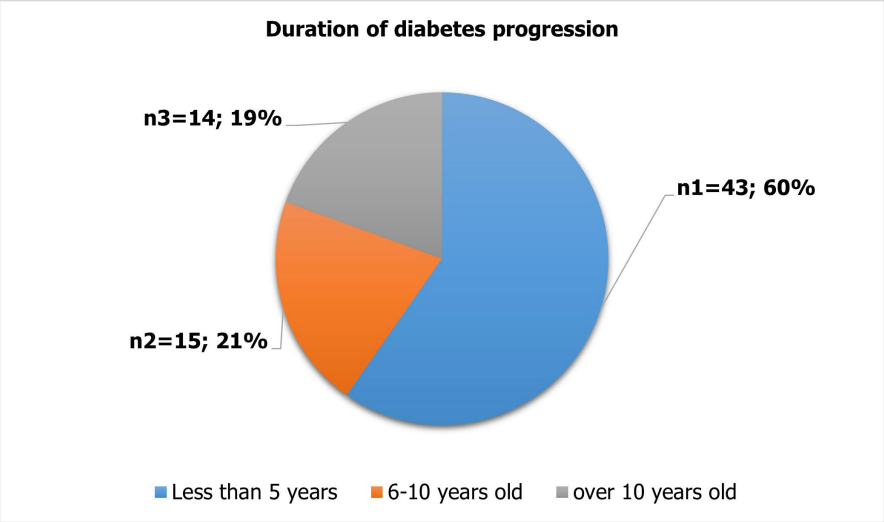


**Figure 1.** Distribution of patients with foot lesions according to known duration of diabetes.

**Table 1.** Distribution of patients according to sociodemographic and clinical characteristics.

| Variables | | Number of participants (n = 72) | Percentage |
|---|---|---|---|
| Age | | | |
| | 30 - 49 | 22 | 30.5 |
| | 50 - 69 | 41 | 56.9 |
| | ≥70 | 9 | 12.7 |
| | **Average ± Et** | **55.44 ± 12.024** | |
| Sex | | | |
| | Male | 30 | 41.66 |
| | Feminine | 42 | 58.34 |
| Occupation | | | |
| | Housekeeper | 31 | 43.05 |
| | Civil servant | 11 | 15.27 |
| | Merchant | 10 | 13.88 |
| | Craftsman | 8 | 11.10 |
| | Cultivator | 6 | 8.35 |
| | Other | 6 | 8.35 |
| Length of hospital stay | | | |
| | <10 days | 10 | 14.70 |
| | 11 - 40 days | 40 | 58.82 |
| | 41 - 70 days | 16 | 23.52 |
| | 71 - 100 days | 1 | 1.48 |
| | More than 100 days | 1 | 1.48 |

**Table 2.** Comparison of patients with foot lesions to those without lesions according to cardiovascular risk factors.

| Risk factor | Cases (n = 72) | Controls (n = 72) | $\chi^2$ test (df = 1) | P-value | OR (IC95%) |
|---|---|---|---|---|---|
| High blood pressure (BP > 140/85 mmHg) | 22 (30.6%) | 31 (43.1%) | 2.42 | 0.12 | 0.58 (0.29 - 1.13) |
| Smoking | 13 (18.1%) | 12 (16.7%) | 0.05 | 0.83 | 1.10 (0.47 - 2.58) |
| Excess weight | 16 (22.2%) | 28 (38.9%) | 4.71 | 0.02 | 0.45 (0.22 - 0.93) |

