SURGICAL SEPTIC COMPLICATIONS OF THE DIABETIC FOOT – A SINGLE CENTER EXPERIENCE

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ORIGINAL PAPER

DOI: 10.33695/rojes.v3i2.42
Accepted: 16.11.2021

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Abstract

Diabetic foot includes all the pathogenic changes that are caused by diabetes mellitus (DM): damage to the nerves, vessels, bones and soft tissue, causing changes in the biomechanics of the foot, severe infections and tissue damage. Diabetic foot has a higher risk of amputation compared to the risk of nephropathy or retinopathy caused by DM and is the most common cause of hospitalization of patients with DM. In the management of these patients, the most important things are a good glycemic control, lifestyle change and the choice of an appropriate medical and surgical treatment. We conducted a retrospective study on 299 patients with type 1 (DMT1) or 2 (DMT2) of DM associated with septic lesions in the lower limb, hospitalized in the General Surgery Department of the Clinical Hospital „Dr. Ion Cantacuzino” between January 1, 2020-December 31, 2021. A better glycemic control was found in patients receiving insulin (20.3%) in contrast to those on oral antidiabetics (16.3%). Vascular involvment was found in 90.6% of cases, followed by neuropathy (27.1%). 95.5% of patients treated with insulin had arteriopathy in their disease pathology, and those treated with oral antidiabetics were diagnosed with arteriopathy in 86.7% of cases. The main type of lesion was wet gangrene, in 59.9% of patients. Necrosis and ischaemic gangrene are found in 19.7% of cases and 16.7% respectively.

Keywords: diabetic foot, amputation, surgery, diabetes mellitus

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia and is classified into three types: type 1 diabetes, type 2 diabetes and gestational diabetes [1]. Type 1 diabetes mellitus (T1DM) represents 5% to 10% of DM and is characterized by autoimmune destruction of insulin-producing beta cells in the islets of the pancreas. Type 2 diabetes mellitus (T2DM) represents 90% of DM; in this case the insulin resistance is incriminated in the physiopathology. T2DM is a

heterogeneous, complex, multisystemic pathology with multiple associated comorbidities that requires a multifactorial and individualized approach to treatment [2].

For the diagnosis of T2DM the following criteria are to be fulfilled: glycaemia a jeun: 126 mg/dL (7 mmol/L) or higher on two separate tests; glycated hemoglobin level of 6.5% or higher on two separate tests; a blood sugar level of 200 mg/dL — 11.1 millimoles per liter (mmol/L) — or higher; oral glucose tolerance test - a blood sugar level more than 200 mg/dL (11.1 mmol/L) after two hours indicates the presence of diabetes. If there are symptoms specific to DM (polyuria, polypsia, weight loss, polyphagia) a single modified analysis of these indicates the presence of DM. In the absence of a diabetes-specific clinical picture, two modified tests will be required.

The term "diabetic foot" refers to all the pathogenic changes that are caused by DM in the nerves and blood vessels, bones and soft tissues, which can lead to changes in the biomechanics of the foot, that can cause severe infections and even tissue damage which can go as far as the need for amputations at this level [3]. The risk of a diabetic patient suffering from a foot lesion which could lead to amputation is greater than that of diabetic nephropathy or retinopathy, with the diabetic foot being the most common cause of hospitalization for patients with diabetes [4].

According to epidemiological data, neuropathy is responsible for about 50% of cases of diabetic foot. Peripheral occlusive arterial disease itself is responsible for only 15% of cases, while in 35% of cases, foot ulcers develop as a combination of both neuropathy and angiopathy [5].

The diabetic foot can be divided into two categories: the neuropathic foot: the foot is warm with optimal vascularization and a present, easily detectable pulse; it is susceptible to bone deformities and joint problems, leading to the entity defined as Charcot's neuropathic osteoarthropathy [5],[6]. The second form is neuroischemic foot with cold integuments, impalpable pulse with suboptimal vascularization.

