ORIGINAL ARTICLE

Metabolic syndrome in patients with type 2 diabetes mellitus older than 40 years of age

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ABSTRACT

Introduction: type 2 diabetes mellitus is associated with other metabolic and non-metabolic disorders, with the possible common pathogenic link of insulin resistance and the progression of atherosclerotic cardiovascular disease. This situation has been denominated the metabolic syndrome.
Objective: to characterize patients with metabolic syndrome and type 2 diabetes mellitus over 40 years of age.
Methods: a descriptive, cross-sectional, developmental study, the universe consisted of 289 patients with a diagnosis of type 2 diabetes mellitus and the sample consisted of 159 patients with three or more criteria to establish the diagnosis of metabolic syndrome.
Results: the diagnosis of metabolic syndrome predominated in women with four criteria (44.3%); obesity, sedentary lifestyle, arterial hypertension and dyslipidemia, as family pathological history, were the predominant risk factors and 10 years of evolution (41.6%), with the highest percentage of criteria for diagnosis, which worsened metabolic control and increased cardiovascular risk.
Conclusions: patients diagnosed with metabolic syndrome with three and four criteria predominated in equal proportions. Family history of arterial hypertension, obesity and sedentary lifestyle were the most frequent, and arterial hypertension, abdominal obesity and dyslipidemia were the most relevant clinical and biochemical aspects. Those with between five and 10 years of evolution of the disease, with combined treatment of oral antidiabetics and insulin and with acceptable control prevailed. The increase in the number of years of evolution of diabetes and its poor control increase the diagnostic criteria for metabolic syndrome, with high and very high cardiovascular risk.
Key words: metabolic syndrome; cardiovascular risk; diabetes mellitus, type 2

RESUMEN

Introducción: la diabetes mellitus tipo 2 se asocia con otras alteraciones metabólicas y no metabólicas, con el posible nexo patogénico común de la resistencia a la insulina y la progresión de la enfermedad cardiovascular aterosclerótica. A esta situación se la ha denominado síndrome metabólico.

Objetivo: caracterizar a los pacientes con síndrome metabólico y diabetes mellitus tipo 2 mayores de 40 años.
Métodos: estudio de desarrollo, descriptivo, de corte transversal. El universo estuvo comprendido por 289 pacientes con diagnóstico de diabetes mellitus tipo 2 y la muestra por 159 con tres o más criterios para establecer el diagnóstico de síndrome metabólico.
Resultados: el diagnóstico de síndrome metabólico predominó para las mujeres con cuatro criterios (44,3%). La obesidad, el sedentarismo, la hipertensión arterial y la dislipidemia, como antecedentes patológicos familiares, fueron los factores de riesgo predominantes y 10 años de evolución (41,6%), con mayor porciento de criterios para el diagnóstico, lo que empeoró el control metabólico y aumentó el riesgo cardiovascular.
Conclusiones: predominaron los pacientes diagnosticados con síndrome metabólico con tres y cuatro criterios en igual proporción. Los antecedentes familiares de hipertensión arterial, obesidad y sedentarismo fueron los más frecuentes, y la hipertensión arterial, la obesidad abdominal y la dislipidemia los aspectos clínicos y bioquímicos más relevantes. Prevalecieron los que tenían entre cinco y 10 años de evolución de la enfermedad, con tratamientos combinados de antidiabéticos orales e insulina y con un control aceptable. El incremento de los años de evolución de la diabetes y su mal control aumentan los criterios diagnósticos del síndrome metabólico, con alto y muy alto riesgo cardiovascular.
Palabras clave: síndrome metabólico; riesgo cardiovascular; diabetes mellitus tipo 2

