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Surgical management of the diabetic foot, Brazzaville University Hospital

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Abstract
Diabetic foot is a formidable complication of diabetes mellitus. It is frequent and serious, with a very high rate of amputation of pelvic limbs and dramatic socio-economic and psychological consequences.
Objective: To study the epidemiological, diagnostic and therapeutic aspects of diabetic feet in the emergency department of the Brazzaville University Hospital Center.
Patients and method: This was a descriptive cross-sectional study with retrospective data collection that took place in the medical-surgical emergency department of the Brazzaville University Hospital. It covered the period from 1er January 2021 to 31 December 2022. We included all patients treated surgically in the emergency department for a diabetic foot. Epidemiological, diagnostic and therapeutic variables were studied.
Results: During the study period, 673 patients were admitted to the emergency department of Brazzaville University Hospital, including 106 patients with trophic disorders of the foot who had undergone surgical treatment, representing a frequency of 15.75%. The mean age was 55.41 ± 9.94 years (37 to 83 years). Males predominated, with a sex ratio of 1.3. Type 2 diabetes mellitus was found in 92 patients (86.79%). Hypertension (51.90%), dyslipidaemia (29%) and obesity (13.96%) were the main associated cardiovascular risk factors. 12 patients had previous foot lesions leading to amputation, involving the leg (2 cases), the metatarsals (4 cases) and a toe (1 case). Foot lesions were classified as stage 3D (29.24%), stage 3C (27.35%), stage 3B (18.86%), stage 2B (14.15%) and stage 1C (9.43%). 80 patients (75.5%) had undergone amputation: trans tibial (62.5%), trans femoral (18.75%), trans metatarsal (8.75%).
Conclusion: Foot injuries are common in diabetic patients. They are the third most common cause of admission to emergency surgery.

Keywords: Diabetic foot, amputation, university hospital Center, Brazzaville

Introduction

Diabetes mellitus is a major public health problem [1]. Its prevalence is estimated at 8.8% of the world's population [2]. Among its complications, the diabetic foot remains formidable. It is frequent and serious, with a high rate of amputation of pelvic limbs and often dramatic socio-economic and psychological consequences [3]. Every 20 seconds, a pelvic limb or part of a pelvic limb is amputated worldwide, in connection with a complication of diabetes [4]. This is the set of clinical abnormalities of the foot in a diabetic patient characterised by ulceration, infection or destruction of the deep tissues, associated with neuropathy and/or peripheral arteriopathy of the pelvic limbs [5].

In Africa, foot lesions in diabetics are unfortunately very common, accounting for 15% to 25% of hospital admissions [3]. In the Republic of Congo, MONABEKA *et al* reported in 2001 that 14.9% of hospital admissions were related to trophic disorders of the foot in diabetic patients [6]. A recent study carried out in Brazzaville reported a hospital admission rate of 20.4% [7].

The aim of this study was to examine the epidemiological, diagnostic and therapeutic aspects of diabetic feet in the emergency department of the Brazzaville University Hospital Centre (CHU).

Patients and Method

We conducted a descriptive cross-sectional study with retrospective data collection. It took place in the medical-surgical emergency department of Brazzaville University Hospital and covered a two-year period from 1er January 2021 to 31 December 2022. We included all patients treated surgically in the emergency department for a diabetic foot. The diagnosis of diabetic foot was made for any infection, ulceration or destruction of the deep tissues of the foot associated with neuropathy and/or peripheral arteriopathy of the pelvic limbs in a diabetic patient. The variables studied were :

- **Epidemiological:** Age, sex, origin, socio-economic level (patients were divided into two groups: those with no fixed or low income, including farmers, housewives and the unemployed; and those with a fixed or high income, including civil servants and shopkeepers).

