Deficient Prevention and Late Treatment of Diabetic Retinopathy in Mexico

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Abstract

Introduction: *Retinopathy is a common complication of diabetes that causes visual impairment in 10% and blindness in 2% of the patients. The purpose of the study is to describe the clinical profile of the diabetic patient in an ophthalmology unit of Tijuana, Mexico.* **Methods:** *Retrospective study of a random sample of 500 medical charts of patients with diabetes treated between 2006 and 2010 at the Retina Service of the Fundación CODET para la Prevención de la Ceguera IBP Ophthalmology Center.* **Results:** *58.6% of the patients sought medical attention due to visual deterioration and only 6.2% of them were referred by a healthcare professional. At their initial visit, 46.4% of the patients had a history of diabetes of 15 years or more and 30.8% had clinically significant visual impairment (CSVI) associated with long standing diabetes and previous eye surgery. 25.4% treated patients suffered visual impairment progression (VIP) associated with retinopathy advanced stages.* **Conclusions:** *Diabetes patients are referred to ophthalmology services too late, when visual loss is usually advanced and irreversible.* (Gac Med Mex. 2014;150:511-8)

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Introduction

Diabetes mellitus (DM) and its complications represent a serious public health problem[1,2]. Diabetes is the fourth cause of death worldwide[3] and the main cause of cardiovascular disease, renal failure, adult-onset blindness and non-traumatic amputations[4]. In 2010, there was an estimate of 285 million persons with this disease in the world, a figure that by the year 2025 will exceed 300 million, with most part of the increase expected to occur in underdeveloped countries[5]. This pandemia is primarily explained by the elevated prevalence and incidence of type 2 diabetes mellitus, which is more easily modified by lifestyle[6].

In Mexico, diabetes is the main cause of death among women and the second in men. In 2006, diabetes accounted for 12.6% of all deaths occurred in this country; the average age at the time of death was 66 years[7]. Currently, the estimated prevalence of diabetes in Mexico is 6.3 million of people (approximately 7.5% of the entire population), with an annual incidence of approximately 300,000 cases[8]. DM represents the main economic burden within the health sector institutions. Between the years 2002 and 2004, an annual expenditure of USD 452,064,988 was documented in the National Institute of Social Security for providing care to patients suffering from diabetes, with an average annual expenditure of USD 3,193.95 per patient[9]. National healthcare costs for diabetes in Mexico were estimated to be USD 15,118,300,000 in the year 2000[10-13].

One of the most common complications of diabetes is retinopathy, currently considered the third cause of irreversible blindess worlwide and the first cause of irreversible blindness in working age adults in developing countries[14]. The prevalence of retinopathy varies according to the criteria used to identify it and the studied population. In the population-based study conducted in the state of Wisconsin, U.S.A., prevalence of

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some degree of retinopathy was documented in 78% of subjects with 15 years or more of diabetes, a figure that increased up to 98% if the diabetes had started at 30 years of age or later[15,16]. Between 2005 and 2008, the estimated global prevalence of retinopathy in the diabetic population of the U.S.A. was 28.5%, with 4.4% presenting overt visual involvement[17]. In Mexico, in the state of Hidalgo, prevalence of some degree of retinopathy was documented in 33% of individuals in a random sample of 117 diabetic patients[18], and the cummulative incidence of diabetic retinopathy in a cohort of 100 diabetic patients during a 12-year follow-up in León (Guanajuato) was 71%[19].

The magnitude of the diabetes and diabetic retinopathy current problem has led to the proposal of multisector participation strategies, where governments and health institutions, as well as the population, collaborate actively in specific programs[14]; however, there is still an important educational deficit on the care of the health of people with diabetes or at risk of suffering it, and even among healthcare workers themselves[20-23].

The general purpose of this study was to determine the clinical and epidemiological profile of diabetic patients under the care of an ophthamology center in the city of Tijuana, as a baseline diagnosis that allows for more effective prevention and care strategies to be proposed for this vulnerable population group.