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is associated with other metabolic and non-metabolic disorders that, with the possible common pathogenic link of insulin resistance (IR), occur sequentially or simultaneously in a patient and accelerate the development and progression of atherosclerotic cardiovascular disease. This situation has been termed the metabolic syndrome (MS).[1]
Metabolic syndrome and its components have a great impact on the quality of life of those who suffer from it, although they are highly vulnerable to prevention and treatment measures. It is essential to adopt an international definition and diagnostic criteria in order to compare its magnitude between countries, states, cities, socioeconomic strata and age groups of the population.[2]
The prevalence of MS varies according to its definition and diagnostic criteria, the ethnic group studied, gender and age distribution. While it is true that the definition and diagnostic criteria to be adopted will depend on the purposes pursued, it is desirable to reach a consensus, in order to establish comparisons at the local, national and international levels.[2]
According to the National Health and Nutrition Examination Survey (NHANES) in US adults the prevalence of MS increased by more than 10% in 20 years, from 22% between 1988 and 1994 to 33% between 2007 and 2012. According to data from 2011 to 2016 the weighted prevalence of MS was 34.7% (95% CI 33.1-36.3). During this study period the frequency of MS increased significantly among those aged 20 to 39 years (from 16.2% to 21.3%; p=0.02), in women (from 31.7% to 36.6%; p=0.04), in Asian participants (from 19.9% to 26.2%; p=0.008) and in Hispanic participants (from 32.9% to 40.4%; p=0.01). Likewise, a significant increase in disease prevalence with age was evident for all subgroups.[3]

In Europe, one of the classic studies is the one carried out in Bostnia, which shows values of 10% for women and 15% for men; these figures rise to 42% in men and 64% in women when there is a disorder of hydrocarbon metabolism (altered basal glycemia or impaired glucose tolerance) and reach 78 to 84% in patients with type 2 diabetes mellitus.[4]
Early diagnosis and treatment are of vital importance in order to prevent complications. Therapeutic measures are available, both on lifestyle and drugs that, by acting on the pathophysiological bases that give rise to these processes, can, in some way, prevent them and, if this is not possible, reverse or slow their evolution towards more advanced stages.[1,2] The aim of this study is to characterize patients with metabolic syndrome and type 2 diabetes mellitus over 40 years of age.

METHODS

Design and population

A developmental, descriptive, cross-sectional research was carried out at the "Arnaldo Milián Castro" University Clinical Surgical Provincial Hospital of Santa Clara City, Villa Clara Province, from September 2020 to September 2022.
The population consisted of 289 patients with a diagnosis of type 2 diabetes mellitus who attended the Endocrinology Consultation. The sample consisted of 159 patients, selected through a criteria-based sampling.
Inclusion criteria:

- Who had three or more criteria proposed by the International Diabetes Federation (IDF) to establish the diagnosis of metabolic syndrome
- Age over 40 years old
- Who had a medical history, medical notes and physical examination (weight, height, abdominal circumference and blood pressure).
- Who had the following laboratory tests: fasting glucose and lipid profile (total cholesterol and triglycerides).

Exclusion criteria:

- Who suffered from mental illnesses that prevented an adequate interrogation.

Study variables

Variable diagnosis of metabolic syndrome:
Metabolic syndrome is a group of metabolic and vascular alterations secondary to insulin resistance with hyperinsulinemia. It is defined according to the IDF with three or more diagnostic criteria (abdominal perimeter, fasting glucose, C-HDL, triglycerides and blood pressure).
Scale: with three diagnostic criteria, with four diagnostic criteria, with five diagnostic criteria.

Study variables:

- Gender: feminine, masculine
- Age: 40-49, 50-59, 60-69, 70 years of age and older.
- Family pathological history: arterial hypertension, ischemic heart disease, hyperlipoproteinemia, primary hypothyroidism, stroke, liver cirrhosis, chronic obstructive pulmonary disease.

- Lifestyles: sedentary lifestyle, smoking, alcohol intake.
- Obesity: is the term used to define weight gain. According to body mass index (IMC, índice de masa corporal) using the Quetelet Index:

$$IMC = \frac{Peso(K_g)}{[Talla(m)]^2}$$

Scale: Non-obese: IMC between 18.5 and 24.9 kg/m2; Obese: IMC above 25 kg/m2

Clinical variables:

- Years of evolution of Diabetes mellitus: less than 5 years, 5 to 10 years, more than 10 years.
- Treatment of Diabetes mellitus: diet alone, sulfonylureas, biguanides, insulin, combined treatments.
- Metabolic control: assessment of clinical and biochemical parameters that evaluate the metabolic state of the disease and the risk of chronic complications in the diabetic patient (Table 1).