Ischaemic gangrene is characterized by the appearance of an area of necrosis located at the level of the fingers of the lower limb in particular, which has the ability to extend, covering the entire finger or even adjacent tissues. This lesion may progress to self-amputation (rarely) or may become infected and as a result wet gangrene may occur [4].

Ischaemic gangrene involves tissue necrosis due to chronic ischemia through which the tissue becomes paresthetic, dehydrated and necrotic [7].

Wet gangrene occurs as a result of superinfection of ischemic necrosis in gangrene lesions. Locally, the appearance of purplish erythematous swelling will be observed, accompanied by local pain and fever (38-38.5 ° C). This type of infection can progress to a proximal or deep septic process to the osteoarticular skeleton [8]. Extensive wet gangrene is a serious, urgent situation; emergency surgery for amputation is essential. The septic process is characterized by a rapid expansion that occurs in the form of necrotic-purulent spindles along the interosseous spaces, tendons and synovial sheaths, progressively affecting the muscles and the osteoarticular system [8].

Managing and treating a diabetic foot infection can be challenging and should involve a multidisciplinary team of experts, including surgeons, infectious disease specialists, diabetologists, podiatrists, etc [9]. Most diabetic foot infections start with an injury and once an infection occurs the risk of hospitalization and amputation increases dramatically. Early identification of the infection and prompt treatment can optimize the patient's outcome and can save the affected limb [9]. The purpose of the treatment of diabetic foot is to achieve tissue healing while maintaining adequate function. Antibiotic treatment of the invasive infection in conjunction with tissue debridement or

amputation are essential management principles [10].

Material and methods

A retrospective study was carried out over a period of 12 months from January 1, 2020 to December 31, 2021, with a group of 299 patients with T1DM or T2DM associated with septic lesions in the lower limb. The patients were hospitalized in the General Surgery Department of the Clinical Hospital "Dr. Ion Cantacuzino". The selection of patients in the study was made using inclusion and exclusion criteria. As inclusion criteria we mention: Patients who were admitted exclusively to the General Surgery Department of the Clinical Hospital "Dr. Ion Cantacuzino", people over 18 years of age male and female who have been diagnosed with DM and have septic lesions in the pelvic limb. The exclusion criteria are represented by incomplete clinical observation sheets; inpatients outside the period 1 January 2020-31 December 2021; patients not diagnosed with diabetes. The data needed to perform this study were obtained from the interpretation of the patient observation files.

Results

In order to carry out this study, the following parameters were analyzed and interpreted: sex; age; type of DM; DM treatment; when DM started; cardiovascular damage; kidney damage; the presence of neuropathy; the presence of arteriopathy; blood glucose value; the presence of anemia; type of intervention; surgical history; post amputation evolution; post-amputation mortality; early death after surgery.

From the group of 299 patients included in the study, who were treated in the General Surgery Department of the Clinical Hospital "Dr. Ion Cantacuzino", between January 1, 2020 and December 31, 2021, 93 (31.1%) were female and 206 (68.9%) patients were male. The mean age of the patients with lower limb pathology who have been diagnosed with DM was 64.9 years, ranging from 27 to 95 years. Of the total number, in terms of age and sex distribution, both men and women showed a peak incidence of lower limb pathology in the group age of 50-79 years old, with the mention that the peak of men it was reached faster, respectively in the 6th and 7th decades, respectively (Figure 1). Among the female patients, 43% are found in the 8th decade.

