

Risk factors and distribution of arterial obstructions and/or occlusions in patients with critical lower limb ischemia

Factores de riesgo y distribución de las obstrucciones y/o oclusiones arteriales en pacientes con isquemia crítica de miembros inferiores

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ABSTRACT

As a consequence of the increase in patients who come to our hospital diagnosed with Peripheral Vascular Disease (PVD) and a significant number of them present Critical Ischemia of the Lower Limbs (ICMI); We started a study with the aim of stratifying the distribution of obstructions and/or occlusions in the arterial circuit of the lower limbs of these patients and recording the cardiovascular risk factors present in patients with ICMI.

This study was carried out for 3 years, where 785 patients diagnosed with PVD were evaluated and of these, 200 patients (25.4%) presented ICMI, in the study it was possible to show that this pathology predominates in the male sex, that among the cardiovascular risk factors diabetes mellitus is present in more than half of the population studied, that smoking is a cause that increases atherosclerotic disease making possible its evolution and worsening of the disease. ICMI, being a pathology generally of chronic evolution, its arterial distribution is mainly presented as lesions that cover different areas in the arterial circuit and its presence predominates in the Femoropopliteal and Infrapopliteal joint sectors, it was observed that the longest obstructions are present in the region infrapopliteal artery with an average of 180 mm in length and that the occlusions in this pathology occur more frequently in the posterior tibial artery

Keywords: critical lower limb ischemia, peripheral vascular disease.

RESUMEN

Como consecuencia del aumento de pacientes que acuden a nuestro hospital diagnosticados con enfermedad vascular periférica (EVP) y de ellos un número importante presentan isquemia crítica de miembros inferiores (ICMI), iniciamos un estudio con el objetivo de estratificar la distribución de las obstrucciones y/o oclusiones en el circuito arterial de los miembros inferiores de dichos pacientes y registrar los factores de riesgo cardiovasculares presentes en los que cursan con ICMI.

Este estudio se llevó a cabo durante 3 años. Se evaluó a 785 pacientes diagnosticados con EVP, de los cuales 200 (25,4%) presentaron ICMI. Se pudo evidenciar que esta patología predomina en el sexo masculino, que entre los factores de riesgo cardiovasculares la diabetes mellitus está presente en más de la mitad de la población estudiada y que el tabaquismo es una causa que incrementa la enfermedad aterosclerótica haciendo posible su evolución y agravamiento. La ICMI, al ser una patología generalmente de evolución crónica, su distribución arterial está principalmente presente como lesiones que abarcan diferentes zonas en el circuito arterial y predomina su presencia en los sectores conjuntos femoropoplíteos e infrapoplíteos. Se observó que las obstrucciones más largas están presentes en la región infrapoplíteo con un promedio de 180 mm de longitud y que las oclusiones se presentan con mayor frecuencia en la arteria tibial posterior.

Palabras clave: isquemia crítica de miembros inferiores, enfermedad vascular periférica.

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INTRODUCTION

Given the presence and incessant growth of Critical Ischemia of the Lower Limbs (ICMI), as a result of the evolution and worsening of Peripheral Vascular Disease (PVD)¹ worldwide and becoming a public health problem shortly, the Cardiovascular risk factors such as age, sedentary lifestyle, diabetes mellitus, smoking, dyslipidemia, overweight, previous coronary disease and even increased life expectancy are present in patients suffering from PVD, these promote the pathological change that sews in the formation and evolution of severe obstructions in the arteries of the lower limbs; We have carried out a study that allows us to stratify the anatomical distribution of Critical Lower Limb Ische-

mia (ICMI) and record which are the main risk factors that are present in our study population.

This study was carried out as a result of the increase in the number of consultations in our Hospital for Peripheral Vascular Disease and a significant number of this group presented ICMI; We decided to start a registry of patients treated for 3 years in January 2020, register, diagnose and include in our study those who had a diagnosis of Critical Ischemia of the Lower Limbs Grade III and IV of the Fontaine Classification, in this way to know the main cardiovascular risk factors present in our patients and additionally observe the distribution of lesions and/or occlusions in the arterial circuit of the lower limbs.

Objective

Carry out a study that helps us record the predominant risk factors in patients diagnosed with Critical Ischemia of the Lower Limbs Grade III and IV of the Fontaine Classification and establish the distribution of obstructions and/or occlusions in the arterial circuit in our study population.

METHOD AND MATERIALS

This study is based on an observational, prospective, descriptive method, which was carried out from January 1, 2020 to December 31, 2022, in which we included patients who came to our hospital with a diagnosis of peripheral vas-

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TABLE 1. Fontaine classification.