Table 1. Metabolic control variable scale

Scale	Bueno	Aceptable	Malo
Fasting blood glucose (mmol/l)	< 6.1	6.1-7	> 7
Glycemia, one or two hours postprandial	< 7.8	7.8-10	> 10
Total cholesterol (mmol/l)	< 5.2	5.2-6.1	> 6.1
Triglycerides (mmol/l)	< 1.7	1.7-2.2	> 2.2
IMC (kg/m^2)	18.5-24.9	25-26.9	≥ 27
Systolic blood pressure (mmHg)	< 130	140	> 140
Diastolic blood pressure (mmHg)	< 85	90	> 90

Cardiovascular risk variable:

The probability that a patient will develop a serious cardiovascular disease (myocardial infarction or stroke). It is generally estimated for the next 10 years after evaluation of the individual and takes into account age, sex, systolic blood pressure, tobacco use, total blood cholesterol and the presence of diabetes mellitus. The instructions for the use of the WHO/ISH risk prediction tables were taken into account.

Scale: ≥40% very high; <40% to 20% high; <20% to 10% moderate; <10% low.

Procedures/data collection and handling

The study employed theoretical, empirical and statistical methods that, with elements of qualitative and quantitative approaches, allowed the research to be carried out.

The patients were evaluated in consultation with prior informed consent. A medical interview was conducted at the Endocrinology outpatient clinic of the referred hospital. The information obtained was collected in the individual clinical history (model 54-04-1 of the Ministry of Public Health).

The data for the investigation were collected through a form elaborated for research purposes.

For the physical examination, each patient's blood pressure, height, weight and waist circumference were taken and the body mass index was calculated. An anaeroid sphygmomanometer, SMIC brand, previously calibrated at the Office

of Standardization of Villa Clara, was used to measure blood pressure. The proposed criteria were applied to make a correct measurement and for height and weight a standardized, correctly calibrated and certified Metripond scale was used. Waist circumference was measured with a flexible, inextensible and millimetric tape measure with the patient standing, at the end of exhalation and taking the midpoint between the lower edge of the costal grid and the upper end of the iliac crest.

The complementary examinations were performed at the Clinical Laboratory of the "Arnaldo Milián Castro" University Clinical Surgical Provincial Hospital; they included fasting glycemia and two-hour postprandial glycemia and total cholesterol and total triglycerides that allowed evaluating the metabolic control, establishing the diagnostic criteria for MS and estimating the cardiovascular risk.

The instructions for the use of the World Health Organization (WHO) risk prediction tables were taken into account. These tables indicate the risk of suffering a serious cardiovascular event, fatal or not (myocardial infarction or stroke), over a 10-year period according to age, sex, systolic blood pressure, tobacco use, total blood cholesterol and the presence of diabetes mellitus in 14 WHO epidemiological subregions. The WHO tables for the Americas region A (AMR A), designed for the epidemiological subregion corresponding to Canada, Cuba, and the United States of America, were used.

Statistical analysis

The data were stored in an Excel 2019 electronic tabulator spreadsheet, then exported to the statistical programs Jamovi2.3.0 and RStudio (R graphical interfaces), both free and open source statistical software for Gnu/Linux, Windows and MacOS. These programs make use of new third-generation statistical spreadsheets designed from scratch for ease of use.

A reliability level of 95% was set for which all null hypotheses of statistical tests used with statistical significance less than 0.05 were rejected.

The results were presented in text, tables and statistical figures and were contrasted and compared with the literature reviewed that relates to the research problem.

The chi-square test was used to evaluate the association in which if the significance value $p<0.05$ the association was considered to exist.

To characterize the association (intensity and direction) the Gamma statistic was evaluated for nominal variables.

To evaluate the intensity:

The closer to 1 or -1 the value of the statistic, the greater the intensity.

- From 0 to 0.3 or -0.3 low intensity.
- From 0.3 to 0.6 or -0.6 moderate intensity
- From 0.6 to 1 or -1 high intensity.

To evaluate the sense:

- From 0 to +1 the association is direct (when one variable increases, the other increases).
- From 0 to -1 the association is inverse (when one increases, the other decreases).

Ethical considerations

From the ethical point of view, the research was justified because it was carried out in accordance with the established in the National Health System, with the provisions of Law No. 41 of Public Health and in correspondence with the Declaration of Helsinki.

RESULTS

A total of 159 patients were studied, 97 (61%) of them were women. With three and four criteria of metabolic syndrome, 43.4% summed to more than 80% in very similar proportions for both sexes (Table 2). There was no significant association between the number of criteria and sex when applying the non-parametric Chi-square test of independence in the sample examined (p>0.05).