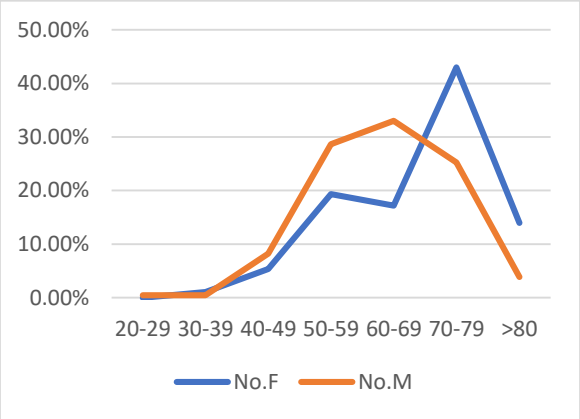

Figure 1 - Age and sex distribution

In terms of the type of DM that the patients had, 9 patients had DMT1 and 290 had DMT2. The dominant percentage (97%) of patients who develop diabetic foot is found among patients with D2TM, so we can conclude the importance of preventing risk factors that are involved in the etiology of DM. Most patients, 64.8% have had the disease for more than 10 years; 30.1% of patients could not specify the time of onset, and only 5.1% of patients had an onset of the disease under 10 years of age. It is thus observed that a minority of patients presented the need for surgery less than 10 years after the evolution of the disease. Cardiovascular lesions in patients who develop complications of the pelvic limbs are found in a large proportion; of the total number of patients included in this study, about one-third had kidney damage and a small proportion of patients had retinopathy.

A significant percentage of patients, respectively 61.5%, have anemia, but a normal value of hemoglobin was found in a percentage of 38.5%.

In the group we studied, patients used both insulin and oral antidiabetics to control the underlying metabolic disease (Table 1). There is a slight difference in the type of treatment administered, being predominantly the one with oral antidiabetics, which is 55.5%. In our study, the main type of lesion was wet gangrene (Figure 2 and 3), which is the most common type of lesion due to a septic pathology of the diabetic foot, namely 59.9% of patients have this complication. The following lesions in frequency are necrosis and ischemic gangrene (Figure 4) (19.7% and 16.7% respectively). Other less common complications include ischemic gangrene, abscess and osteonecrosis (Figure 2).

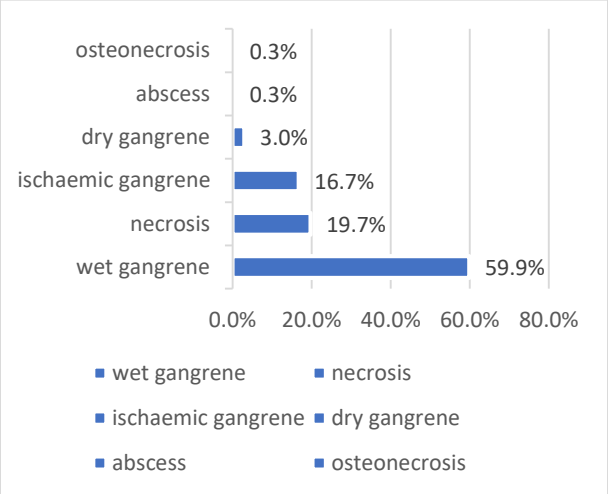

Figure 2 - Type of lesions in patients with diabetic foot.

Discussion

Following the study, we can conclude that males with DM have a higher rate of diabetic foot. As in the literature, men are more likely to develop complications of diabetes, unlike women, whose percentage is lower. This can be attributed to various factors from a different lifestyle depending on gender, to genetic and hormonal factors [11].

Figure 3 - Wet gangrene of the toes

Figure 4 - Ischemic gangrene of the toes

The maximum prevalence of age is between 50 and 79 years. These data correspond to the results found in the literature according to which an important risk factor for the occurrence of chronic complications is advanced age [12].

It can be seen that the occurrence of diabetic foot and its septic complications that lead to the need for surgery is much more common among patients with an evolution of the disease over 10 years, so that education as well as early presentation to the doctor can change the prognosis of the disease. In our

study there is an occurrence of complications of DM that are more common among patients whose pathology began 10 or more years ago. The duration of the disease for almost 10 years is recognized in the literature as an important risk factor [13].

In the group we studied, there were more patients treated with oral antidiabetics (55.5%) than insulin (44.5%). The literature refers to the presence of better glycemic control with fewer complications of diabetes in patients treated with insulin [14].

Glycemic control is very important in these patients, to prevent various complications that can lead in time to sepsis, amputations and other adverse consequences [15].