Grade I	Asymptomatic
Grade II a	Intermittent claudication > 200 m
Grade II b	Intermittent claudication < 200 m
Grade III	Pain at rest
Grade IV	Necrosis / gangrene

TABLE 2. Clinical demographic characteristics of the study group.

Variable	Number	Percentage
Population	200	100%
Average age	68	
Male sex	169	84,50%
Risk factors		
Arterial hypertension	152	76%
Smoking	105	52,50%
Dyslipidemia	72	36%
Mellitus diabetes	123	61,50%
Cardiovascular history		
Previous coronary heart disease	22	11%
Previous amputation	9	4,50%
Bilateral commitment	16	8%

cular disease. Of these, the population that presented Grade III and IV Critical Ischemia of the lower limbs according to the Fontaine Classification (**Table 1**) was included in the study. It must be emphasized that ICMI also presents acutely, but this study is focused and it was based on patients with Critical Ischemia of the Lower Limbs of chronic presentation as a result of the severe evolution of PVD.

These patients were diagnosed by arterial Doppler echo of the lower limbs, Ankle/Arm Index (ABI), peripheral angiography and the distribution and severity of obstructions and/or occlusions were evaluated (**Table 1**).

Statistical analysis

The results were expressed in percentages for the variables according to each category that was established for the study.

RESULTS

This work had a study population of 785 patients who presented EVP and after its evaluation, 200 patients with ICMI Grade III and IV of the Fontaine classification entered the study, therefore 25.4% of the patients who came to our consultation with EVP presented ICMI, we established the main risk factors present in patients with this pathology, the average age of patients with ICMI was 68 +/- 6 years, 84.5% of the patients are male, 76% presented arterial hypertension, 52.5% are smokers, 36% dyslipidemic, 61.5% diabetes mellitus (DBT) under treatment, 11% with previous vascular disease, 4.5% with previous amputation, 8% of the patients presented bilateral compromise and 11% presented coronary disease previous (**Table 2**).

TABLE 3. Angiographic distribution of lesions in ICMI.

Variable	Number	Percentage
Femoropopliteal and infrapopliteal	82	41,00%
Infrapoplitea	78	39,00%
Femoropopliteal	20	10,00%
Iliac femoropopliteal	10	5,00%
Iliacus femoral	8	4,00%
Femoral	2	1,00%

Obstructions present in the ICMI

Affected area	Length
Iliac	60 mm
Femoropopliteus	120 mm
Infrapopliteus	180 mm

Occlusions present in the ICMI

Affected arteries	Percentage
Posterior tibial	35%
Anterior tibial	30%
Peroneal artery	20%
Femoral	10%
Poplitea	5%

The distribution of obstructions and/or occlusions in the lower limbs occur in isolation, affecting a single sector of the arterial circuit, however, in this type of chronic lesions their presentation is more frequent when performed jointly between several segments of the arterial circulation of the affected lower limb.

In this way it was possible to see that the lesions occur with a higher incidence in the joint regions that cover the Femoropopliteal and infrapopliteal area with 41%, followed by infrapopliteal lesions with 39%, lesions in the femoropopliteal region occurred in 10%, Lesions that included the iliac-femoropopliteal areas occurred in 5%, the iliac-femoral region 4% and the femoral area 1%.

The length of the obstructions that occur in the iliac zone is an average of 60 mm, while in the femoropopliteal region it is 120 mm and the longest are in the infrapopliteal or infrapatellar region with 180 mm obstructions; On the other hand, occlusions occur in a higher percentage in the arteries of the infrapatellar region with a higher prevalence in the posterior tibial artery (**Table 3**).

DISCUSSION

Peripheral Vascular Disease is a pathology that occurs in more than 200 million people in the world, with an incidence of between 500 and 1000 cases per million inhabitants¹, its pathophysiology exposes the presence of an imbalance between the contribution and the need for Blood flow to the tissues of the lower limbs, underlying atherosclerotic disease, usually manifests itself after 50 years of age, its progress is strongly linked to age, increasing by more than 10% among patients between 60 and 70 years of age², from slow evolution and interacts with risk fac-

tors related to age, diabetes mellitus, smoking, dyslipidemia, among others³; where the obstructions become severe stenosis and/or occlusion occurs in isolation or in multiple areas of the arterial circuit.

ICMI has two forms of presentation, one acute and the other chronic; Acute is the least common and its origin occurs as a result of embolism, dissection, trauma, acute thrombosis, phlegmasia alba dolens, occlusion of previous vascular reconstruction and is characterized by a clinical picture of sudden onset, ischemic pain at rest, deficit neurological (sensory and motor) and absence of pulsatile flow in Doppler; Chronic ICMI is more frequent and represents the terminal stage of peripheral arterial disease, which increases the risk of amputation over time with an incidence of 25% one year after diagnosis; Its main causes are related to atherosclerosis or severe peripheral vascular disease that has evolved and causes obstructions to become occlusions, with its clinical picture of ischemic pain at rest, with or without minor or major tissue loss (Necrosis).