- **Diagnosis:** the type of diabetes, how long it has progressed, medical history (cardiovascular risk factors, i.e. hypertension, obesity, smoking, dyslipidaemia), surgical history (history of ulceration or amputation), time to consultation, circumstances in which foot lesions occurred, site of lesion, presence of neuropathy and/or arteriopathy, presence of bone lesions, blood

glucose and glycated haemoglobin on admission. The results of the paraclinical work-up (blood count, lipid profile, standard foot X-ray, arteriovenous Doppler ultrasound of the pelvic limbs). The severity of the lesions was assessed using the University of Texas classification (Table 1)

Table 1: University of Texas classification

	Grade 0 Epithelial lesion	**Grade 1** Superficial wound	**Grade 2** Tendon or capsule damage	**Grade 3** Bone or joint damage
Stage A ▪ No infection ▪ No ischaemia	0A (0%)	1A (0%)	2A (0%)	3A (0%)
Stage B ▪ Infection ▪ No ischaemia	0B (12,5%)	1B (8,5%)	2B (28,6%)	3B (92%)
Stage C ▪ No infection ▪ Ischemia	0C (25%)	1C (20%)	2C (25%)	3C (100%)
Stage D ▪ Infection ▪ Ischemia	0D (50%)	1D (50%)	2D (100%)	3D (100%)

- **Therapeutics:** medical treatment (insulin therapy, OADs, antibiotic therapy, heparin therapy), surgical treatment (level of amputation, open or closed stump, debridement).
- **Evolutionary:** length of hospitalisation, post-operative follow-up, mortality

The data were collected on a survey form drawn up for the purpose. The data were entered into Microsoft Excel 2020 and then exported to SPSS version 25, where they were tabulated and analysed. Nominal and ordinal qualitative variables were expressed as numbers and percentages, while quantitative variables were expressed as mean and median.

Results

During this period, 673 patients were admitted to the surgical emergency department of Brazzaville University Hospital, including 106 patients with trophic disorders of the foot requiring surgical treatment, representing a frequency of 15.75%. The mean age was 55.41 ± 9.94 years, with extremes ranging from 37 to 83 years. The most common age group was 48 to 58 years (Figure 1).

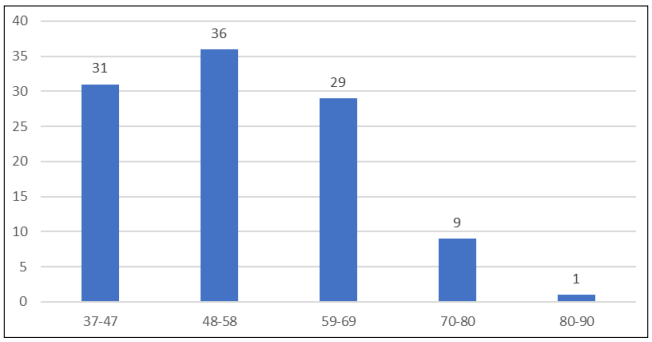

Fig 1: Breakdown of patients by age group

There was a male predominance, with 60 patients (57% of cases) and *a sex ratio of* 1.30.

70 patients (66.04%) had no fixed or low income, compared with 36 patients (33.96%) who had a fixed or high income.
Type 2 diabetes mellitus was found in 92 patients (86.79%). The mean time to onset of diabetes was 7.3 ± 2.6 years, with extremes ranging from 4 to 22 years. Arterial hypertension (51.90%), dyslipidaemia (29%) and obesity (13.96%) were the main associated cardiovascular risk factors. 12 patients had previously suffered foot lesions leading to amputation, with two cases involving the leg, four involving the metatarsals and one involving a toe.
The average time taken for patients to be seen was 23 ± 7.5 days, with extremes of 9 and 130 days. 30 patients stated that their lesions were of traumatic origin. In the 76 other patients, the lesions appeared spontaneously. We found diabetic neuropathy in 71.29% of cases, arteriopathy in 17% and a combination of neuropathy and arteriopathy in 12% of cases. Infection was at the forefront of the clinical picture in 70.97% of cases.
Foot lesions were classified as stage 3D in 29.24% of cases, stage 3C (Figure 4) in 27.35% of cases, stage 3B in 18.86% of cases, stage 2B in 14.15% of cases and stage 1C in 9.43% of cases.

