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Characteristics, Therapeutic and Evolutionary Data on the Diabetic Foot: About 71 Cases

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Abstract

Introduction: The diabetic foot (DF) is a major cause of morbidity and mortality in diabetic patients, often leading to amputations. Its management requires a collaborative care approach involving diabetologists, infectiologists, vascular surgeons, and other specialists. This study aims to evaluate the epidemiological, diagnostic, therapeutic, and evolutionary factors related to hospitalized diabetic foot patients at Abass Ndao Hospital in 2022. **Methodology:** This cross-sectional, descriptive, and analytical study included 71 patients hospitalized between January 1 and December 31, 2022, for lower limb lesions, whether infectious or not. Data were collected via the KoboToolbox platform and analyzed using RStudio software. **Results:** The mean age of patients was 63.7 (±12.3) years with 10.4 years of diabetes duration, predominantly type 2 (97.1%). 74% showed poor dietary compliance and 73% poor medication adherence, with lesions appearing spontaneously in 60.6% of cases, mostly on the soles (32.1%) and toes (25%). The germ most frequently isolated was Klebsiella pneumoniae (25.6%). In the short term, 60.6% of patients had a favorable outcome, while 22.5% died, mainly due to septic shock (68.75%). Sixteen patients (22.5%) required amputation, mainly of the leg (56%). **Conclusion:** This study underscores the significant challenges of diabetic foot complications in an under-resourced healthcare setting. Despite multidisciplinary management, delays in consultation, non-compliance, and comorbidities contribute to high rates of mortality and amputations. Emphasizing the need for timely interventions, improved access to care, and better patient education are essential to improve patient management.

Keywords

Diabetes, Diabetic Foot, Infection

1. Introduction

Diabetes mellitus is a condition characterized by chronic hyperglycemia, resulting from an absolute or relative insulin deficiency, secondary to a complex interaction between genetic and environmental factors. This condition leads to long-term complications, notably vascular and neurological. Among these, diabetic foot is defined as infection, ulceration, or destruction of the deep tissues of the foot, associated with neurological disorders and/or peripheral vascular involvement of the lower limbs in diabetic patients [1] [2].

Diabetic foot is one of the main causes of morbidity and mortality associated with diabetes mellitus. The clinical form is neuropathic, ischemic or mixed. It can be complicated by ulcers, infections, deformities and amputations. It is responsible for numerous hospitalizations and can compromise not only vital prognosis, but also, more frequently, functional prognosis, when amputation of a lower limb becomes necessary [3] [4]. Several studies on the diabetic foot in Africa show high prevalence. In Senegal, Tall *et al.* (2020) found that 14.9% of the 1499 patients hospitalized at Abass Ndao Hospital were treated for diabetic foot [3]. In the sub-region, Koffi Dago *et al.* (2020) noted 14.2% in Yopougon, and Djibril *et al.* (2018) found a prevalence of 12.90% [5] [6].

Therapeutic management of the diabetic foot is based on a multidimensional approach, including metabolic control, local wound treatment with appropriate dressings and infection management. These interventions may be supplemented by surgical or endovascular procedures where necessary. Because of the complexity of this approach, multidisciplinary collaboration between diabetologists, infectiologists, podiatrists, vascular surgeons, and orthopedists is essential.

To evaluate the epidemiological, diagnostic, therapeutic and evolutionary aspects of diabetic foot in hospitalized patients at Abass Ndao Hospital in 2022, a study was carried out at the Department of Internal Medicine.

2. Patients and Methods

This descriptive and analytical cross-sectional study, conducted from January 1 to December 31, 2022, involved 71 patients admitted to the Internal Medicine Department of the Abass Ndao Hospital for various lower limb lesions whether infectious or not.

Data was collected using a specially designed data collection form on the KoboToolbox platform. The form collected socio-demographic, clinical, paraclinical, therapeutic and evolutionary data. Data entry was also carried out on this platform, while data analysis was performed using RStudio software (version 4.2.3). It comprised a descriptive section and an analytical section with univariate models. All

patients were informed of the anonymized use of their data and signed a free and informed consent form.

