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Amputations and Disarticulations in the Diabetic Population of Saint-Louis of Senegal: Experience on a Series of 1308 Patients

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Abstract: Diabetes is one of the most common metabolic diseases, and statistical disparities are decreasing between Northern countries and sub-Saharan Africa. This disease is grafted with 10 to 15% of tissue complications that can result in amputations of limbs. The objective of our work was to quantitatively evaluate amputations and disarticulations over a period of 9 years. This is a retrospective study resulting from the exploitation of the registers and medical files of 4 departments of the Regional Hospital of Saint-Louis, over a period of 9 years. We selected 1308 patient files for inclusion in the study. We found a high prevalence for gangrenes (61.1%) and chronic skin ulcers (19.2%). Diabetes was inaugural in 13.6% of surgical complications. Lower limb involvement was predominant (75.1%). A total of 778 amputations and disarticulations were performed over a period of 9 years. Amputations and disarticulations predominated (Fig. 3) on legs (59.4%), thighs (22%) and forefeet (12%). The surgical complications of diabetes that attack the soft tissues are bad. They are the main cause of limb amputation in diabetics. Mutilating surgery can be prevented by better sensitization and rapid management of diabetes.
Keywords: diabetes, tissue complications, amputations and disarticulation.

INTRODUCTION

At the beginning of this 21st century, diabetes represents a major public health challenge with worrying prevalence and ever-increasing mortality and morbidity rates. Diabetes is one of the most common metabolic diseases, and disparities are decreasing between Northern countries and sub-Saharan Africa [1]. Although many countries, such as Senegal, have developed national strategies to combat diabetes and its complications, care remains problematic, especially outside the capital Dakar.

According to several series, this disease is grafted from 10 to 15% of tissue complications that are the consequence of 3 entangled factors [2]: arterial lesions, neuropathic damage and infection. These complications are more and more frequent, and their management sometimes calls for a particularly aggressive and mutilating surgery, with disabling complications in the long term.

Diabetic patients represent vulnerable populations that are exposed to many problems. Financial limitations exacerbate this state of vulnerability. In particular, the impossibility for some patients to obtain adapted shoes can lead to the appearance of ulcers and necrosis requiring limbs amputations. Lower extremity amputations represent a common complication of diabetes, usually arising from vascular and neuropathic problems.

In sub-Saharan Africa, the prevalence rate of diabetes varies widely from country to country. Between 2010 and 2012 prevalence ranged from 2.8% in some rural areas of Angola [3] to 28.2% in cities of South Africa [4,5]. However, a recent study reported that in Saint-Louis (Senegal) this prevalence exceeded 10% in 2012 with uncontrolled diabetes in 2/3 of cases [6]. In 2015 Seck *et al*. even reported a gross prevalence of 12.7% in urban areas [7]. This prevalence is reflected in an increase in the complications of diabetes, including limbs amputations and disarticulations. The objective of our work was to quantitatively evaluate amputations and disarticulations over a period of 9 years, in order to highlight the impact of this mutilating surgery in the diabetic population of Saint-Louis.

MATERIAL AND METHODS

This is a retrospective study resulting from the exploitation of the registers and medical files of 4 hospital departments (Emergency room, General Surgery, Intensive cares and Operating room) of the Regional Hospital of Saint-Louis, over a total period of 9 years, from January 1st, 2009 to December 31st, 2017. In these files and registers we recorded the various parameters related to any surgery due to the tissue complications of diabetes.

RESULTS

A total of 1458 files were initially collected for diabetic patients who had at least one surgery for a tissue complication of their diabetes (Fig 1). However, 150 files were incomplete or unusable. We therefore selected 1308 patient records for inclusion in the study, with high prevalence for gangrenes (61.1%) and chronic skin ulcers (19.2%).