Material and methods

The study was carried out at the *Fundación CODET para la Prevención de la Ceguera* Ophthalmology Center in the city of Tijuana, Baja California, Mexico, with approval of the Ethics Committee of said institution.

This was a retrospective study with information contained in clinical charts of patients diagnosed with DM who were attended at the Retina Service over a five-year period (2006-2010). A random sample of 500 patient charts was selected out of a total of 16,256 corresponding to this period. The calculated sample size to determine the prevalence of clinically significant visual impairment (CSVI) was 380, considering an expected prevalence of 50% (to maximize the sample size) with a two-tailed a of 0.05 and 80% power. In order to explore associations with some predictive variables, it was decided to include 500 patient charts.

The only inclusion criterion was being a diabetic patient attended at that ophthalmology center; charts lacking a visual acuity determination performed at the initial assessment were excluded.

The investigated variables, at the initial clinical assessment and thereafter, included: date of first care, age, sex, type, duration and treatment of diabetes, metabolic control of diabetes, history of hypertension, dyslipidemia, smoking and alcoholism, previous eye surgery, person or institution that referred the patient to the ophthalmology center, main complaint, visual acuity with and without correction for both eyes, intraocular pressure in both eyes, diagnoses considered at initial ophthalmologic assessment and specialized ophthalmology service the patient was referred to.

The main diagnoses considered by the Retina Service, laser interventions, surgery and intraocular medication (IM), as well as visual acuity with and without correction at last visit and its date, were obtained from the progression notes.

Visual acuity observed in the first and the visit was used to create the following visual deterioration categories: no visual impairment (any visual acuity better than 20/39); mild vision loss (visual acuity from 20/40 to 20/59); moderate vision loss (visual acuity from 20/60 to 20/199); severe vision loss (visual acuity from 20/200 to 20/399); profound vision loss (visual acuity from 20/400 to 20/1500; finger counting (visual acuity from 20/1600 to 20/4000; hand movement perception; light perception, and no light perception.

Using the International Classification of Diseases 10 reviewed criteria, CSVI of the patient was defined as visual loss equal or greater than moderate visual impairment in the better eye[24]. The better eye, which also served as index eye, was that which in the first assessment had the highest visual acuity, and was taken as a reference to compare visual acuity observed at the first and last visits. Considering the difference between the visual acuity final category and that observed at the beginning (visual acuity final category minus visual acuity initial category), subjects who improved could be identified when visual acuity improved by at least one category with regard to the initial one; subjects who remained stable, when final visual acuity was the same as that recorded at initial visit; and subjects who had visual deficit progression, when final visual acuity worsened by at least one category with regard to the initial one.

Information was analyzed using the Statistical Package for the Social Sciences (SPSS), version 17, statistical sofware for Windows. The descriptive analysis was carried out by estimating absolute and relative frequencies of the main categorical variables and central tendency and dispersion measures for numerical variables. A bivariate analysis was constructed

Table 1. Duration of diabetes

	n	(%)
Less than one year	3	(0.6)
From 1 to 4 years	39	(7.8)
From 5 to 9 years	74	(14.8)
From 10 to 14 years	86	(17.2)
From 15 to 19 years	99	(19.8)
20 or more years	133	(26.6)
Unavailable information	66	(13.2)

by calculating the odds ratio (OR) with 95% confidence intervals (CI) and Fisher's exact chi-square test to compare the groups in the main categorical variables, and by estimating the mean differences, with the CI at 95%, with significance tested using Student's t-test to compare the groups in continuous variables with a normally appearing distribution, or the Mann-Whitney U-test when the numerical variables did not show a normally-appearing distribution. A two-tailed a of 0.05 was set to establish statistical significance.

Results

Five hundred clinical charts of patients with DM were reviewed: 230 men (46.0%) and 270 women (54.0%). Patient ages ranged from 14 to 89 years, with a mean of 57.7 (standard deviation [SD]: 10.95); the median had a value of 58 (interquartile range [IQR]: 14).