Table 2. Number of criteria for the diagnosis of metabolic syndrome and gender

Criteria	Women	%**	Men	%**	Total	%*
Three	39	40.2	30	48.4	69	43.4
Four	43	44.3	26	41.9	69	43.4
Five	15	15.5	6	9.7	21	13.2
Total	**97 (61%)**	**100**	**62 (39%)**	**100**	**159**	**100**

*Percentage calculated with respect to total: ** Percentage calculated with respect to the criteria
X^2=1,5922; p=0,451
Source: medical records

Table 3. Distribution of the number of criteria in the diagnosis of metabolic syndrome and epidemiological variables

Epidemiological variables		Diagnostic criteria for metabolic syndrome							
		Three		Four		Five		Total	
		N	%**	N	%**	N	%**	N	%*
Pathological Family history	Arterial hypertension	31	31.0	48	48.0	21	21.0	100	62.9
	Ischemic heart disease	14	26.9	21	40.4	17	32.7	52	32.7
	Hyperlipoproteinemia	28	36.4	34	44.2	15	19.5	77	48.4
	Primary hypothyroidism	25	46.3	22	40.7	7	13.0	54	34.0
	Encephalic vascular accident	5	19.2	13	50.0	8	30.8	26	16.4
	Hepatic cirrhosis	1	20.0	2	40.0	2	40.0	5	3.1
Obesity	Non obese	2	33.3	4	66.7	0	0.0	6	3.8
	Obese	67	43.8	65	42.5	21	13.7	153	96.2
Lifestyle	Sedentary lifestyle	58	42.3	60	43.8	19	13.9	137	86.2
	Smoking	21	30.4	33	47.8	15	21.7	69	43.4
	Alcohol consumption	9	39.1	11	47.8	3	13.0	23	14.5

*Percentage calculated with respect to total; ** Percentage calculated with respect to epidemiological variables
Source: medical records

The most frequent pathological family history was arterial hypertension (62.9%), where 48% of the patients presented four criteria for metabolic syndrome. Obesity was diagnosed in 153 individuals (96.2%); proportionally with three and four criteria for MS around 42-43% as well as sedentary lifestyle, the most prevalent lifestyle identified in 137 (86.2%). Of those who reported smoking (69), 33 (47.8%) had four criteria and 21 had three (30.4%) (Table 3).

The study group was dominated by patients with five to 10 years of evolution (66, 41.5%), not far behind the group with less than five years, which accounted for 35.8%. Those with more than 10 years of evolution were one percent lower. For patients less than five years old, three criteria predominated (68.4%), for patients between five and 10 years old, four criteria predominated (56.1%), as did those more than 10 years old (47.2%).
There was a significant association between the number of criteria for the diagnosis of metabolic syndrome and the years of evolution of diabetes mellitus ($p<0.05$), that is, the more years of evolution the patient has, the greater the number of criteria present for the diagnosis of metabolic syndrome (Table 4).

Table 4. Distribution of the number of criteria in the diagnosis of metabolic syndrome and years of diabetes mellitus evolution

Years of diabetes mellitus evolution	Diagnostic criteria for metabolic syndrome							
	Three	%**	Four	%**	Five	%**	Total	%*
<5	39	68.4	15	26.3	3	5.3	57	35.8
5 - 10	23	34.8	37	56.1	6	9.1	66	41.5
>10	7	19.4	17	47.2	12	33.3	36	22.6

*Percentage calculated with respect to total; **Percentage calculated with respect to the variable years of evolution of diabetes mellitus.
$X^2=35.0996$; $p=0.000$
Source: medical records

Combined treatments (30.2%) and the use of biguanides (25.2%) and insulin (23.9%) predominated. With diet alone there were 12 patients (7.5%) of which there were 8 with three criteria, 3 with four and only one with five (Table 5).

Table 5. Distribution of the criteria number in the diagnosis of metabolic syndrome and the treatment applied

Treatment	Diagnostic criteria of metabolic syndrome							
	Three	%**	Four	%**	Five	%**	Total	%*
Diet only	8	66.7	3	25.0	1	8.3	12	7.5
Sulfonylureas	11	52.4	7	33.3	3	14.3	21	13.2
Biguanides	22	55.0	13	32.5	5	12.5	40	25.2
Insulin	9	23.7	25	65.8	4	10.5	38	23.9
Combined treatments	19	39.6	21	43.8	8	16.7	48	30.2

*Percentage calculated with respect to total, **Percentage calculated with respect to treatment
$X^2=14.4962$; $p=0.0697$
Source: medical records

Patients with acceptable metabolic control predominated (54.1%), of whom 52.3% had four criteria and 40.7% had three criteria. Of those with poor metabolic control (25.2%), 37.5% had three criteria, 35% had four and 27.5% had five (Table 6).
Significant association was demonstrated between the number of criteria for the diagnosis of metabolic syndrome and the metabolic control of the patients ($p<0.05$). According to the Gamma statistic (0.251) it was concluded that the association is direct with low intensity, that is, the increase in the number of criteria worsens metabolic control.

