DIABETIC RETINOPATHY AND ASSOCIATED FACTORS IN ELDERLY CARE IN A SPECIALIZED CENTER IN NORTHEAST BRAZIL

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ABSTRACT: Diabetic Retinopathy (DR) is one of the consequences of Diabetes Mellitus (DM), being one of the main causes of irreversible visual loss in the general population, having associated factors of significant importance. **Background/ Objectives**: To characterize the diabetic elderly affected by RD and the related factors. **Methods**: This is a cross-sectional, descriptive and analytical study, consisting of people aged 65 and over with DM, with more than one year of diagnosis, attended in the city of Fortaleza-CE. The total sample of this research was 256 elderly people, obtaining secondary data from the ophthalmological evaluation for the diabetic retinopathy outcome, resulting in 111 elderly people. **Results**: It was evidenced that of the 111 evaluated patients, 62 (55.8%) presented DR on examination. The findings showed an association between diabetic neuropathy (DN) and DR, with 66.7% (32) of elderly diabetics with DN expressing associated DR. Of the patients using insulin, 63.6% (42) had DR. Regarding the use of oral antidiabetic drugs, 48.2% (40) of those who use it revealed RD on examination, against 51.8% (43) who did not present this disease. There was also a relationship between time of disease in years and RD, with a median of 18 years for the outcome. There was no significant association between other variables and DR. **Conclusions:** This is an important complication of DM, with modifiable risk factors and that has deleterious consequences for patients' quality of life. Therefore, it needs studies and public policies for prevention and early detection.

KEYWORDS: Elderly; diabetes mellitus; diabetic retinopathy.

RETINOPATIA DIABÉTICA E FATORES ASSOCIADOS NO CUIDADO AO IDOSO EM UM CENTRO ESPECIALIZADO NO NORDESTE BRASILEIRO

RESUMO: A Retinopatia Diabética (RD) é uma das consequências do Diabetes Mellitus (DM), sendo uma das principais causas de perda visual irreversível na população geral, possuindo fatores associados de importância significativa. **Objetivo.** Caracterizar os idosos diabéticos acometidos por RD e os fatores associados. **Material e Métodos.** Trata-se de estudo transversal, descritivo e analítico, constituído por pessoas com 65 anos e mais com *diabetes mellitus,* com mais de um ano de diagnóstico, atendidos no Município de Fortaleza-CE. A amostra total desta pesquisa foi de 256 idosos, obtendo-se dados secundários da avaliação oftalmológica para o desfecho retinopatia diabética, resultando em 111 idosos. **Resultados.** Evidenciou-se que dos 111 pacientes avaliados, 62 (55,8%) apresentaram RD ao exame. Os achados evidenciaram associação entre neuropatia diabética (ND) e RD, com 66,7% (32) dos idosos diabéticos com ND exprimindo RD associada. Dos pacientes que fazem uso de insulina, 63,6% (42) possuíam RD. Relativo ao uso de medicamentos antidiabéticos orais, 48,2% (40) dos que usam revelaram RD ao exame, contra 51,8% (43) que não apresentaram esta enfermidade. Verificou-se também relação entre tempo de doença em anos e RD, com mediana de 18 anos para o desfecho. Não houve associação significante entre outras variáveis e RD neste estudo. **Conclusão.** Esta é uma complicação do DM importante, com fatores de risco modificáveis e que gera consequências deletérias para a qualidade de vida dos pacientes. Necessita, portanto, de estudos e políticas públicas para prevenção e detecção precoce.

INTRODUCTION

Population aging is one of the most significant facts of this century, estimated that in 2017 there were 962 million people aged 60 or over in the world, comprising 13 percent of the global population, furthermore it is projected that in 2050 it will reach 2.1 billion of elderly people [26].

In accordance with these data, the Continuous National Household Sample Survey (PNAD) maintained an aging trend in the Brazilian population in recent years, given that the group of people aged 60 or over represented 12.8% of the population total resident, rose to 15.4% in 2018 [14].

With this rapid aging process there is also an increase in the most prevalent conditions in this age group, making chronic non-communicable diseases an increasingly serious public health problem [7].