3. Results

3.1. Socio-Demographic Data

The study included 71 cases with a male-to-female ratio of 1.21 and a mean age of 63.73 years (±12.29 years). The mean duration of diabetes was 10.35 years (±6.97 years), predominantly type 2 diabetes at 97.1%. Dietary non-compliance was observed in 51 patients (73.9%), and 50 patients (72.5%) showed poor adherence to treatment. Twenty-eight patients (39.4%) used non-insulin regimen while 26.8% had no treatment. Notable cardiovascular risk factors like hypertension were observed in 49.3% and obesity in 8 patients.

3.2. Clinical and Paraclinical Data

In 60.60% of cases, lesions appeared spontaneously, and the absence of pedicure was noted in 83.10%. Lesions were predominantly found on the foot (64.29%), especially the sole (32.1%) and toes (25%). The average consultation time was 35 days, with extremes ranging from 1 week to 6 months. Most patients (98.6%) did not benefit from off-loading. The mean blood glucose was 2.7 ± 1.10 g/l. TEXAS grade 1D was the most frequent (28.2%), followed by grade 2D (18.3%).

Of the 63 full blood counts performed, 56 (88.89%) revealed anemia, with a mean hemoglobin level of 8.89 g/dl ± 2.32 g/dl. Klebsiella pneumoniae was the most frequently isolated germ (25.64%), followed by Pseudomonas Aeruginosa (17.95%). Underlying lesions included osteitis in 30.56% and peripheral artery disease in 66.67% of the 9 CT lower limb angiography performed.

3.3. Therapeutic and Evolutionary Data

All our patients had multidisciplinary management. Metabolic and anti-infectious management, as well as discharge and tetanus prevention for open wounds, were the order of the day. Medical treatment included broad-spectrum antibiotic therapy, tailored to the antibiogram, routine insulin therapy, ongoing oral antidiabetic medications, and anti-tetanus vaccine (47.9%) of patients. Analgesics and anticoagulants were systematically administered, and foot care was provided for all.

In 94.4% of cases, patients received a saline and Betadine dressing, while 59.2% of antibiotic therapy, which was primarily empirical, complemented the management of diabetes and cardiovascular risk factors. Antibiotic therapy consisted mainly of a combination of antibiotics in 70 patients (98.8%). Imidazoles were the most frequently used antibiotic class (90.14%), followed by beta-lactams (81.69%) and quinolones (21.13%). Tetanus sero-vaccination was administered to 34 patients (47.9%). Of these, 36.6% required surgical debridement, and two patients underwent revascularization.

Hospital stays ranged from 1 to 43 days, with an average of 2 weeks and a median of 10 days. While 60.56% of patients had positive outcome, 22.54% of patients

died, mainly from septic shock (68.75%). 17% were transferred for further care, including 16 who underwent leg amputations (56%).

4. Discussion

4.1. Socio-Demographic Data

The mean age of the patients was 63.73 years (±12.29), with a median of 64 years. Although age is a risk factor for type 2 diabetes, no significant correlation between age and risk of amputation or death was found. There was a male predominance (sex ratio: 1.21), as found by Koffi Dago *et al.* [5].

The low rate of early detection of diabetes in the region is due to limited access to care and reliance on traditional medicine. As a result of cultural and religious beliefs, many patients seek medical attention late, often only when complications arise. As a result, diabetes is frequently diagnosed when complications arise, particularly acute metabolic complications, which account for 65.5% of cases. Hyperosmolar hyperglycemia is the main complication, occurring in 90.9% of cases.

The adherence rates in our study closely mirror those found by Tall *et al.* [3] in Tunisia, where 95% of type 2 diabetic patients experienced adherence challenges, potentially due to factors like disease acceptance, inadequate therapeutic education, and difficult socio-economic conditions impacting their treatment and dietary compliance.

The average wait time for consultation regarding foot infections in our patients was 4.74 weeks, akin to the 33 days reported by Djibril *et al.* (with a range of 6 to 120 days) [6]. This delay is due to several factors, such as low socio-economic status, difficulty accessing specialized care, and the lack of hospital follow-up for nearly half of the patients, while 57.8% were hospitalized for acute diabetes-related complications rather than for diabetic foot treatment.