Fig 2: University of Texas Stage 3C diabetic foot lesion

Infection was prominent in stage 2B and 3B lesions, and ischaemia in stage 1C and 3C lesions. In stage 3D lesions,

infection was associated with ischaemia. The mean fasting blood glucose level on admission was 2.50 ± 0.93 g/l, with extremes of 2.20 and 5.11 g/l. The mean glycated haemoglobin was 9.65±3.54%, with extremes of 8 and 16.2%. Neutrophil hyperleukocytosis was noted in 90 patients (84.90%).

Seventy-six (76) patients, or 71.69% of cases, had had a foot X-ray, including ten (9.43%) with osteitis. Medical treatment consisted of broad-spectrum antibiotic therapy in all patients, insulin therapy in 82.81%, and continuation of oral antidiabetics in 17%. Analgesics were used systematically. All patients received local care.

80 patients, or 75.5% of patients, had undergone an amputation

Table 2: Shows the different types of amputation performed on our patients

Types of amputation	N	%
Trans tibial	50	62,5%
Trans femoral	15	18,75%
Trans metatarsal	7	8,75%
Disarticulation	8	10%

Gangrene (Figure 3) was the main reason for amputation (75%).

Fig 3: Diabetic foot lesion classified as stage 3D by the University of Texas

Mortality was 9.43%. There were two cases of post-surgical pulmonary embolism and eight cases of septicaemia. The average hospital stay was 10 days, with extremes of 4 and 21 days.

Discussion

The prevalence of diabetic foot in the emergency department of the Brazzaville university hospital was 15.75% during the study period. This prevalence is comparable to that of DIA *et al* in Senegal, who reported a prevalence of 15.36% [8], and to that of Koffi *et al* in Côte d'Ivoire, who reported a prevalence of 14.2% [9]. This prevalence can be compared with that of Monabeka in 2001, which was 14.9% [6], and proves the place of diabetic foot as a formidable complication of diabetes, despite current preventive measures in the management of this pathology. The mean age of our patients was 55.41 ± 9.94 years; this result is similar to that of Traoré D *et al* in 2017 [10], Traoré B *et al* in 2021 [11] in Mali, and Kyelem *et al* in Burkina Faso [12] who found respectively 53.23±13.74 years, 54.23±15.95 years and 54.8±13.4 years. The age group most affected in our series was 48 to 58 years, since age is a predominant factor in the onset of degenerative complications of diabetes, and this is also consistent with the age of onset of type 2 diabetes mellitus, which is most often diagnosed after the age of 40 according to the literature [11, 13, 14].

The male predominance was highlighted in our series with a sex ratio of 1.30. This result is identical to certain African series [3, 6, 7, 9, 13, 14, 15]; other African series, on the other hand, show a female predominance [8, 11, 12, 16, 17]. It should be noted that there is no parallelism between the onset of diabetic foot and sex. The predominance of men is thought to be linked to manual work, the wearing of tight shoes, and a lack of hygiene and foot care in men [14]. In Africa, poverty, poor hygiene and barefoot walking often interact to worsen the impact of foot lesions caused by diabetes [3, 6]; in our series, 66% of patients had low incomes.