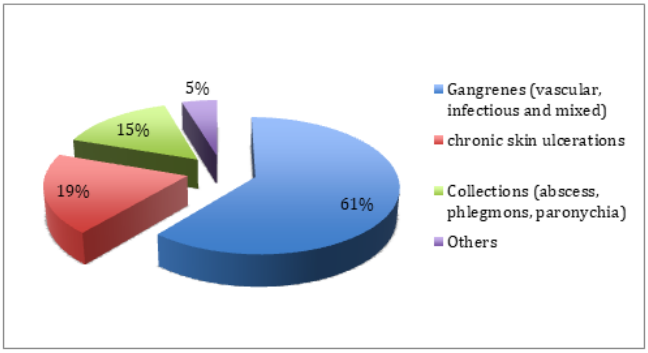

Fig-1: Types of tissue lesions

The sex ratio was 1.12 for men. Patients were aged on average 54.74 years old (19 - 94 years old). Diabetes was inaugural in 13.6% of surgical complications (178 patients). The involvement of the lower limb (Fig. 2) was predominant (75.1%).

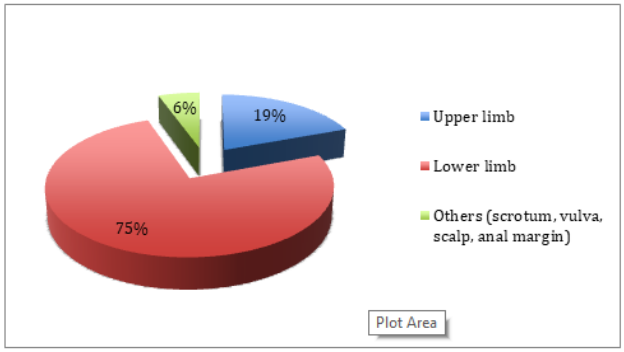

Fig-2: Topography of tissue lesions

In the hand, phlegmons were predominant (55%). About 49% of the patients were received with Wagner stage 5 (Table 1). A total of 778 amputations and disarticulations were performed over a period of 9 years. Amputations and disarticulations predominated (Fig. 3) on the leg (59.4%), the thigh (22%) and the forefoot (12%).

Table-1: The Wagner Ulcer Grade Classification Scale [8]

Grade	Description
Grade 0	Pre- or post-ulcerative site
Grade 1	Superficial ulcer
Grade 2	Penetration into tendon or joint capsule
Grade 3	Involvement of deeper tissues
Grade 4	Gangrene of the forefoot
Grade 5	Gangrene involving more than two-thirds of the foot

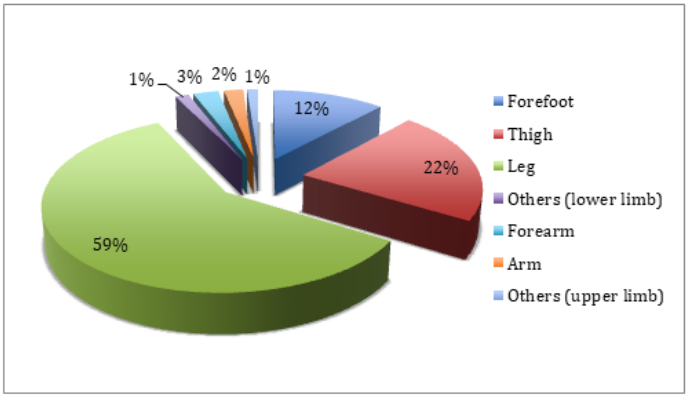

Fig-3: Levels of amputation and disarticulation

The proportion of patients hospitalized as a result of their intervention was 76.4%. The average duration of hospitalization was 12 days (1-138). In the General Surgery department, over the period from January 1, 2009 to December 31, 2017, 96% of non-traumatic amputations and 33% of surgical emergencies were directly related to the complications of diabetes. We found that 29% of patients had already been operated on at least once for a tissue complication of diabetes (recurrence). In the postoperative period the amputated limb equipment only interested 5-10% of patients.