Specifically, the reliance on traditional medicine (8.6% of initial consultations, per Tall *et al.* [3]) and the shortage of specialized facilities in peripheral areas result in treatment delays, further compounded by inadequate therapeutic education and neuropathy, which obscures pain, delays treatment, and exacerbates complications.

Nearly half the patients (49.3%) were hypertensive, of whom more than half (51.43%) were untreated. This diabetes-hypertension association corroborates data according to which cardiovascular comorbidities, such as hypertension, increase the frequency of skin lesions in diabetics [7]-[9]. Increasing urbanization in Africa has led to dietary changes, with excessive consumption of salt and fatty foods, as well as an increase in sedentary lifestyles, favoring metabolic syndrome. Hypertension aggravates foot lesions by promoting arteriopathy and atherosclerotic plaque formation. A study by Beard *et al.* [10] showed that lowering blood pressure in hypertensive diabetics reduced macrovascular risk by 34%. The lipid profile was infrequently assessed in our study because most patients were in an inflammatory and decompensatory state, which can alter the profile by increasing VLDL production and reducing the activity of enzymes like lipoprotein lipase due to insulin deficiency and pro-inflammatory cytokines.

4.2. Clinical and Paraclinical Data

In our series, 68.6% of patients presented with diabetic neuropathy, and several risk factors for diabetic foot were identified, such as unsuitable footwear (12.6%), working with the feet, lack of pedicure, skin bleaching and intertrigo between toes. Lesions were mainly triggered by trauma, in 28 patients, often preceded by pre-existing neuropathy. The location of lesions in the foot (64.29%) is therefore logical. Trauma was also responsible for 32.86% of lesions in Amoussou-Guenou's study [11].

Lesion types were predominantly vascular (41.98%), infectious (20.98%) or mixed (37.04%). Djibril *et al.* observed similar results, with a prevalence of gangrene (61.29%) and ischemic necrosis (12.90%) [6]. This predominance of vascular lesions could be linked to the long-standing nature of diabetes, which is often poorly diagnosed in our context, inadequate follow-up, and a low rate of therapeutic compliance. Indeed, 63.4% of patients presented with a decrease or abolition of lower limb pulses.

Delayed diagnosis and lack of appropriate measures, such as systematic screening for arteriopathy and revascularization, are key factors contributing to the evolution of lesions. Indeed, inadequate management, lack of appropriate offloading, and inappropriate care can encourage superinfection of initial wounds. Infections were mostly moderate to severe, with dermohypodermatitis, abscesses, 22 osteitis and 9 gas gangrene. The severity of the infections is linked to delayed management, which can lead to serious complications such as amputation.

The most frequent germs were Gram-negative bacilli, mainly Klebsiella pneumoniae (25.64%) and Pseudomonas aeruginosa (17.95%), in line with the findings of Koffi Dago *et al.* [5]. These particularly aggressive bacteria probably explain the severity of infections observed in our population.

4.3. Therapeutic and Evolutionary Data

Therapeutic management has involved a multidisciplinary team of diabetologists, infectiologists, general surgeons, vascular surgeons, and anesthesiologists. Studies have shown that such a multidisciplinary approach can reduce the amputation rate by 49% - 85% [4]. However, despite this collaborative effort, only two patients underwent revascularization, and 22.53% required amputation, mainly of the leg (56%) or thigh (31%). These results reflect the severity of the patients' vascular and infectious lesions. The amputation rate in our study is comparable to that observed by Dia *et al.* [12]. (15.8%) and Koffi Dago *et al.* (26.24%) [5] but remains well below that found by Djibril *et al.* in Niger (51.61%) [6].

Regarding the classification of lesions according to the University of Texas classification, our results corroborate those of Oyibo *et al.* [13], who demonstrated that worsening lesions increase the risk of non-healing and amputation. This correlation can be explained by delays in consultation, often linked to limited access to care, patients' low socio-economic level, and a lack of education about diabetes and its complications.

In our study, patients had an average hospital stay of 15 days and a mortality rate of 22.54%, with a median survival of 10 days according to the Kaplan-Meier curve, which aligns with Dia's findings of 16.87 days and a death rate of 16.9%.