The mos common type of diabetes identified in these patients was type 2, which was diagnosed in 481 subjects (96.1%); type 1 diabetes was identified only in 19 (3.8%)

individuals. The observed duration of diabetes ranged from less than one to 35 years, with a mean of 14.56 years and a SD of 7.6. The median was found to be 15 years with an IQR of 11.25. Table 1 shows this information stratified by five-year periods.

Most patients were on medical treatment for diabetes, 288 subjects (57.6%) with oral antidiabetic drugs and only one with diet-based treatment. There was information available on metabolic control based on glycosylated hemoglobin only in 144 clinical charts (28.8%), out of which 103 (71.5%) had glycosylated hemoglobin higher tan 7%. Table 2 shows the most relevant medical and personal history data of the patients.

The reasons for seeking medical help referred by the patients at their first assessment were: visual acuity decrease (293 cases [58.6%]), general assessment (62 [12.4%]), presence of cataracts (32 [6.4%]), eye pain (15 [3%]), lacrimation or eye irritation (9 [1.8%]), glaucoma (9 [1.8%]), eye dryness (4 [0.8%]) and unspecified (76 [15.2%]).

The patients were recommended or referred to the ophthalmology center by various sources; the most frequently mentioned were: relative or friend (254 cases [50.8%], advertising (55 [11%]), healthcare professional (31 [6.2%]), government institution (16 [3.2%], health conference or fair (11 [2.2%]), health institution (9 [1.8%], health promoter (2 [0.4%]) and unspecified (17 [3.4%]); this information was not clarified in 105 cases (21.0%).

The degree of visual impairment observed at first visit for each pair of eyes is shown in table 3. Visual acuity with correction served as the basis to identify patients with moderate or worse visual loss in their index eye at the time of the initial visit: 154 patients already had this condition (30.8%). Table 4 shows the results for patients with significant visual impairment,

Table 2. Medical and personal history

	Present	Absent	Unavailable
	n (%)	n (%)	n (%)
Hypertension	280 (56.0)	191 (38.2)	29 (5.8)
Dyslipidemia	98 (19.6)	77 (15.4)	325 (65.0)
Previous eye surgery	99 (19.8)	321 (64.2)	80 (16.9)
Smoking	59 (11.8)	304 (60.8)	137 (27.4)
Alcoholism	35 (7.0)	306 (61.2)	159 (31.8)
HbA1c ≥ 7	103 (20.6)	41 (8.2)	356 (71.2)

HbA1c: glycosylated hemoglobin A1c.

Table 3. Visual impairment observed at initial visit

	Right eye	Left eye	Index eye
Assessment without correction	n (%)	n (%)	n (%)
No impairment	40 (8.0)	25 (5.0)	52 (10.4)
Mild loss	120 (24.0)	110 (22.0)	167 (33.4)
Moderate loss	106 (21.1)	96 (19.2)	121 (24.2)
Severe loss	79 (15.8)	96 (19.2)	76 (15.2)
Profound loss	4 (0.8)	4 (0.8)	2 (0.4)
Finger counting	90 (18.0)	88 (17.6)	61 (12.2)
Hand movement perception	45 (9.0)	55 (11.0)	18 (3.6)
Light perception	9 (1.8)	8 (1.6)	2 (0.4)
No light perception	6 (1.2)	15 (3.0)	0 (0)
Unavailable	1 (0.2)	3 (0.6)	1 (0.2)
Assessment with correction			
No impairment	89 (17.8)	90 (18.9)	130 (26.0)
Mild loss	135 (27.0)	122 (24.4)	163 (32.6)
Moderate loss	66 (13.2)	73 (14.6)	64 (12.8)
Severe loss	45 (9.0)	47 (9.4)	44 (8.8)
Profound loss	4 (0.8)	0 (0)	0 (0)
Finger counting	3 (0.6)	54 (10.8)	31 (6.2)
Hand movement perception	54 (10.8)	43 (8.6)	14 (2.8)
Light perception	37 (7.4)	6 (1.2)	1 (0.2)
No light perception	5 (1.0)	10 (2.0)	0 (0)
Unavailable	61 (12.2)	55 (11.0)	53 (10.6)