In our study, we found a better glycemic control in patients receiving insulin (20.3% of the total number of patients who received insulin), in contrast to those on oral antidiabetics (16.3% of the total number of patients who received oral antidiabetics).

Variables		**Oral Antidiabetics**		**Insulin**	
		Pts (n=166)	P%	Pts (n=133)	P%
Duration of the disease	<10 years	11	6.6%	4	3%
	>10 years	106	63.9%	88	66.2%
	Undefine	49	29.5%	41	30.8%
Preprandial blood glucose	<125 mg/dl	27	16.3%	27	20.3%
	>125 mg/dl	106	83.7%	106	79.7%
	>300 mg/dl	33	19.9%	22	16.5%
Etiopathogeny	Arteriopathy	144	86.7%	127	95.5%
	Neuropathy	47	28.3%	34	25.5%
	Mixt	25	15.1%	28	21.1%
Postoperative care	<5 days	62	37.3%	45	33.8%
	5-9 days	75	45.2%	58	43.6%
	>=10 days	24	14.5%	28	21.1%
	No surgery	5	3%	2	1.5%
Nephropathy	+	50	30.1%	58	43.6%
	-	116	69.9%	75	56.4%
Retinopathy	+	28	16.9%	37	27.8%
	-	138	83.1%	96	72.2%
Cardiovascular disease	+	118	71.1%	96	72.2%
	-	48	28.9%	37	27.8%
Anemia	+	100	60.2%	84	63.2%
	-	66	39.8%	49	36.8%
Hyperleukocytosis	+	86	51.8%	81	60.9%
	-	80	48.2%	52	39.1%
Previous surgery	+	91	54.8%	81	60.9%
	-	75	45.2%	52	39.1%

Table 1 - Comparison between patients treated with insulin therapy and patients treated with oral antidiabetics.

We observed a higher percentage of patients on insulin therapy (21.1%), who had a postoperative period of more than 10 days, in contrast to patients treated with oral antidiabetics (14.5%). The percentage of patients with hyperleukocytosis treated with insulin was greater than those treated with oral antidiabetics.

Arteriopathy, neuropathy and mixed lesions (arteriopathy and neuropathy) can be listed as risk factors for the occurrence of septic complications of the diabetic foot. They promote the appearance of ulcers by reducing sensitivity and vascularity, or both. Vascular damage is the most common cause of diabetic foot. This can be determined both by the involvement of small vessels (microangiopathy) and by the involvement of large vessels (macroangiopathy). In our study, the most common pathology was arteriopathy (90.6%), followed by neuropathy (27.1%). 95.5% of patients treated with insulin had arteriopathy in their disease pathology, and those treated with oral antidiabetics were diagnosed with arteriopathy in 86.7% of cases.

Conclusion

Following the study, we can conclude that males with DM have a higher rate of diabetic foot. The maximum prevalence of age is between 50 and 79 years.

It can be seen that the occurrence of diabetic foot and its septic complications that lead to the need for surgery is much more common among patients with an evolution of the disease over 10 years, so that education as well as early presentation to the doctor can change the prognosis of the disease. Glycemic control is an important factor to consider, as it can be seen that patients with poor glycemic control are more likely to suffer from chronic complications, so both the choice of optimal treatment and educating patients about the importance of lifestyle life and adherence to treatment are key factors in reducing the number of complications.

We found a better glycemic control in patients receiving insulin, in contrast to those on oral antidiabetics. Also, patients treated with insulin have experienced arteriopathy more frequently, unlike those treated with oral antidiabetics. A higher percentage of patients on insulin therapy had a postoperative period more than 10 days, in contrast to patients treated with oral antidiabetics.

Diabetic foot occurs most frequently in patients with DMT2 and much less among those with DMT1. The high prevalence of wet gangrene, being the most common septic complication of patients under study, leads to an increased rate of surgery, and a decrease in their number can help reduce the number of mutilating interventions and significantly improve the quality of life of patients.

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