**Table 3.** Distribution of patients according to radiological bone lesions.

| Variables | Number of participants (n = 72) | Percentage |
|---|---|---|
| **Basic bone lesions (97.18%)** | | |
| Cortical rupture | 20 | 27.8 |
| Bone demineralization | 19 | 26.4 |
| Extensive lysis | 15 | 20.8 |
| Candy cane | 8 | 11.11 |
| "Rubber eraser strokes" | 6 | 8.3 |
| Sequestration | 2 | 2.77 |
| Cortical rupture | 20 | 27.8 |
| Bone demineralization | 19 | 26.4 |
| **Joint damage (45%)** | | |
| Tight line spacing | 15 | 20.8 |
| Subluxation | 10 | 13.9 |
| Disappearance of line spacing | 8 | 11.1 |
| **Soft tissue injuries (48.8%)** | | |
| Loss of substance | 34 | 47.2 |
| Arterial calcification | 1 | 1.4 |

**Table 4.** Distribution of lesions by location.

| Variables | Number of participants (n = 72) | Percentage |
|---|---|---|
| Phalanges | 35 | 60.4 |
| Metatarsals | 16 | 27.6 |
| Heel bone | 3 | 5.2 |
| Cuboid | 2 | 3.5 |
| Astragalus | 1 | 1.7 |
| Lower third of the leg (tibia) | 1 | 1.7 |

**Table 5.** Distribution of cases by type of surgical procedure.

| Variables | Number of participants (n = 72) | Percentage |
|---|---|---|
| **Surgical procedure** | | |
| Flattening | 39 | 54.16 |
| Amputation | 20 | 27.77 |
| Disarticulation | 13 | 18.05 |

**Table 6.** Comparison of patients with foot lesions to those without foot lesions according to diabetes complications.

| Complication | Cases (n = 72) | Controls (n = 72) | Test $\chi^2$ (ddl = 1) | P-value | OR (IC95%) |
|---|---|---|---|---|---|
| Peripheral neuropathy | 59 (81.9%) | 30 (41.7%) | 24.74 | p = 0.0007 | 6.33 (3.00 - 13.36) |
| Peripheral artery disease | 52 (72.2%) | 19 (26.4%) | 30.26 | <0.001 | 7.30 (3.45 - 15.47) |
| Coronary insufficiency | 9 (12.5%) | 3 (4.2%) | 3.27 | 0.070 | 3.29 (0.86 - 12.5) |
| Stroke | 2 (2.8%) | 1 (1.4%) | 0.34 | 0.0559 | 2.03 (0.18 - 22.6) |

The average age in our study was 55.44 ± 12.4 years, compared to that observed by Awalou *et al.*, where the average age was 60.70 years [6]. The sex ratio was 0.71 with a female predominance of 58.33% compared to 41.66% male, compared to that reported by the authors, who found a predominance of 61% [7]. In our study, this female predominance could be due to the fact that the majority of women have not been to school and are unaware of the risks associated with poor treatment compliance, and to the fact that among the professions encountered, housewives were the most numerous, with a frequency of 45.05. The duration of diabetes in our patients was less than 7 years ± 2.5 years for 59.72% compared to a study [8] or the average duration of diabetes was 16.25 years, which proves that foot lesions in diabetics occur after several years of progression. The length of hospitalization varied between 14 and 45 days compared to that found in Algeria, where the length of hospital stay was 26.7 days ± 21 days [8]. Patients who had long hospital stays were those who either had delayed healing due to poor circulation or who developed a secondary infection of the wound due to antibiotic resistance. The following cardiovascular risk factors were noted: high blood pressure in 30.55% of cases compared to 43.05% in the control group, compared to a frequency of hypertension of 16.20% reported by the authors in a study conducted at the Bejaïa University Hospital Center in Algeria [8]. High blood pressure and diabetes are two conditions that exacerbate each other and increase the risk of developing diabetic foot by promoting vascular complications (poor circulation, arteritis) and nerve complications (neuropathy) that lead to ulcers, infection, and amputation. Smoking was recorded in 18.05% of cases compared to 16.66% in the control group. It should be noted that smoking increases the risk of diabetic foot by damaging the blood vessels and nerves in the feet, which reduces tissue oxy-