which was identified mainly in patients with longer duration of diabetes and in those who referred having undergone previous eye surgery. According to the information contained in the charts and the corresponding assessment by the retinologist, 365 subjects (73.0%) were observed to have been identified as carriers of some degree of diabetic retinopathy. Data consistent with proliferative retinopathy was observed in 297 of these cases (81.4%), and in 68 (18.6%), evidence of non-proliferative retinopathy was found. The stage of diabetic retinopathy (mild, moderate or severe) could not be established due to lack of information. Major complications of diabetic retinopathy were identified in many patients: hemovitreous was diagnosed in 94 of the 500 reviewed cases (18.8%); in 36, clinically significant macular edema (7.2%); in 30, tractional retinal detachment (6.0%);

in 1, vascular occlusion (0.2%); and in 9, neovascular glaucoma (1.8%). The presence of any of these complications allowed for the complicated retinopathy category to be established in 156 subjects (31.2%). Some subjects showed more than one of these complications. Some type of cataract was identified in 33 subjects (6.6%). Glaucoma was recorded in 11 cases (2.2%), 9 of the already mentioned neovascular type, and two cases of open angle glaucoma.

Table 5 lists the ophthalmologic interventions performed by the institution on the 500 subjects included in the sample. Noteworthy, 245 patients (49%) did not receive any intervention (included in this group were 188 patients who completed only one or two visits and were lost to follow-up). The combination of IM plus photocoagulation was the most commonly used treatment

Table 4. Clinically significant visual impairment (CSVI) at first visit

	With CSVI	Without CSVI		
	n	n	OR (95% CI)	p
Sex				
Female	87	155	1	
Male	67	138	0.86 (0.58-1.28)	0.480
Treatment with insulin				
No	94	202	1	
Yes	42	63	1.43 (0.90-2.27)	0.128
Duration of diabetes				
< 15 years	54	132	1	
≥ 15 years	100	161	1.51 (1.01-2.27)	0.026*
Arterial hypertension				
No	53	118	1	
Yes	92	160	1.28 (0.85-1.93)	0.253
Smoking				
No	94	179	1	
Yes	19	34	1.06 (0.58-1.97)	0.870
Alcoholism				
No	95	182	1	
Yes	11	20	1.05 (0.48-2.29)	1.00
Previous eye surgery				
No	92	195	1	
Yes	40	49	1.73 (1.06-2.81)	0.031*

*With statistical significance.

approach (16.6%). Seventy subjects had a single surgery practiced and 19 underwent combined procedures (two types of surgery). The most frequently practiced retinal surgery was pars plana vitrectomy (63 cases).

The last visual acuity obtained was also analyzed (Table 6). Considering only those 255 patients who underwent some intervention and using the non-corrected visual acuity (which was reported more consistently), the difference between the first and the last visual acuity assessment was calculated and 53 patients (20.7%) were observed to show some visual acuity improvement, 127 (49.8%) remained without changes and 65 (25.4%) showed visual impairment progression (VIP). This variable could not be determined in 10 subjects (3.9%). Considering the 65 patients who showed VIP in spite of the interventions performed, the most commonly associated characteristic with this outcome was having complicated retinopathy (Table 7).