DISCUSSION

The International Diabetes Federation (IDF) estimates for 2012 indicated that the total number of diabetics was 371 million patients [9]. About 7.5% (27.5 million patients) of this population resided in Africa, including 14.7 million patients in sub-Saharan Africa, and 12.8 million patients in North Africa and Sudan. The IDF projections suggest that in 2030 the total population of diabetics will increase by 51% to reach 552 million patients. The largest relative growth will occur in Africa, which will then have 49.7 million patients, or 9% of the total population of people with diabetes [9]. Globally, an estimated 422 million adults were living with diabetes in 2014, compared to 108 million in 1980. The global prevalence (age-standardized) of diabetes has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population. This reflects an increase in associated risk factors such as being overweight or obese. Over the past decade, diabetes prevalence has risen faster in low- and middle-income countries than in high-income countries. This increase is estimated to account for 40% of population growth and aging, 28% for an increase in prevalence at specific ages, and 32% for the interaction of both factors [10,11].

Diabetes caused 1.5 million deaths in 2012. Higher-than-optimal blood glucose caused an additional 2.2 million deaths, by increasing the risks of cardiovascular and other diseases. Forty-three per cent of these 3.7 million deaths occur before the age of 70 years. The percentage of deaths attributable to high blood glucose or diabetes that occurs prior to age 70 is higher in low- and middle-income countries than in high-income countries [11]. The combination of increasing prevalence of diabetes and increasing lifespans in many populations with diabetes may be leading to a changing spectrum of the types of morbidity that accompany diabetes. In addition to the traditional complications described above, diabetes has been associated with increased rates of specific cancers, and increased rates of physical and cognitive disability [11].

The rapid growth in the prevalence of diabetes in Africa is largely attributed to accelerated changes in the environment. These changes are characterized by increased urbanization and its consequences, and by an increase in life expectancy in Africa [1,3,4,5]. Studies in Senegal show that the presence of diabetes is associated with "classical" risk factors: age, female gender, obesity, family history of diabetes, physical inactivity, risky eating. With the increase in life expectancy, major changes in lifestyle have occurred with adverse consequences for the impact of diabetes: rapid urbanization, food transition, sedentary lifestyle [7]. Numerous predictions predict an abnormal increase in diabetes incidence in sub-Saharan Africa over the next decade [11].

Diabetes and its complications bring about substantial economic loss to people with diabetes and their families and to health systems and national economies through direct medical costs and loss of work and wages. While the major cost drivers are hospital and outpatient care, a contributing factor is the rise in cost for analogue insulins1 which are increasingly prescribed despite little evidence that they provide significant advantages over cheaper human insulin [12-15]. The physical complications associated with diabetes, including poor vascularization, can cause lower- limb wounds that may lead to amputation. Without proper care and support this can profoundly limit a person’s ability to work, play a full family role and enjoy recreational activities. Furthermore, people with diabetic wounds require close attention to prevent infection and deterioration that can lead to death.

Rehabilitation services play a fundamental role across the continuum of care for people with diabetes, helping prevent complications and providing interventions to keep people mobile and active.

Diabetes appears to dramatically increase the risk of lower extremity amputation because of infected, non-healing foot ulcers [16]. Rates of amputation in populations with diagnosed diabetes are typically 10 to 20 times those of non- diabetic populations, and over the past decade have ranged from 1.5 to 3.5 events per 1000 persons per year in populations with diagnosed diabetes [16]. The physical, psychological and economic consequences of lower extremity amputations are severe. These amputations hinder the mobility and autonomy of patients. They can have a lasting impact on employment opportunities and quality of life, with a direct impact on patients' morbidity [15,16]. However limb amputations are not systematic in case of diabetic foot, they always result from the failure of a conservative treatment. The main reason for lower extremity amputations is probably ischemia, which is frequently associated with diabetes. Amputated diabetics pose particular problems in relation to wound healing, disability, patient survival and functional difficulties.