Table 6. Distribution of the criteria number in the diagnosis of metabolic syndrome and metabolic control

Metabolic control	Diagnostic criteria for metabolic syndrome							
	Three	%**	Four	%**	Five	%**	Total	%*
Good	19	57.6	10	30.3	4	12.1	33	20.8
Acceptable	35	40.7	45	52.3	6	7.0	86	54.1
Poor	15	37.5	14	35.0	11	27.5	40	25.2

*Percentage calculated with respect to total; **Percentage calculated with respect to metabolic control
X^2=14,2712; p=0,0065
Source: medical records

Cardiovascular risk was very high (33.3%) and high (30.2%); when it was very high total of 53 patients, 12 (22.6%) had five criteria (Table 7).
According to the parametric test not parametric Ji square independence there was significant association between the number of criteria for the diagnosis of metabolic syndrome and cardiovascular risk (p<0,05). The Gamma statistic (0.455) shows that the association is direct with the mean intensity, that is, the greater the number of criteria, the greater the cardiovascular risk.

Table 7. Distribution of the number of criteria in the diagnosis of metabolic syndrome and cardiovascular risk

Cardiovascular risk	Diagnostic criteria for metabolic syndrome							
	Three	%**	Four	%**	Five	%**	Total	%*
Very high	12	22.6	29	54.7	12	22.6	53	33.3
High	20	41.7	22	45.8	6	12.5	48	30.2
Moderate	22	64.7	11	32.4	1	2.9	34	21.4
Low	15	62.5	7	29.2	2	8.3	24	15.1

*Percentage calculated with respect to total; **Percentage calculated with respect to cardiovascular risk
X^2=21,3109; p=0,0016
Source: medical records

DISCUSSION

MS seen in its general context is a conglomerate of cardiometabolic risk factors (initially only a few may be present). The identification of one or more elements of MS justifies follow-up and clinical management of the patient because this risk may increase.
In this study, patients with three and four criteria according to the FDI for the diagnosis of MS predominated. Taking into consideration that the FDI considers abdominal obesity as a mandatory criterion and that all the patients already had a diagnosis of DM2, arterial hypertension, hypertriglyceridemia and low HDL cholesterol levels were added.
This coincides with other studies that state in their results that the frequency of MS, according to the FDI criteria, is 10 points higher than that observed when the criteria of the National Cholesterol Education Programme Adult Treatment Panel III (NCEP-ATP III) are applied, and more than 15 points higher than those of the WHO, which could be related to the fact that the FDI has as an indispensable requirement the presence of abdominal obesity, which is very frequent in persons with DM 2, and also sets lower cut-off points for central obesity than the NCEP-ATP III. To diagnose MS, the FDI considers that the patient fulfills the components related to dyslipidemia or hypertension

simply by the fact that he/she follows specific treatment for one or the other disease.[5]

It is the author's opinion that dyslipidemia and hypertension are two of the aspects that most influence the diagnosis of MS and, in turn, the cardiovascular risk involved: was the first most frequent aspect in women in this study, is linked to the most frequent age groups and to the postmenopausal period and was the second most frequent aspect mentioned in men and is associated with abdominal obesity, the same as the repercussion of the pathophysiological aspects of dyslipidemias with their atherosclerotic effect at the level of the blood vessels and arterial hypertension with its vascular and cardiac repercussion, respectively. If we consider that all the patients were type 2 diabetics, it was to be expected that they would manifest themselves with glucose levels above normal values, in the case of women in fasting periods and in men in the postprandial period.