Discusion

In the studied random sample of 500 charts of patients with DM, we observed that only a small percentage,

which corresponded to 12.4% (95% CI: 9.5-15.2), sought medical help for preventive examinations. The majority, 58.6% of the sample (95% CI: 54.2-62.9), looked for medical help at the institution due to decreased vision. Diabetic retinopathy is a condition that

Table 5. Ophthalmologic interventions performed

	n	(%)
None	245	(49)
Only laser	27	(5.4)
Only IM	55	(11.0)
Only surgery	47	(9.4)
Laser + IM	84	(16.6)
Laser + surgery	9	(1.8)
Surgery + IM	14	(2.8)
Laser + surgery + IM	19	(3.8)
Total	500	(100)

Table 6. Visual impairment observed at last visit

	Right eye	Left eye	Index eye
Assessment without correction	n (%)	n (%)	n (%)
No impairment	23 (4.6)	20 (4.0)	38 (7.6)
Mild loss	100 (20.0)	96 (19.2)	128 (25.5)
Moderate loss	94 (18.8)	76 (15.2)	101 (20.2)
Severe loss	62 (12.4)	57 (11.4)	56 (11.2)
Profound loss	0 (0)	2 (0.4)	0 (0)
Finger counting	65 (13.0)	66 (13.2)	53 (10.6)
Hand movement perception	33 (6.6)	41 (8.2)	12 (2.4)
Light perception	11 (2.2)	15 (3.0)	6 (1.2)
No light perception	8 (1.6)	19 (3.8)	0 (0)
Unavailable	104 (20.8)	106 (21.6)	105 (21.0)
Assessment with correction			
No impairment	40 (8.0)	44 (8.8)	58 (11.6)
Mild loss	80 (16.0)	64 (12.8)	93 (18.6)
Moderate loss	37 (7.49)	38 (7.6)	37 (7.4)
Severe loss	28 (5.6)	27 (5.0)	27 (5.4)
Profound loss	1 (0.2)	0 (0)	0 (0)
Finger counting	27 (5.4)	21 (4.2)	15 (3.0)
Hand movement perception	19 (3.8)	17 (3.4)	6 (1.2)
Light perception	4 (0.8)	8 (1.6)	3 (0.6)
No light perception	3 (0.6)	11 (2.2)	1 (0.2)
Unavailable	261 (52.2)	270 (54.0)	260 (52.0)

evolves insidiously and causes painless visual deterioration. Lack of information and prevention by treating physicians results in many patients seeking help only when they have visual deficit or loss[14].

On the other hand, it is worrying that only 6.2% of the patients in this sample indicated having been referred to the institution by a healthcare professional (95% CI: 5.1-7.2), which may suggest that healthcare professionals may be overlooking recommending the patients to have early and regular ophthalmologic examinations since the moment the diagnosis of type 2 diabetes mellitus (T2DM) is established, or at five years of the type 1 diabetes (T1DM) diagnosis, and thereafter every year in both types of diabetes, as specified by the NOM 015-SSA2-2010 standard for the prevention, treatment and control of DM[25]. However, it should be noted that these data could be subject to information bias, since they were taken from what the patient indicated as the reason for referral and the person who suggested him to be assessed in that specific ophthalmology center.

In the sample, only 8.4% of the patients had suffered from diabetes for less than 5 years (95% CI: 5.9-10.8) and, most unfavorably, almost half the sample (46.4%; 95% CI: 42.0-50.7), for 15 or more years, a situation that would explain the high proportion of CSVI detected at the patients' initial visit, which was documented in almost a third part of the cases (30.8%; 95% CI: 26.7-34.8). This observed CSVI prevalence is much higher to that reported in the general DM patient population, with an estimated 4.4%[17], mainly because this is an ophthalmology referral center. Of note, CSVI was primarily associated with the presence of long standing diabetic disease and with a history of previous eye surgery.

Table 7. Analysis of association of categorical variables with VIP

	With VIP	Without VIP		
	n	n	OR (95% CI)	p
Sex				
Female	34	98	1	
Male	32	90	1.02 (0.58-1.79)	1.00
Treatment with insulin				
No	42	134	1	
Yes	21	44	1.52 (0.81-2.84)	0.19
Duration of diabetes				
< 15 years	30	71	1	
≥ 15 years	36	117	0.73 (0.41-1.28)	0.30
Arterial hypertension				
No	27	69	1	
Yes	36	108	0.85 (0.47-1.52)	0.65
Smoking				
No	37	119	1	
Yes	6	25	0.77 (0.58-1.97)	0.870
Alcoholism				
No	95	182	1	
Yes	11	20	1.05 (0.29-2.02)	0.81
Previous eye surgery				
No	39	123	1	
Yes	16	35	1.44 (0.72-2.88)	0.35
Complicated retinopathy				
No	27	117	1	
Yes	39	71	2.38 (1.34-4.21)	0.002*

*With statistical significance.

