Research Article
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Achievement of control goals in type 2 diabetic patients of a cardiovascular risk program

Abstract

Introduction: Type 2 diabetes mellitus is a complex pathology with a global distribution that poses a challenging context to achieve its adequate control. Interventions from primary care have an unquestionable relevance within the treatment of the population that presents it.

Objective: To evaluate the fulfillment of the proposed goals in type 2 diabetic patients, who entered a cardiovascular risk program in a Colombian health institution, after 1 year of management between January and December 2022.

Methods: Observational and descriptive study, which included all the medical records of type 2 diabetic patients (146 subjects) who entered a cardiovascular risk program at an outpatient health services institution in Cali, Colombia and met the inclusion criteria; follow-up was 1 year. Data were exported to statistical software for a univariate analysis with measures of central tendency and dispersion. A bivariate analysis and a binary logistic regression were also done.

Results: No patient managed to comply with all the parameters evaluated; the female gender obtained better results in the majority. On the one hand, the paraclinical with the greatest achievement of control was the urine albumin/urine creatinine ratio -UACR- (82.0%), on the other hand, the one with the least achievement was glycosylated hemoglobin (41,0%). Obesity and dyslipidemia demonstrated a statistically significant relationship as factors that do not allow the achievement the glycemic control.

Conclusions: Achieving adequate control of type 2 diabetes mellitus can be challenging, involving the self-care adopted by the patients and an interdisciplinary health approach. Due to the nature of this morbidity, a comprehensive management with a solid educational component could favor this achievement.

Keywords: type 2 diabetes mellitus, health services, primary health care, preventive health services

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Introduction

Type 2 Diabetes (T2DM) is a heterogeneous metabolic disorder that mostly affects adult population and is characterized by the presence of chronic hyperglycemia.[1] Currently, there are approximately 510 million people worldwide with this disease and, of these, 32 million are in Central and South America.[2] From primary care, interventions must promote the maintenance of health and prevent the development of the disease, and from secondary prevention, the objective is to detect the disease early and to establish an appropriate treatment through an interdisciplinary approaching to achieve an optimal metabolic control and prevent the appearance of complications.[3]

Regarding the identification of the achievement of metabolic goals through attention in specific programs, it has been found that, satisfactory control is difficult to achieve due to factors such as diagnosis after 45 years of age, where life habits, generally unhealthy, are settled and are difficult to modify.[4] On the other hand, attention in promotion and prevention programs is not immune to the social, economic and cultural changes that have deteriorated the provision of health services. Circumstances such as the breakdown of dialogue between patients and health personnel, the fragmentation of care processes and an excessive demand for services by users make it difficult to achieve the expected results, making it necessary to strengthen care programs and education about the context that frames diabetes mellitus.[5] The purpose of this study was to evaluate the compliance with the proposed goals in 146 patients who entered the cardiovascular risk program, after 1 year of follow-up, between January and December 2022.

Methods

Descriptive and observational study, in which the work units were the clinical records of patients with type 2 diabetes who entered the cardiovascular risk program of a Health Institution, (146 patients) and who met the inclusion criteria: having an established diagnosis of the morbidity, having entered the cardiovascular risk program in January 2022 and having remained in it until December of that year. By including all records, there was little probability of selection bias, but since the information was not primarily collected by the researcher, information bias could have occurred (a non-controllable fact).

With the authorization of the administrative area of the health institution, which is part of an integrated network for the provision of outpatient services, serving the population of some of the largest benefit plan management companies in the country, has specialized medical personnel, and is located in Cali (third largest city of Colombia), the medical records were accessed and all the information about the proposed variables was obtained: age, gender, race, body mass index (BMI), alcohol consumption, smoking, regular physical activity (minimum 30 minutes 5 times a week), blood pressure values (goal <140/90 mm/Hg), total cholesterol levels -TC- (goal <200 mg/dl), high-density cholesterol levels -CHDL- (goal > 40 mg/dl for men and >50 mg /dl for women), low-density cholesterol levels -CLDL-

(goal <100 mg/dl and <55 mg/dl in patients with a history of macro vascular events), percentage of glycosylated hemoglobin -HbA1c- (goal <7.0%) and urine albumin/urine creatinine ratio -UACR- (goal <30/mg/gr in patients without chronic kidney disease previously established by this parameter).