In some aspects, a study found that the predominant fasting blood glucose values corresponded to hyperglycemia (>130 mg/dl) in 65.4% of the men and 57% of the women (p=0.067). Regarding the lipid profile, 69% of the men and 56.2% of the women presented hypercholesterolemia (total cholesterol >200 mg/dl). Abnormal levels of triglycerides or hypertriglyceridemia (≥150 mg/dl) did not show differences by sex.[6]

One investigation found that abdominal obesity was the most frequently found component, more so in the male sex. Arterial hypertension with hypotensive treatment and ascertainment of blood pressure figures ≥130/85 mmHg (or both) was detected in 98 cases (39.69%); this indicator was also found mostly in the male sex. Fasting hyperglycemia was detected in 115 patients (46.56%) and predominated in the female sex (47.29%). Hypertriglyceridemia was found in 67 cases (27.13%) and also prevailed in the female sex (22.48%). Hypercholesterolemia was found in 86 patients (34.82%), mostly male (49, 41.52%). With the exception of cholesterol levels, the rest of the aspects coincide with the results found in this study.[7]

In this study, patients with an evolution of diabetes mellitus between five and 10 years predominated; although those with a relatively recent diagnosis of the disease did not predominate, neither did those with more than 10 years of diabetes mellitus. This period of the disease is not characterized by the appearance of a high number of chronic complications and there is still a pancreatic reserve in most cases, which allows us to work on pharmacological and preventive treatment. These results are in agreement with other studies in which patients had more than five years of evolution of DM2 and 66% of patients with five to nine years of diabetes mellitus were found in one and 57.5% of patients with less than 10 years of evolution in another,[8,9] and differ from another in which the predominant group was more than 10 years of evolution (45.6%), or from one in which 40% of the patients had less than five years of the disease of the total number of cases studied, or from another in which 67.8% had an evolution of more than 10 years (67.8%) or from one that reported a mean evolution of 11.37±4.5 years.[10,11,12,13]

It could be questioned that in this study, and taking into consideration the pathophysiological element of insulin resistance, the greatest number of patients were treated with combinations of insulin and oral antidiabetic drugs, with metformin as monotherapy and insulin monotherapy in second and third

place, respectively. This element, if analyzed from the point of view of the need to achieve better glycemic control in the study group, does not seem unwise; however, it also indicates that diabetes is a disease that is still not well managed, whether it is present in isolation or associated with other diseases or its own complications. The adverse effects of intensive treatment of diabetes, particularly regimens that include insulin and some of the hypoglycemic agents, increase the risk of hypoglycemia, as well as unintended weight gain.

In the authors' opinion, insulin therapy is the most effective treatment for DM2 when other agents such as oral antidiabetics begin to fail; however, the improvement in glycemic control with insulin has always been associated with an increase in body weight, which can be substantial and greater than that found in patients receiving treatment with oral antidiabetics, which is evidently not favorable when addressing the management of MS.

This work coincides with another that states that the addition of basal insulin is one of the most recommended options when treatment with oral agents fails in persons with DM2. Many patients manage to reach the therapeutic objectives with this alternative, at least initially; however, it is often necessary to intensify treatment after some time to reach or maintain the objectives foreseen for each patient, and this does not coincide with another in which only 28.82% used insulin treatment and patients treated with metformin predominated, with 121 patients out of the total of 131 treated with an oral antidiabetic, for 92.4%.[14,15]

The predominance of acceptable metabolic control in the study group is in accordance with the average levels of glycemia reached and with the rest of the factors that have an impact on the control of diabetics; nevertheless this, and the non-negligible number with poor metabolic control, are still a measure of how much can be done in order to achieve better goals in the future, in accordance with an adequate and updated management and in line with the strategies and protocols proposed by experts worldwide.[15]

This coincides with the findings of a study that found 50.88% of patients with adequate metabolic control of DM2 (HbA1c less than 7%) and with another study in which 56% of patients had adequate control, and differs from a similar study conducted in Mexico that found that only 23.66% of diabetics were metabolically controlled and that the risk factors for poor control were the lack of medication intake and not following a diet or exercise.[15,16,17]

The high statistical association between the years of evolution of diabetes and the diagnosis of MS found in this research translates into the fact that the more years of evolution the patient presents, the greater the number of criteria present for the diagnosis of MS. This aspect is inescapably linked to poor metabolic control or failure to achieve the goals of optimal control that allow the patient to add up the diagnostic criteria for MS which, in turn, constitute cardiovascular risk factors.