The multiplicity of diseases and chronic organic dysfunctions constitutes a particularity of the elderly that must be observed carefully [30]. Consequently, this pattern of illnesses requires constant monitoring, permanent care, continuous medication and periodic exams [29].

Among these chronic non-communicable diseases in the elderly, diabetes mellitus stands out, which progresses in this age group with an increase in its incidence and prevalence in Brazil and around the world [11]. According to the International Diabetes Federation, in 2019 the estimated number of people between 65 and 99 years old with diabetes in the world is 135.6 million (19.3%), with Brazil being one of the 10 countries with the highest prevalence of the disease, with around of 6.1 million diabetics, in addition to the 7.7 million people with undiagnosed diabetes [15].

In view of this, diabetes mellitus is an important and growing health problem for all countries, regardless of their level of development. Early diagnosis and treatment of the disease are extremely important to avoid its complications, such as classic macro and microvascular diseases, which can result in increased morbidity, affect health outcomes and reduce the quality of life of the elderly [23].

Among microvascular conditions, diabetic retinopathy (DR) stands out. This disease is one of the main causes of irreversible visual loss in the general population in many countries, including the adult working population and the elderly. It is also noteworthy that the individual risk of DR is 50 to 60% in a person with type 2 diabetes mellitus (DM2) [34]. One of the aggravating factors of this pathology is the fact that it is asymptomatic in its initial stages, and it is not possible to detect it without performing fundoscopy. As a result, it was found that after 20 years of diagnosis, more than 60% of those affected by type 2 DM present some form of retinopathy [5].

This disease progresses through predictable stages, categorically passing from the initial non-proliferative type to the more advanced or proliferative type. The critical distinction that separates nonproliferative DR (NPDR) from proliferative DR (PDR) is the presence of ocular neovascularization [12].

It initially develops due to anatomical and functional changes in several retinal cells, including the appearance of microaneurysms, adhesion of leukocytes, apoptosis of vascular cells and neuronal cells. These changes progress, causing the rupture of the internal and external blood barriers of the retina, which causes diabetic macular edema, being the most important cause of vision loss in DR. Capillary degeneration and the development of acellular capillaries lead to deterioration of retinal perfusion and subsequently retinal hypoxia and neovascularization [2].

Risk factors for the development and progression of DR, therefore, can be broadly divided into modifiable factors, such as hyperglycemia, hypertension, hyperlipidemia, and obesity; and non-modifiable factors such as duration of diabetes, puberty, and pregnancy [25]. It is evident that one in every four patients with type 2 diabetes mellitus, between 10 and 15 years of diagnosis, has diabetic retinopathy, this percentage reaching 63% when the disease has been present for more than 30 years [32].

Researchers also observed racial/ethnic variation in the prevalence of DR, which may reflect a combination of disparities in socioeconomic status and access to healthcare, and a differential contribution of traditional risk factors for DR, such as poor glycemic control, blood pressure and duration of diabetes [24].

Given the context presented, the importance of diabetes and the ophthalmological changes resulting from this disease can be observed, which, without intervention, can lead to loss of vision and other complications. It should also be noted that obtaining data on the incidence of diabetic retinopathy and the factors related to its appearance are relevant for developing public health strategies and screening programs [21]. Therefore, this research aims to characterize elderly diabetics affected by diabetic retinopathy and the associated factors.

MATERIALS AND METHODS

The research universe in Brazil was made up of people aged 65 and over with diabetes mellitus, with at least one year of diagnosis of the disease and who gave their agreement, assisted by the specialized care of the Unified Health System (SUS) of the Municipality of Fortaleza , capital of the State of Ceará. To calculate the sample, the total number of elderly people in 2012 (N=242,430) in the city of Fortaleza was considered [4]. The minimum sample size was taken to estimate the population proportion of diabetics with the expected greatest symmetry of 20%, significance level of 5% (95% confidence interval) and maximum allowable error of 5%. In this way, a sample size of 246 elderly people was obtained. For the diabetic retinopathy outcome, secondary data were obtained from the ophthalmological evaluation of 111 of these elderly people.