The data were exported to Jamovi statistical program and a univariate analysis of the absolute and relative frequencies of the qualitative variables was carried out. Kolmogorov-Smirnov test was applied to the quantitative variables to subsequently carry out a descriptive analysis with measures of central tendency and dispersion according to their distribution. Tests such as Chi Square, Fisher's Exact Test and Mann-Whitney U were used for the bivariate analysis, establishing values of p <0.05 (95% CI) as a statistically significant difference. A binary logistic regression was also done. The evaluation instrument applied to this study was the STROBE verification template. Based on Article 11 of Resolution 8430/1993 issued by the Ministry of Social Protection of Colombia, this research was classified as risk-free, and likewise, there was no requirement to complete informed consent.

Results

In the total number of records (146 medical records), female gender and white race showed predominance. The age had a median of 58 years (IQR 7.0), most population had overweight with 56.0% and the most frequently associated comorbidity was high blood pressure with 53.0%; of this percentage, 94.0% maintained blood pressure values <140/90 mm/Hg. 58.0% of the population had a diagnosis of diabetes <5 years and, of this proportion, 16.0% had recently diagnosis (less than 2 months). At the time of entering, 20.0% of the population had a diagnosis of established chronic kidney disease without any patient being in dialytic or predialytic stage. Within the antidiabetic pharmacological treatment, the median number of medications was 3.0 (IQR: 1.0), metformin was the most used medication with 76.0% and 14.0% of the population was on insulin therapy (Table 1).

The urine albumin/urine creatinine ratio -UACR- was the paraclinical test that demonstrated the greatest control, with 82.0%; in contrast, glycosylated hemoglobin was the paraclinical with the lowest achievement of the goal with 41.0%. Not smoking was the most adopted healthy lifestyle habit with 90.0%. Regarding sex, 24.0% of men had normal weight, high-density cholesterol -CHDL- was the paraclinical in which greater control was achieved with 69.0% and glycosylated hemoglobin was the paraclinical with lower achievement of the goal with 33.0%. Not smoking and no alcohol consumption were around 80.0%. Among the women, 22.0% had normal weight, the urine albumin/urine creatinine ratio -UACR- showed the greatest control with 96.0% and high-density cholesterol -CHDL- had the lowest achievement with 26.0%. 95.0% of women did not smoke (Table 2).

The bivariate analysis, demonstrated a statistically significant relationship, between achieving the HbA1c goal (<7.0%) and some clinical conditions such as gender, age, obesity, dyslipidemia, high blood pressure and time of diabetes diagnosis, with p values <0.05 (95% CI) (Table 3). By applying a binary logistic regression, just obesity and dyslipidemia remained as factors that do not allow the achievement that goal (Table 4).

Table 1 Baseline patient characteristics

	Population	
Characteristic	**n=146**	**%**
Sex		
Woman	86	59,0
Age (years)		
<40	4	3,0
49-49	18	12,0
50-59	56	39,0
60-69	50	34,0
70-79	12	8,0
>80	6	4,0
Race		
White	112	77,0
Black	34	23,0
Education level		
Elementary school	10	7,0
Secondary school	72	49,0
Technician/Technologist	34	24,0
College	30	20,0
Body Mass Index (BMI) kg/m2		
Median; RIQ 28,0; 3,0		
Normal weight	34	23,0
Overweight	82	56,0
Obesity	30	21,0
Comorbidities		
High blood pressure	78	53,0
Dyslipidemia	72	49,0
Chronic kidney disease	30	20,0
Glomerular filtration rate (GFR) <60 milliliters/minute	20	75,0
Urine albumin/urine creatinine ratio (UACR) >30 miligramos/gramo	10	25,0
Hypothyroidism	10	7
Heart failure	6	4,0
Ischemic cardiomyopathy	12	8,0
Stroke	4	3,0
Type 2 Diabetes diagnosis time (years)		
Median; RIQ 5,0; 1,0		
<5	85	58,0
5-10	45	31,0
>10	16	11,0
Antidiabetic medication		
Median; RIQ 3,0; 1,0		
Metformin	111	76,0
DPP-4 inhibitors	104	71,0
SGLT2 inhibitors	71	49,0
GLP1 analogues	13	9,0
Sulfonylureas	0	0,0
Basal insulin	20	14,0
Short-acting insulin	12	8,0

Source: Prepared by the author based on medical records data

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Table 2 Distribution of achievement of control goals in the population and by gender ∞ Millimeter of mercury ¥ Percentage * Milligrams/deciliter † Milligrams/gram