genation and slows healing, increasing the risk of ulcers and serious infections. Diabetic smokers are 7 to 8 times more likely to develop lower limb arteritis. Excess weight was observed in 22.2% of cases compared to 38.9% in the control group. Being overweight is a major risk factor for diabetic foot, as it increases pressure on the feet, worsens insulin resistance and poor blood circulation, and can lead to deformities and ulcers due to uneven weight distribution. The cases developed many more complications, with a stroke frequency of 2 cases to 1 in the control group. Coronary insufficiency was detected in 9 patients with foot lesions, or 12.5%, compared to 3 patients, or 4.2%, in the control group. Arteritis of the lower limbs was present in 52 cases (72.22%) compared to 19 cases (26.38%) in the control group. Peripheral neuropathy was observed in 59 patients with foot lesions, compared with 39 patients in the control group. This neuropathy mainly affects the lower limbs and causes pain, cramps, decreased sensitivity, and wounds (plantar perforating ulcer). It can also affect the autonomic nervous system. Erectile dysfunction is also frequently observed. Certain organs such as the stomach, intestines, and heart should also be monitored for the risk of digestive disorders, diarrhea, or increased heart rate. Radiologically, the following bone lesions were observed on the images (See Attachment Description **Images 1-4**): Elementary bone lesions were noted in 97.19% of cases, cortical fractures in 27.77% of cases in our cohort, reported by the authors at a frequency of 0.07% [9]. This cortical fracture occurs at an early stage of osteolysis and is difficult to detect on X-rays of the foot. Multiple views are required. It affects the ends or the entire length of the phalanges and the metatarsal heads. The authors have reported that it resembles a sucked candy cane [9] at a frequency of 0.5% compared to 11.11% in our cohort. This aspect corresponds to a thinning of the diaphysis from the base of a phalanx or metatarsal toward its tip, which has often disappeared. The "eraser tip" appearance was observed in 8.57% of cases in our study, compared with a frequency of 2% reported by the authors. In our study, joint space narrowing was the most common finding (20.83%), reflecting cartilage degradation linked to a chronic inflammatory or infectious process. Complete disappearance of the joint space, observed in 11.11% of cases, reflected advanced and severe joint damage. This frequency is significantly higher than that reported in another study (1.3%), suggesting a delay in diagnosis and late management of patients in our context. Subluxation of the joint ends, found in 13.88% of cases, indicates joint instability secondary to structural lesions, which can have a significant functional impact. The joint damage found in our study was joint space narrowing, with a frequency of 20.83%, reflecting cartilage degradation linked to a chronic inflammatory or infectious process. Joint space loss was found in 11.11% of cases, reflecting advanced and severe joint damage, suggesting delayed diagnosis and late treatment of patients in our setting. Subluxation of the joint ends, found in 13.88% of cases, indicates joint instability secondary to structural lesions, which can have a significant functional impact. This trend is observed because most of the patients enrolled are found to have advanced foot lesions or consult for delayed healing.

In our cohort, surgical management of diabetic foot was common. Limb amputation was performed in 29.16% of cases, reflecting a conservative strategy aimed at controlling infection and preserving the limb whenever possible. However, the high rates of amputation (25%) and disarticulation (24%) reflect severe tissue damage and worsening infectious lesions, often associated with delayed treatment or advanced disease. Several studies have shown that diabetic foot ulcers are a major cause of lower limb amputations, with an overall amputation rate of up to approximately 31% in patients with severe ulcers [10]. Similarly, the literature suggests that amputations, particularly major amputations, are often associated with increased morbidity and mortality, highlighting the importance of early reassessment and multidisciplinary management to improve clinical outcomes [11]. The choice of surgical procedure was adapted to the limb's scarring potential, which is determined by its vascularization. When dealing with a toe wound, the procedure can range from disarticulation to amputation. Despite therapeutic advances and limited procedures, amputation unfortunately remains the inevitable outcome of diabetic foot in a large number of cases.