92 patients (86.79%) had type 2 diabetes ; type 2 diabetes mellitus is the most common in the world, affecting 80-90% of diabetic patients according to the WHO [1, 2]. Our results corroborate those of other African authors [3, 7, 8, 9, 11, 14]. The mean time to onset of diabetes was 7.3±2.6 years, with extremes ranging from 4 to 22 years; this result is close to that of Dia *et al* [8] in Senegal, who found a mean age of type 2 diabetes mellitus of 8.91 years. Skin complications and trophic disorders of the foot in diabetics are often associated with the age of diabetes [13, 18]. Several factors may explain this: lack of universal health cover, low socio-economic status, denial of the disease and, moreover, neuropathy by suppressing the warning sign of pain. All these factors lead patients to resort more often than not to self-medication or traditional medicine. In our series, the average consultation time was 23±7.5 days, with extremes of 9 and 130 days. This result is consistent with other African authors on the subject [8, 19]. Type 2 diabetes mellitus is a chronic disease, often associated with certain cardiovascular diseases such as arterial hypertension and dyslipidaemia, which may explain the occurrence of macroangiopathic complications (arteriopathy) in the limbs [16]. In our series, arterial hypertension and dyslipidaemia accounted for 51.90% and 29% of cases respectively. Obesity accounted for 13.96% of cases in our series. This result is lower than that of Traoré [10] in Mali in 2017, who reported a frequency of 42.5%. The urbanisation of African cities has led to changes in diet, with exaggerated consumption of salts and fatty foods and an increase in sedentary lifestyles, exposing populations to metabolic syndrome [8, 16, 19]. Trophic disorders of the foot in diabetic patients are the consequence of several pathophysiological mechanisms: neuropathy, arteriopathy and infection [1, 2, 3]. Peripheral neuropathy, both sensitivomotor and autonomic, is frequent and represents the main complication at the origin of diabetic foot lesions, with loss of pain alertness, foot deformities, hyper-weight-bearing and skin dryness [6, 17, 19]. In our series, neuropathy was present in 71.29% of

cases. Arteriopathy, which is more frequent and more serious than in non-diabetic patients, is a very important aggravating factor responsible for delayed healing and gangrene [1, 2, 3]; it affected 17% of our patients. Infection is also a major aggravating factor because of the risk of deep extension, particularly to the bone, which may lead to amputation, and of general extension, with its life-threatening risk [6, 17, 19]. Foot lesions most often occur after a minor local trauma in a neuropathic setting ; in our series, 30 patients had a foot lesion following a microtrauma. Our results are inferior to those of Diallo *et al*. [14] in Guinea, and Djibril *et al*. [13] who report a predominance of lesions due to microtrauma. Diabetes imbalance is a factor favouring the onset of trophic disorders of the foot, as has been reported in the literature, especially when diabetes has been present for several years [1, 2, 3, 6, 9, 10, 14, 15]. The mean fasting blood glucose level on admission was 2.50 ± 0.93 g/l, with extremes of 2.20 and 5.11 g/l. The mean glycated haemoglobin was 9.65±3.54%, with extremes of 8 and 16.2%. Delayed consultation and poor glycaemic control, combined with long-standing diabetes and sometimes denial of the disease, mean that patients come for consultation at a very advanced stage of the lesions, with the risk of 100% amputation in the vast majority of cases. Stages 3D, 3C and 3B have been found in several African studies [16, 17, 18, 19]. These stages have a risk of amputation of up to 100%. 80 patients (75.47% of cases) underwent amputation, with 62.5% of cases involving the leg. Leg amputation can be performed with an open stump in the case of predominantly infectious lesions with infiltration of the tissues, which allows good drainage of secretions, and can be covered at a later date. In predominantly ischaemic lesions, the section was sutured immediately. Traoré *et al* [16] in Mali reported 48% of cases of leg amputation, Koffi *et al* [20] in Côte d'Ivoire reported 44.7% of cases, and Sano *et al* [19] in Burkina Faso reported 47.36%. The high rate of amputation in our series may be related to the severity of the lesions on admission ; this was also the case in the study by Djibril *et al* [13] in Togo. Management of the diabetic foot should be multidisciplinary and collaborative, involving different specialities. It has been shown that this approach leads to a reduction in the amputation rate from 49% to 85% [2]. The post-operative course was dominated by suppuration, and this concerned open stump amputations. Mortality was around 9.43%. Our result is comparable to that of Koffi *et al* [9] in Côte d'Ivoire who found 8.20%, but lower than that of Monabeka *et al*. [6] who found 22.6%.

Conclusion

Foot injuries are common in diabetic patients, and in surgical emergencies they are the third most common cause of hospitalisation. Patients most often consult a doctor at an advanced stage of the lesions, which worsens the functional and vital prognosis. The fight against diabetic foot disease therefore relies on prevention through education of patients and healthcare staff and early detection of lesions, as well as multidisciplinary, concerted management.

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Conflict of interest: The authors declare no conflict of interest.

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