The prevalence of some degree of diabetic retinopathy found in 365 subjects out of the 500 studied cases (73.0%) is similar to that reported by Prado-Serrano, et al. (71% in the study of 13,670 cases seen at the Ophthalmology Department of the General Hospital of Mexico[26]). Of the 365 patients detected with retinopathy in our study, 297 (73.0%) showed data consistent with proliferative retinopathy and only 68 (18.6%) met the criteria for non-proliferative retinopathy diagnosis; in the case of the presence of proliferative retinopathy, the figure is considerably higher than that reported by Prado-Serrano et al. (73 vs 63%; OR: 2.56; 95% CI: 1.83-3.27). In our study, the presence of clinically significant macular edema in 36 (9.8%) of the 365 subjects with retinopathy is similar to the 16% rate reported by Prado-Serrano et al.[26].

Finally, of special note are those cases where, in spite of receiving ophthalmologic intervention, there was VIP, which were 65 out of 255 patients attended at the institution (25.4%; 95% CI: 21.5-29.2) and that

were associated with advanced disease due to proliferative retinopathy complicated with hemovitreous, tractional retinal detachment, clinically significant macular edema, neovascular edema and/or vascular occlusion.

Our study has several limitations that should be mentioned. First, the information was retrospective in nature, and was generated with ophthalmologic care-related, not investigational, purposes, which is why omission of important data, such as metabolic control of the patients or retinopathy severity classification, was unavoidable. Due to this same situation, the precise reasons why part of the patients (188 out of 500 [37.6%]) completed only one or two visits and discontinued their follow-up, could not be established. It should be noted that we tried to analyze the characteristics of this group and we found that it was comprised mostly by women without complicated retinal disease. In general, a high dropout rate from ophthalmologic care follow-up was observed, which might reflect low medical and prevention culture among the studied population. The

classification of retinopathy severity only as complicated and non-complicated cases was due to the lack of information on the degree of diabetic retinopathy in the reviewed patient charts, which constitutes an important limitation. This limitation could be reduced in future studies if the ophthalmology community is encouraged to write down a complete report on the clinical assessment made, with adherence to international diagnostic criteria and classifications, as well as to carry out the good clinical practice principles with regard to clinical charts.

We should emphasize the considerations issued in the Diabetic Retinopathy Clinical Prectice Guidelines for Latin America, which state that diabetic retinopathy is preventable in 80% of the cases with early detection and treatment, as well as multidisciplinary management, with the primary goal of achieving a good control of hyperglycemia, hypertension and dyslipidemia. Education is fundamental in order to promote self-care among patients and their families for the management and prevention of complications. Good metabolic control delays the onset of new, and the progression of existing lesions. Diabetic retinopathy prevalence and incidence are rising and, if actions are not taken, these figures will double by year 2030. Improving the screening and early laser treatment coverage is urgently needed, in order to preserve visual function, improve the quality of life of patients and to achieve a 10-fold reduction in healthcare costs. This means that national diabetic retinopathy early care programs have to be formalized. General practice and resident ophthalmologists have to be trained on the management of diabetic retinopathy, with a simplified classifiaction and adequate management of the different diabetic retinopathy stages[14].

In the diabetic patient, diabetic retinopathy and associated visual impairment are very frequent complications. Early referral to specialized centers for diagnosis, control and treatment must be considered a priority in family medicine everyday practice, as well as education of patients and their families, healthcare institutions and society itself, in order to, in close collaboration, take relevant actions to counteract the current and future diabetes pandemic and its consequences.

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