## 5. Conclusion

Foot lesions in diabetics represent a serious medical, social, and economic problem that must be taken into account in their care. Radiological examination of the skeletal system provides insight into the physiological mechanism responsible for trophic lesions and determines the degree of bone damage, enabling appropriate therapeutic decisions to be made. Prevention through awareness of foot hygiene and early detection of risk factors are essential to minimize the occurrence of these disabling and potentially fatal complications.

## Ethical Statement

Written informed consent was obtained from the patient's parent for publication of this case report and any accompanying results.

## Conflicts of Interest

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

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## Attachment Description

### Iconography:

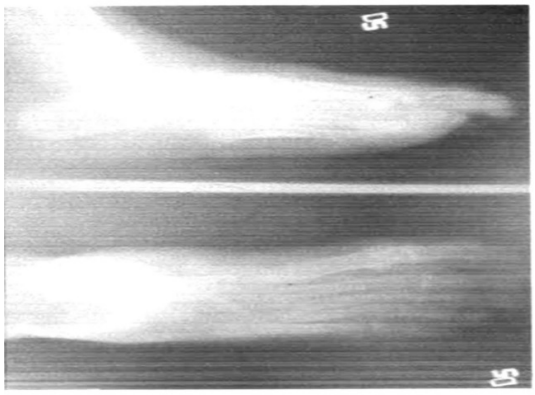

Image 1. Radiograph showing thickening of the surrounding soft tissues with preserved interarticular space, suggestive of superinfected necrosis, without radiographically visible bone destruction.

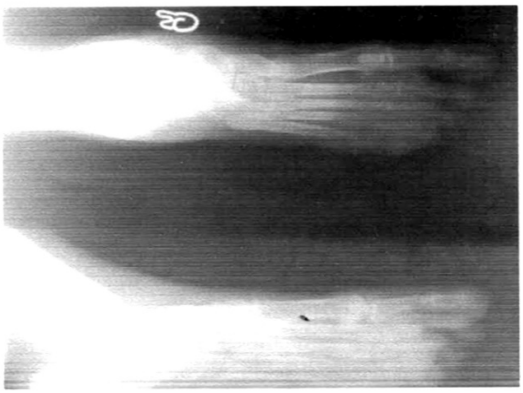

Image 2. Radiographic evidence of advanced osteolysis involving the distal and middle phalanges of the fifth toe of the left foot, associated with lysis of the base of the fourth metatarsal. Additional incomplete osteolysis of the middle phalanx of the fourth toe is observed, complicated by interphalangeal dislocation. The osteolytic pattern appears elongated and tapered, corresponding to a so-called "sugar-cane" appearance, with focal eraser-like osteolytic defects.

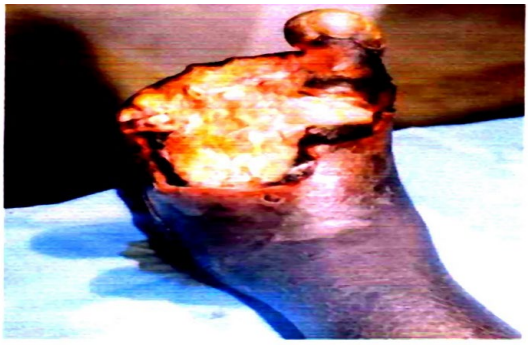

Image 3. (Ulcer) Disarticulation of the last 4 toes.

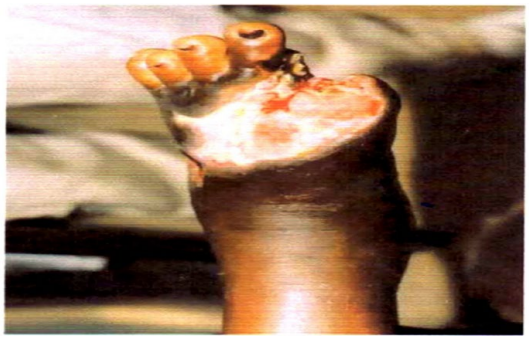

**Image 4.** (Gangrene) Disarticulation of the big toe.