At the Integrated Center for Diabetes and Hypertension (CIDH), there are a total of 1,978 people aged 65 and over actively registered for at least one year with a diagnosis of type 2 diabetes mellitus. These records were selected based on their original number in the service; one in every eight medical records was drawn, appearing in a systematic non-probabilistic sample. The semi-structured questionnaire for sociodemographic and clinical data was composed of:

a) Identification form - collection of sociodemographic (age and sex) and clinical data related to diabetes mellitus (metabolic control, acute and chronic complications of diabetes and clinical changes on clinical examination), general health data (systemic diseases, continuous use of medications, adherence to dietary measures, harmful habits, body mass index - BMI, among others). For BMI, the cutoff point proposed by Lipschitz specific to the elderly population was used [17].

b) Clinical ophthalmological evaluation - the presence of DR was identified based on the evaluation by specialist doctors from the institution where the presence or absence of signs of diabetic retinopathy was assessed during the complete ophthalmological examination with retinal mapping under binocular mydriasis.

The organization and consolidation of results occurred using the Statistical Package for the Social Sciences, Co. Chicago IL USA (SPSS) for Windows (version 20.0). Statistical measures were used that allowed the interpretation of the data, seeking to respond to the research objectives. The research project, after being submitted for approval by Centro Integrado de Diabetes e Hipertensão (CIDH), was approved by the Research Ethics Committee of the Universidade de Fortaleza (UNIFOR), under Opinion no. 1,666,717.

RESULTS

Of the total number of diabetic elderly people evaluated in the research (246), 111 (45.1%) underwent a complete ophthalmological evaluation. Of these, 62 (55.8%) revealed that they had diabetic retinopathy (DR) on examination and 49 (44.2%) did not. For the variables age (p=0.892), sex (p=0.359), smoking (p=0.135) and use of alcoholic beverages (p=0.497), there was no statistical significance for the RD outcome (Table 1).

Variables	Total	Retinopathy				PR (CI 95%)	p-Value
		Yes		No			
		n	%	N	%		
Age group	-	-	-	-	-	-	0,892[1]
65 - 74	74	41	55,4	33	44,6	1	-
75 or more	37	21	56,8	16	43,2	1,02 (0,72-1,45)	-
Gender	-	-	-	-	-	-	0,359[1]
Male	53	32	60,4	21	39,6	1,17 (0,84- 1,62)	-
Feminine	58	30	51,7	28	48,3	1	-
Smoking	-	-	-	-	-	-	0,135[2]
Yes	8	2	25,0	6	75,0	1	-
No	103	60	58,3	43	41,7	2,33 (0,69-7,82)	-
Drinks alcohol	-	-	-	-	-	-	0,497[1]
Yes	14	9	64,3	5	35,7	1,18 (0,76-1,81)	-
No	97	53	54,6	44	45,4	1	-

Table 1. Diabetic retinopathy according to sociodemographic variables of elderly

[1] Qui-square test; [2]Fisher's exact test

For comorbidities related to chronic complications of DM, there was no statistical significance between systemic arterial hypertension (p=0.365), coronary artery disease (p=0.473), heart failure (p=0.477), cerebrovascular accident (CVA) (p=0.209) , foot injuries (p=0.073) and amputations (p=0.076) and DR. For the diabetic neuropathy complication, there was statistical significance for the DR outcome with 66.7% (32) presenting ophthalmological changes and 33.3% (16) not presenting (p=0.048).

Concerning the treatment for DM 2, there was no statistically significant difference between adopting dietary measures (p=0.283) and RD. Statistical significance was found between the use of oral antidiabetics (ADO) and RD, with 48.2% (40) of those who use some ADO expressing RD and 51.8% (43) not (p=0.005) as well as the use of insulin, with 63.6% (42) of those who use it presenting DR and 36.4% (24) not (p=0.046).

In the evaluation of acute complications related to DM2, it was found that there is no statistically significant difference between episodes of hypoglycemia (p=0.367), ketotic decompensation (p=0.254) or hyperosmolarity (p=0.462) in the six months prior to clinical evaluation and diabetic retinopathy.