Age is a non-modifiable risk factor that is present in the majority of patients with ICMI; in our study, the average age was 68 years.

Diabetes mellitus is one of the main causes related to this disease, its prevalence in the general population is 8%, it is estimated that in Latin America in 2030 there will be approximately 91 million people with diabetes and it is increasing rapidly, 15 to 25% develop ulcerations in the feet throughout their lives, more than 50% of them will have serious complications, the possibility of generating critical ischemia of the lower limbs increases 5 times and the possibility of amputation 5 to 10 times, in patients with diabetes the distribution of the lesions are found mainly in the femoral and infrapopliteal region with 36%⁴.

Smoking is associated with a marked increase in the risk of peripheral atherosclerosis, excessive cigarette consumption progresses the disease and increases the risk of amputation, peripheral graft occlusion and mortality, so smoking cessation is the cornerstone in the treatment of PVD, as well as in the treatment of coronary vascular disease⁵. Smoking promotes endothelial dysfunction and alters lipid metabolism and coagulation, distribution is more frequent in the Iliaco Femoral and popliteal region. Dyslipidemia is a risk factor in the formation of atherosclerosis, familial or acquired hypercholesterolemia is an adjuvant of PVD and therefore in ICMI, this will also be reflected in the carotid and coronary arteries. Its presence increases the possibility of presenting complications related to Cerebro Vascular Accidents (CVA) and Acute Myocardial Infarction (AMI).

Its diagnosis can be made through different study methods, among the main ones we can mention non-invasive studies such as Doppler echo, B mode, pulsed (color-energy) flow mode, three-dimensional (with intravenous contrast that enhances the image, Doppler ankle/brachial index, endovascular imaging techniques such as intravascular ultrasound (IVUS), image reconstruction

techniques: Angiotac, Angio-MRI, Angiographic techniques: digital angiography⁶.

ICMI treatment is based on reperfusion of the affected limb, this can be through a surgical, endovascular and hybrid strategy; the purpose of the procedure is to reperfuse and avoid amputation of the limb⁷.

In the case of endovascular treatment, angioplasty with stent is performed and the surgical strategy consists of repair by this route (Aorto-bifemoral Bridge, Axillo-bifemoral Bridge, Femoro-Femoral Bridge).

The complication of ICMI if it is not treated on time is amputation, which goes beyond a disability, increases mortality up to almost 50% in the first 12 months after surgery, it is estimated that 1 million amputations are performed per year in the world, only in the USA more than 90% of amputations per year are due to ischemia or infectious gangrene⁸, 30% of infrapopliteal amputations do not walk again, 70% of general amputations do not walk again either⁹, after of a major amputation¹⁰, 60% have a contralateral amputation at 5 years and 50% die at 5 years.

CONCLUSION

This study allowed us to evaluate and identify the presence of peripheral vascular disease of the lower limbs in the population that came to our hospital, diagnose and identify patients who present with ICMI in its severe stage, helped to recognize the main risk factors involved in the formation of this pathology, in which it indicates that patients with diabetes mellitus are more likely to have ICMI because it is the main cardiovascular risk factor present in those patients with PVD, smoking is another pathology that increases atherosclerosis, aggravating PVD, so it is necessary to design anti-smoking mechanisms in our community, dyslipidemia, whether acquired or with a genetic component, produces and accelerates the evolution of PVD, follow a daily diet based on Mediterranean food, increase daily physical activity, reduce levels LDL-C <70 mg/dl, use antiplatelet agents in patients with pathological ABI (<0.5); regarding the distribution of lesions; these predominate in isolation in the infrapopliteal region, with greater prevalence in the posterior tibial, anterior tibial, and peroneal arteries in that order; on the other hand, significant lesions in multiple areas of the arterial circuit are concentrated in the region that jointly involves the femoral, popliteal, and infrapopliteal arteries; In general, the distribution of severe lesions occurs in the infrapopliteal areas where the arteries are of smaller caliber with an average of 2.5 mm in diameter and where occlusions are more present than stenosis. Therefore, these data explain why in the ICMI signs and symptoms occur more frequently in the distal segments of the lower limbs, the recommendation of this study is that we must create a multidisciplinary team in our hospitals made up of clinical physicians, clinical cardiologists, interventional cardiologists, vascular surgeon, surgeon surgeons, traumatologists, diabetologists, psychologists and nephrologists, in order to provide comprehensive care to patients undergoing ICMI.

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