Parameter		Percentage of patients who met established goals						
		Population			By Gender			
		Total (n=146)			Men (n=60)		Women (n=86)	
		n	%	Median; (RIQ).	n	%	n	%
Clinic	Normal weight according to Body Mass Index (BMI)	34	23,0	28,0; (5,0)	14	24,0	19	22,0
	Blood pressure <140/90∞	138	94,0	130; (5,0) 84 ; (3,0)	56	94,0	82	95,0
Paraclinic	Glycosylated hemoglobin ¥	60	41,0	8,1; (1,28)	20	33,0	40	47,0
	Total cholesterol *	82	56,0	236;(12,0)	23	38,0	60	70,0
	HDL cholesterol *	68	44,0	38; (8,0)	41	69,0	22	26,0
	LDL cholesterol *	78	54,0	96; (12,0)	29	48,0	49	57,0
	Urine albumin / urine creatinine ratio (UACR)†	120	82,0	26; (2,0)	38	63,0	82	96,0
Habits	Exercise	74	51,0	-	32	54,0	40	47,0
	Not smoking	132	90,0	-	51	85,0	81	95,0
	No alcohol consumption	126	87,0	-	47	79,0	79	92,0

Source: Prepared by the author based on medical records data

Table 3 Achievement of glycosylated hemoglobin (HbA1c) goal and some clinical conditions

Variable	Achievement of glycosylated hemoglobin goal (HbA1c <7.0%)				P value
	Yes		No		
	n	%	n	%	¤Chi
Gender					0,04¤
Men	20	33,0	40	67,0	
Women	40	47,0	46	53,0	
Race					0,06¤
White	46	41,0	66	59,0	
Black	14	47,0	20	53,0	
Age (years)	57	(RIQ 8,0)	66,0	(RIQ 7,0)	0,32ŧ
Obesity	8	27,0	22	73,0	<0,0£
Dyslipidemia	24	33,0	48	66,0	0,02¤
High blood pressure	52	67,0	26	33,0	0,08¤
Ischemic cardiomyopathy	6	50,0	6	50,0	0,14£
Heart failure	2	33,0	4	67,0	0,24£
Chronic kidney disease	14	47,0	16	53,0	0,19¤
Hypothyroidism	6	60,0	4	40,0	0,29£
Stroke	2	50,0	2	50,0	0,07£
Type 2 Diabetes diagnosis time (years)	4,0 (RIQ 2,0)		9,0 (RIQ 5,0)		0.03ŧ

Square ŧ Mann-Whitney U £ Fisher's Exact Test

Source: Prepared by the author based on medical records data

Table 4 Binary logistic regression of glycosylated hemoglobin (HbA1c) goal achievement and some clinical conditions

Predictor	P value	Adjusted OR	95% C.I	
			Min.	Max.
Gender				
Male- Female	0,693	1,472	0,4712	2,046
Race	0,841	1,306	0,7203	1,659
White-Black				
Age (years)	0,285	0,110	0,1009	1,185

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Table 4 Continued...

Predictor	P value	Adjusted OR	95% C.I	
			Min.	Max.
Obesity				
Yes-No	0,002	5,283	40,977	12,239
High blood pressure				
Yes-No	0,872	1,612	14,730	2,357
Dyslipidemia				
Yes-No	0,034	2,933	16,256	4,804
Type 2 Diabetes diagnosis time (years)	0,592	1, 057	0,0737	1,529

Note: The reference category was the same for all variables Yes/No

Source: Prepared by the author based on medical records data

Discussion

The main contribution of this work was the obtaining of information about control of diabetic patients in three basic parameters: clinical, biochemical and healthy lifestyle habits, showing that none of the patients achieved the goals in all the parameters evaluated; in most of the cases, the achievement of control of these was unsatisfactory. Having found a greater proportion of women within the population, can be explained by the current epidemiological context of type 2 diabetes mellitus, which affects women more, due to biological factors such as aging and the estrogenic deficiency that comes with it. This decreases the cardiovascular protective effect and promotes the appearance of greater insulin resistance mainly after 50 years of age.[6,7]

The higher frequency of overweight in the population was similar to the information reported by Arbués et al.[8] who documented that more than 30.0% of the diabetic population has this condition aroused by the current industrialized diet model and sedentary lifestyle. Less than a fifth of the population had normal weight, being this similar to the finding obtained by Álvarez, et al.[9] who reported it at 16.0%.