Regarding the mental health assessment of the diabetic elderly people in the study, the following tests were carried out: screening for depressive symptoms using the Yesavage Geriatric Depression Scale, 15-item version, and for screening for possible cognitive deficits using the Mini Mental State Examination. There were no differences between positive screenings for depressive symptoms (p= 0.278) and cognitive impairment and DR (p=0.505) (Table 2).

Variables	Total	Retinopathy				PR (CI 95%)	p-Value
		Yes		No			
		n	%	N	%		
Arterial Hypertension	-	-	-	-	-	-	0,365[1]
Yes	96	52	54,2	44	45,8	1	-
No	15	10	66,7	5	33,3	1,23 (0,82-1,84)	-
Category of Arterial Hypertension	-	-	-	-	-	-	0,266[1]
Moderate	76	40	52,6	36	47,4	1	-
Heavy	13	9	69,2	4	30,8	1,32 (0,86-2)	-
Coronary Insufficiency	-	-	-	-	-	-	0,473[1]
Yes	31	19	61,3	12	38,7	1,14 (0,81-1,61)	-
No	80	43	53,8	37	46,3	1	-
Heart Failure	-	-	-	-	-	-	0,477[1]
Yes	14	9	64,3	5	35,7	1,19(0,77-1,83)	-
No	96	52	54,2	44	45,8	1	-
Stroke	-	-	-	-	-	-	0,209[2]
Yes	11	4	36,4	7	63,6	1	-
No	100	58	58	42	42,0	1,6(0,72-3,55)	-
Peripheral Neuropathy	-	-	-	-	-	-	**0,048[1]**
Yes	48	32	66,7	16	33,3	1,41 (1-1,99)	-
No	55	26	47,3	28	52,7	1	-
Current Wound on the Foot	-	-	-	-	-	-	0,073[1]
Yes	14	11	78,6	3	21,4	1,48 (1,06-2,06)	-

No	96	51	53,1	45	46,9	1	-
Amputation	-	-	-	-	-	-	0,076[2]
Yes	8	7	87,5	1	12,5	1,64 (1,19-2,25)	-
No	101	54	53,5	47	46,6	1	-
Dietary Measures	-	-	-	-	-	-	0,283[1]
Yes	83	43	51,8	40	48,2	1	-
No	25	16	64,0	9	36,0	1,24 (0,86-1,77)	-
Insuline	-	-	-	-	-	-	**0,046[1]**
Yes	66	42	63,6	24	36,4	1,43 (0,98-2,08)	-
No	45	20	44,4	25	55,6	1	-
Oral Antidiabetics	-	-	-	-	-	-	**0,005[1]**
Yes	83	40	48,2	43	51,8	1	-
No	28	22	78,6	6	21,4	1,63 (1,21-2,19)	-
Hypoglycemia in the Last 6 Months	-	-	-	-	-	-	0,367[1]
Yes	30	19	63,3	11	36,7	1,18 (0,84-1,66)	-
No	80	43	53,8	37	46,3	1	-
Ketotic decompensation in the last 6 months	-	-	-	-	-	-	0,254[2]
Yes	3	3	100	0	0,0	1,83 (1,54-2,17)	-
No	106	58	54,7	48	45,3	1	-
Hyperosmolarity in the last 6 months	-	-	-	-	-	-	0,462[2]
Yes	8	6	75,0	2	25,0	1,37 (0,88-2,11)	-
No	102	56	54,9	46	45,1	1	-
Nutritional status (BMI)	-	-	-	-	-	-	0,323[2]
BMI < 22 kg/m2	7	2	28,6	5	71,4	1	-
22<BMI<27 kg/m2	29	18	62,1	11	37,9	2,17 (0,65-7,25)	-
BMI > 27 kg/m2	72	40	55,6	32	44,4	1,94 (0,59-6,39)	

Table 2. Diabetic retinopathy according to clinical variables in the elderly

[1] Qui-square test; [2]Fisher's exact test

Regarding nutritional status, there was no statistical significance between body mass index and RD (p=0.323).