Figure 1. Iconography of ischemic gangrene of the left foot of a patient hospitalized at the internal medicine unit of Abass Ndao Hospital.

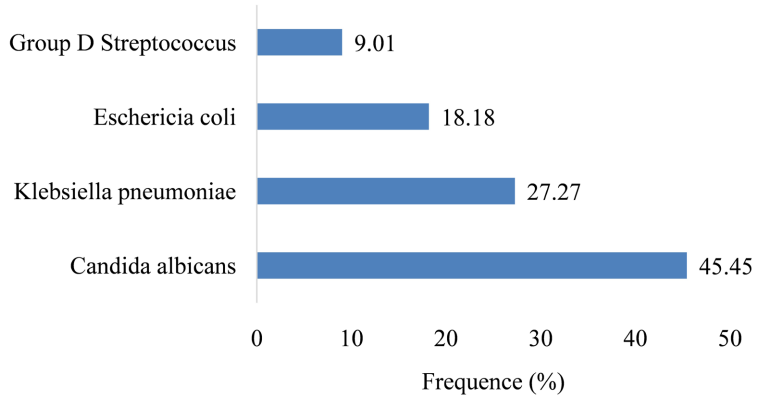

Figure 2. Distribution of patients according to results of urine culture.

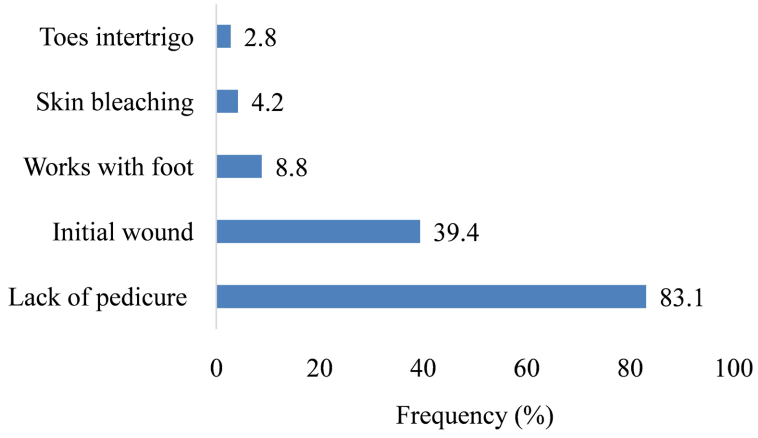

Figure 3. Distribution of patients according to risk factors for lesions.

Figures 1-3 reflect those reported by Dia (16.87 days' stay and a death rate of 16.9%). The high mortality, mainly due to septic shock (68.75%), is in line with the observations of Dia *et al.* (60%) [12] and Koffi Dago *et al.* (47%) [5].

Furthermore, the delay in amputation observed in our series exposes patients to a worsening of lesions, which are often severe.

This delay can be attributed to several factors: limited availability of operating theatres, surgeons' overwork, and patients' temporary inability to undergo surgery due to severe anemia and inflammatory syndrome. Indeed, 88.9% of our patients were anemic, with a mean hemoglobin level of 8.98 g/dl, and sometimes as low as 3.9 g/dl. This anemia, of multifactorial origin, was also marked by an inflammatory profile, with a mean CRP of 132.24 mg/l, sometimes reaching 447.2 mg/l. These factors required blood transfusions to stabilize patients prior to amputation. However, the limited availability of blood products in our regions, combined with the scarcity of compatible blood groups, contributed to longer amputation times.

5. Conclusions

Our study reveals that, despite comprehensive care, the progression of diabetic foot lesions is often negative due to consultation delays, poor treatment compliance, and the challenges of managing comorbidities like hypertension and anemia, exacerbated by the high incidence of severe infections from Gram-negative bacteria such as Klebsiella pneumoniae and Pseudomonas aeruginosa.

This study demonstrates the need to improve prevention, early diagnosis, and management of risk factors.

To reduce the morbidity and mortality linked to diabetic foot complications, it is crucial to enhance therapeutic education, improve access to specialist care, implement detection and treatment protocols for diabetic arteriopathy and neuropathy, and adopt more effective treatments like early revascularization to limit amputations and improve long-term outcomes.

Conflicts of Interest

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

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