Similar results are reported in a study that suggests that a DM2 evolution time of more than five years should alert health professionals to the possibility of poor control, particularly in men younger than 65 years of age.[18]

The prevalence of the different treatment regimens was not significantly associated with the diagnosis of MS. Patients with the full set of criteria behaved the same as the overall outcome. Although most physicians recognize metformin as the treatment of choice in these cases, the search for a more

optimal metabolic control leads to the use, with a high frequency, of combined treatments of insulin with metformin or other oral antidiabetics.
In the selection of pharmacological treatment, oral agents are considered for most cases. All drugs have their limitations, some do not achieve a change in glucose from the beginning, others reach the proposed goal and maintain it only for a few years. The need to add an agent with a complementary mechanism of action (combination therapy) and even a third drug or its combination with insulin has been accepted. People with type 2 diabetes require insulin in 25% of cases.[19]
In the case of metabolic control, there was a high statistical association with the diagnosis of MS. Poor metabolic control was associated with patients who had the five diagnostic criteria proposed by the IDF. This is logical if we take into account that there are common elements for both definitions, such as glycemia levels, lipids and arterial hypertension, fundamentally.
Similar results were reported in a study in which 92.30% of the patients presented several of the indicators for metabolic control with values above the established criteria for being considered poor or acceptable, which points to the fact that in patients with DM2, high BMI is associated with the alteration of the rest of the criteria for MS as an expression of the close relationship between obesity and DM2 and of the biochemical and physiological connection existing between both diseases at the pathophysiological level, in which the increase in body weight is associated with the increase of pro-inflammatory factors that promote insulin resistance and the malfunction of the β-cells in the pancreas.[20] Another study reports, regarding metabolic control variables in patients with MS and DM2, findings of prevalences close to 86% of indicators for poor control associated with elements such as overweight, obesity, arterial hypertension and dyslipidemias, all of which are criteria for MS.[21]
The interest in the metabolic syndrome lies mainly in the fact that it is associated with a higher prevalence of cardiovascular disease in general and coronary heart disease in particular. The presence of MS in patients with DM2 increases the cardiovascular and coronary risk fivefold. In this study, cardiovascular risk was significantly associated with the diagnosis of MS, that is, the higher the number of criteria, the higher the cardiovascular risk.
This aspect coincides with that of other studies which state that the individual components that define MS are clear cardiovascular risk factors, so it is logical that their simultaneity leads to a greater risk;[22,23] however, some specialists question whether the sum of the elements of MS improves this predictive capacity when compared with the consideration of each of them separately.[24]
Another work could increase the arguments in favor of the first idea because, in the absence of MS, none of its component risk factors had a significant association with the development of CVD. Only smoking, which is not part of this syndrome, markedly increased the risk of cardiovascular complications. Another study found that cases with MS were 4.31 times more likely to develop IHD than those without MS.[5,25]
The cardiovascular risk of MS depends on the risk factors present in each individual and is not greater than the sum of the components that determine it, but it generally triples the risk of developing cardiovascular disease (up to 80% of patients with MS die from cardiovascular complications). It is also

associated with an overall increase in all-cause mortality and increases the risk of developing type 2 diabetes mellitus by a factor of five.[26]
These results coincide with a study that suggests that, taking into account the factors that make up the metabolic syndrome and the independent consequences of each of them on the cardiovascular system, it is to be expected that the association of several of these factors will increase the damage that occurs and that the more factors that are added together, the greater the risk of suffering some type of cardiovascular disease.[27]
Another study has found similar results and, in addition, it has been observed that the risk of cardiovascular disease increases exponentially when more than three components of MS are associated.[28]
A study based on data from the Third Health Survey conducted in the United States showed that MS is significantly associated with myocardial infarction and stroke in both men and women, but also that the addition of criteria is related to the severity of angiographic lesions in the coronary arteries and their clinical complications.[29]

CONCLUSIONS

Patients diagnosed with metabolic syndrome with three and four criteria predominated in equal proportions. Family history of arterial hypertension, obesity and sedentary lifestyle were the most frequent, as were arterial hypertension, abdominal obesity and dyslipidemia as the most relevant clinical and biochemical aspects. The majority of patients had between 5 and 10 years of evolution of diabetes mellitus, with combined oral antidiabetic and insulin treatment and with acceptable control. As the number of years of diabetes mellitus and its poor control increased, the diagnostic criteria for metabolic syndrome increased, with high and very high cardiovascular risk.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHORS' CONTRIBUTION

ABPM: conceptualization, data curation, research, methodology, project management, validation, visualization, writing the original draft, writing (review and editing).
LODP: conceptualization, data curation, research, methodology, validation, visualization, writing the original draft, writing (review and editing).
DJB: formal analysis.