Statistical significance was found between the duration of diabetes mellitus in years and the presence of diabetic retinopathy, with a median of 18 (10 - 20) years for DR when compared to a median of 10 (5 - 17.5) years (p=0.008). For blood pressure levels at clinical assessment, there is no statistically significant difference between systolic (p=0.245) and diastolic (p=0.842) pressures and the outcome (Table 3).

Variables	Total	Retinopathy		p-Value
		Yes	No	
	Median (1st - 3d quartile)	Median (1st - 3rd quartile)		
Time in years of illness	12 (7 - 20)	18 (10 - 20)	10 (5 -17,5)	**0,008**
SBP while lying down	140 (130 - 160)	144,5 (130 - 170)	140 (135 - 153)	0,245
DBP while lying down	80 (78 - 90)	80 (78 - 90)	80 (80 - 90)	0,842

Table 3. Medians of DM duration in years and blood pressure levels and diabetic retinopathy

Mann-Whitney Test

DISCUSSION

It is estimated that diabetic retinopathy affects around 35 to 40% of patients with DM, that is, approximately 4 million people in Brazil [23]. The findings of this study show an even higher percentage of diabetic elderly people studied with DR, where 55.8% of them presented this complication on ophthalmological examination, demonstrating its clinical importance.

The age of the diabetic and the black race are factors mentioned in the literature for a less favorable evolution of DR [13]. It was also observed that in some studies the proportion of DR was higher in males and in others there was a similar prevalence for both sexes. These differences can be attributed to metabolic and socioeconomic risk factors distributed differently according to sex, which varies in different populations [1]. However, in this research, no statistical significance was found between the variables age (p=0.892) and sex (p=0.359) in relation to DR.

For smoking, research shows that there is no statistically positive or negative association with diabetic retinopathy [33], data from the literature corroborated by the present study where the association between smoking and DR did not show statistical relevance (p=0.135). However, it is important to mention that smoking can negatively affect retinopathy, and it is even necessary to take measures to stop it [23].

Diabetic retinopathy is one of the main causes of acquired blindness in the world, increasing the prevalence with poor metabolic control, hypertension and time of disease evolution [23], which is in line with the findings of the present research for the hypertension variable not detecting a statistically significant difference in its relationship with DR. Differently, other authors analyzed the coexistence of systemic arterial hypertension in 16 patients (67%), of which 13 (81%) were indicated for specific treatment, thus demonstrating the relationship of hypertension as a risk factor for the development of DR [18].

It is also noteworthy that DR is a late complication of diabetes and the presence of chronic hyperglycemia is mandatory in the pathophysiology of the disease [13]. The study revealed that there is no association between ketotic decompensation (p=0.254), hypoglycemia (p=0.367) or hyperosmolarity (p=0.462) in the six months preceding the clinical evaluation. In addition to these factors, patients with retinopathy are at greater risk of other micro and macrovascular complications.

It is noteworthy that there is an association between diabetic retinopathy and cardiovascular disease when related to the degree of severity of retinopathy [23]. However, the present study did not evaluate the severity of DR, and it is not possible to analyze this association. In people with diabetic retinopathy, coexistence of nephropathy, neuropathy, and peripheral vascular disease has been observed [28]. Likewise, our findings showed an association between diabetic neuropathy (DN) and DR (p=0.048), with 66.7% (32) of elderly diabetics with DN revealing associated DR, while 33.3% (16) did not present DR.

No statistical significance was found between coronary artery disease (p=0.473), congestive heart failure (p=0.477), stroke (p=0.209) and DR in this research.

The nutritional status of diabetics is also a factor analyzed in many studies. Data suggest that adipose tissue generates a chronic low-level inflammatory state by producing pro-inflammatory cytokines. This process induces an environment of insulin resistance and endothelial dysfunction, which links obesity to diabetic angiopathy. Studies have found a positive association between retinopathy and obesity [19,20]. Among patients with retinopathy, a higher BMI was associated with more severe retinopathy and vision-threatening retinopathy [20], an association not found in the present research (p=0.323).