The fact that high blood pressure was the most frequent comorbidity was also found by Estrada et al.[10] who identified that 46.0% of diabetic patients had this condition too. This finding can be explained by the pathophysiological changes that occur in diabetic patients and that promote the appearance of high blood pressure, some of these changes are the activation of the sympathetic nervous system with the consequent increase of catecholamines and a greater reabsorption of sodium at kidney level with an increased renin release due to vasoconstriction.[11,12]

Only 41.0% of the population reached the goal of glycosylated hemoglobin, this was similar to studies such as those by Mata-Cases et al.[13] and Moura et al.[14] who also identified an optimal glycemic control in less than 50% of diabetic patients. On the other hand, the CLDL goal was achieved in just over half of the population, this contrasts with the finding reported by Masilela et al.[15] who found lower percentages with 8.0%.

The metabolic control figures mentioned above in the studied population, which can be improved in all the cases, respond to the fact that type 2 diabetes is a complex pathology, with the coexistence of different pathophysiological and environmental mechanisms that have not been understood yet. This context, does not allow addressing this morbidity in a complete manner 1. In addition to that, it is not easy to control lifestyles that increasingly obey the processes of industrialization.[9]

In relation to obesity, as a condition that disadvantages the achievement of HbA1c goal, in the study carried out in 2015 by Anari et al.[16] it was found that of the diabetic patients treated in a diabetes clinic in an Iranian city, 68.0% had poor glycemic control. In this study, poor glycemic control in obese patients was also evident, since only 27.0% of them achieved the HbA1c goal. It has been shown that the accumulation of adipose tissue can generate hypoxia, oxidative stress, inflammation and interference with insulin signaling processes in muscle and liver tissues, which has led to the concept of lipotoxicity as the result of ectopic accumulation of lipids and their deleterious effects in different tissues that promote the hyperglycemic state.[17]

The excess of visceral abdominal fat releases free fatty acids into the bloodstream, which induces atherogenesis, decreased insulin secretion and arouse the phenomenon of resistance to this hormone. Abdominal adiposity also increases the values of prothrombotic factors, causing endothelial dysfunction, vascular damage and, finally, an increase in the incidence of cardiovascular disease.[18]

It is also known, that obesity is an independent risk factor for diabetic microangiopathy[19] and certain types of cancer that are more frequent when this condition coexists with diabetes, representing this a serious health problem which generates an increase in mortality.[20]

Dyslipidemia also disadvantaged the glycemic control for the dyslipidemic diabetic state, which promotes greater formation of low-density lipoproteins at the liver, which due to glycosylation processes, show structural modifications and are less recognized by the liver cell receptor, increasing its passage through the vascular endothelium and thus the inflammatory and hyperglycemic state.[1]

A particular result of this work was the high percentage of patients who maintained blood pressure levels within the goal; this differed from what was reported by Morghetti, et al.[21] who showed that up to 73.0% of diabetic patients do not achieve this control. The fact that, the majority of the population achieved the proposed levels of urine albumin/urine creatinine ratio -UACR-, could have been precisely because of the good control of blood pressure levels. It is documented the relationship between arterial high blood pressure and microalbuminuria, being this last parameter a marker of cardiovascular risk as a result of endothelial injury that may be reversible.[22]

The adoption of not smoking in the majority of the population, can be framed within the information provided by the fourth World Health Organization Report on Global Trends in Tobacco Consumption,[23] which records that, in the last five years, 20 million people became in non-smokers. This could be explained by the anti-smoking campaigns that have been established by health organizations and health services.

The evident difficulty to achieve a satisfactory control in the diabetic population that receives care in health programs, may respond to factors such as the complexity of the disease itself, the age at which the diagnosis is made (life cycle of adulthood), the unhealthy lifestyle habits adopted by the population, and possibly, on account

of the highly clinical approach that is still offered to diabetic patients, making it necessary to improve educational interventions to reach a greater empowerment of themselves regarding this pathology.

Conclusion

The main contribution of this work was to gather information about the control of diabetic patients in three basic parameters: clinical, biochemical and healthy lifestyle habits. The results of this research, indicate that the achievement of the control goals proposed in the cardiovascular risk program can be improved, showing similarity in some parameters when comparing them with findings of previous studies that have made similar evaluations. Obesity must be treated decisively, since its negative impact in the achievement of the glycemic goal. This research could constitute a starting point to try to identify the main areas of intervention within the care received by people with type 2 diabetes mellitus, and thus, try to strengthen the services responsible for the management of these patients, by a continuous monitoring of their performance.

Type 2 diabetes mellitus is a disease that requires the active participation of patients, who must be involved in the adoption of healthy lifestyle habits, and an interdisciplinary health management within the programs of primary care, which must offer a bio psychosocial approach by trained personnel and taking into account all the factors that influence this morbidity.

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Conflicts of interest

The author declares that he did not present any type of conflict or situation that would prevent his participation in this study.

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