Fig-4: Bulky mixed gangrene of the left foot in a diabetic patient, causing leg amputation

The debate about different treatments for diabetes complications continues. In their work Ecker *et al*. [17] report that the best way to determine a level of amputation is to study the temperature and appearance of the skin, rather than pulse, oscillometry, and arteriography. In our work we have not favoured any criteria. We have all taken them into account, the goal being to surgically eliminate all gangrene of diabetic origin, without causing useless disability in our patients. But all these measures did not prevent re-amputations. In the literature, among diabetic amputees, up to 34% still need to be amputated to an even higher level for the same reasons [18]. In our work the proportion of amputee patients at least 2 times on the same limb was 27%. The level of awareness of the disease was low in our study (diabetes was inaugural at the stage of complication in 13.6% of cases). However, this rate was better than those found by Seck *et al*. [7] (57%) and Duboz *et al*. [19] (10%) who also worked on Senegalese populations. This difference can be explained by the fact that at the stage of complications diabetic patients are better sensitized on the disease.

Fig- 5: X-ray showing extensive necrosis of the muscles and bones of the forefoot in a diabetic patient

In order to preserve the quality of life of amputee's as much as possible, early rehabilitation based on prosthesis is strongly encouraged. However, despite the fact that leg amputations offer better chances of rehabilitation than thigh amputations, the success rate of prosthetic rehabilitation of leg amputations is only 66% in the literature [18].]. Member preservation strategies such as revascularization can be interesting alternatives when they are proposed early. In the region of Saint-Louis of Senegal rehabilitation by prostheses is difficult to implement. Indeed, even though there is a prosthetic rehabilitation unit at the Saint-Louis hospital, this unit is largely under-equipped. In addition, these prostheses of members are very expensive compared to the average economic level of the amputated patients. Concerning revascularization procedures for members, they are not yet effective at the Saint-Louis Hospital. This leaves few options for the management of diabetic feet in Saint-Louis. Despite the diversification of diabetic foot management methods in sub-Saharan

Africa, surgery is often the last resort. It is also one of the most expensive methods. In Senegal, health insurance is non-existent for the majority of patients. Hospital costs are therefore mainly supported by the patient's family and relatives, with important social implications. In this context, preventive measures are therefore particularly important. Prevention should be undertaken primarily in patients at risk of complications. This prevention also requires better control of risk factors in the diabetic and non-diabetic population, and broad awareness. In the diabetic population in particular, health education should be offered on the importance of foot care and early detection of limb injuries. These measures must make it possible to reduce the incidence of amputations and disarticulations due to diabetes in the city of Saint-Louis.

Fig-6: Phlegmon of the palm of the right hand in the perforation phase in an untreated diabetic

The relationship between diabetes and the risk of catastrophic medical expenditure by individuals and families has been explored in 35 developing countries. This research found that people with diabetes had a significantly greater chance of incurring catastrophic medical expenditure compared to similar individuals without diabetes. Health insurance was not significantly related to lower risks of catastrophic medical expenditure. The effects were more marked in lower-income countries [15]. Diabetes imposes a large economic burden on the global health-care system and the wider global economy. This burden can be measured through direct medical costs, indirect costs associated with productivity loss, premature mortality and the negative impact of diabetes on nations' gross domestic product (GDP) [10,11]. Direct medical costs associated with diabetes include expenditures for preventing and treating diabetes and its complications. These include outpatient and emergency care; inpatient hospital care; medications and medical supplies such as injection devices and self-monitoring consumables; and long-term care. Besides the economic burden on the health-care system and national economy, diabetes can impose a large economic burden on people with diabetes and their families in terms of higher out-of-pocket health-care payments and loss of family income associated with disability and premature loss of life.

There are no simple solutions for addressing diabetes but coordinated, multicomponent intervention can make a significant difference. Everyone has a role to play – governments, health-care providers, people with diabetes and those who care for them; civil society, food producers, and manufacturers and suppliers of medicines and technology are all stakeholders. Collectively, they can all make a significant contribution to halt the rise in diabetes and improve the lives of those living with the disease.

CONCLUSION

Surgical complications of diabetes that attack the soft tissues and often include several components (vascular, neuropathic, and infectious) with a diabetic imbalance are particularly worrying. They are the main cause of limb amputations and disarticulations in diabetics.

In Saint-Louis of Senegal the problem of managing diabetes and its surgical complications is complex and multifactorial. Mutilating surgery can be prevented by better sensitization and early management of diabetes, as well as a preventive approach to its complications. It also involves the complete management of already amputated diabetics.

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