It is important to mention the fact that patients with diabetic retinopathy are more likely to require medications such as oral hypoglycemic agents or insulin to control the disease. A large-scale study carried out in the Chinese population found that almost 80% of patients with diabetic retinopathy required oral hypoglycemic agents or insulin injections for diabetic control [33].

Other research shows that, after 20 years of illness, close to 99% of insulin-dependent DM patients and 60% of non-insulin-dependent DM patients have some degree of DR [18]. This greater relationship between insulin use and diabetic retinopathy can be explained by the severity and level of glycemic control. In view of this, patients who did not require medication are probably those with adequate or borderline control of glycemic indexes, therefore, they have less risk of developing diabetic retinopathy [33].

In line with these studies, it was found that of the patients using insulin, 63.6% (42) had DR, while 36.4% (24) did not (p=0.046). Regarding the use of oral antidiabetic medications, 48.2% (40) of those who use them revealed DR on examination, compared to 51.8% (43) who did not present this pathology (p=0.005). It must be taken into account that DR is present, especially in patients with long-term illness and difficult glycemic control [16], and this difficult glycemic control is also a related factor in the highest prevalence of insulin treatment [6].

It is noteworthy that as the disease progresses, the profile of medication use for diabetes mellitus changes, showing that, as the disease lasts longer, the use of insulin for therapy becomes more necessary, requiring replacement of the use of oral antidiabetics. In type 2 diabetes, therefore, the initiation of insulin use is time-dependent, as the longer the diabetes progresses, the more possibilities there are for requiring insulin treatment [3].

Therefore, the association between the presence of DR and insulin use may be more related to the duration of the disease than to the use itself. With the progression of the loss of insulin secretion by the pancreas, which usually occurs on average after ten years of disease progression, it may be necessary to combine oral antidiabetic drugs with insulin or even full use of this medication [8].

In this logic, the inverse association found in the research between the non-use of OAD and diabetic retinopathy could be explained, since, as it is necessary to add insulin or replace OAD with insulin, there is a higher prevalence of DR in elderly diabetics, and this association may be a confounding factor.

Regarding the mental state of diabetic elderly people, studies have shown that DR could be associated with changes in the psychosocial well-being of patients. Increased severity of DR and diabetic macular edema are associated with a negative impact on quality of life and depression [9]. In the same understanding, patients with DR were more likely to have difficulty maintaining social interaction and the disintegration of their social lives. There were reports of anxiety due to the problem in maintaining friendships or meeting new people because of the difficulty in recognizing people's faces [10,25]. In this study, however, there were no differences between positive screens for depressive symptoms and cognitive impairment in association with DR.

There was an association between disease duration in years and DR (p=0.008) with a median of 18 years (10 - 20 years) for the outcome. Among diabetics with more than 10 years of diagnosis, 49% had DR, as did other authors who also found this association, mentioning that more than 40% of people with more than 10 years of DM have DR [1,31].

As a limitation of the research, it is noted that all diabetic elderly people estimated in the sample calculation of the study population were not evaluated. It was observed in this work, therefore, that there are many factors associated with diabetic retinopathy in the elderly. This disease is on the rise, with it being estimated that the number of people with DR will increase from 126.6 million in 2011 to 191.0 million in 2030, and the number of people with vision loss due to diabetic retinopathy will increase from 37.3 to 56.3 million [35].

Therefore, more attention should be paid to this complication requiring treatment of classic risk factors, such as hyperglycemia and hypertension, which can prevent or delay the progression of DR [22]. It is known that diabetes prevention is the best approach to preventing DR, which requires fundamental social and political changes to combat diabetes mellitus in the world [35].

CONCLUSIONS

The most important findings are the high percentage of elderly diabetics who developed diabetic retinopathy. Its associated risk factors prevailed: duration of the disease, use of OAD and insulin treatment, and diabetic neuropathy.

In this context, the relevance of the topic as a public health problem with harmful consequences for the quality of life, especially for the elderly, can be seen. The importance of attention and implementation of effective public policies for the prevention and optimized treatment of the disease is urgent.

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