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Original Research Article

Ocular morbidity among diabetics attending the preventive ophthalmic clinic of a tertiary care institute with special reference to diabetic retinopathy

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ABSTRACT

Background: Non communicable diseases have taken over previously life threatening infections in the demographic transition. As the burden of NCDs including diabetes is increasing at an alarming rate the complications related to these diseases are also increasing leading to huge morbidity. Likewise, blindness/ visual impairment due to diabetic retinopathy is now slowly and steadily replacing refractive errors and cataracts as a cause of morbidity.
Methods: This cross sectional study was carried over a period of one year in an ophthalmic unit of a tertiary health care institute in which known diabetic patients were screened for diabetic retinopathy besides various modifiable and non-modifiable risk factors.
Results: Overall prevalence of diabetic retinopathy in our study population was found to be 29.0%. Among various risk factors duration of diabetes, hypertension, HbA1C >6.5% and serum creatinine >1.1 mg/dl were found to be significantly associated with diabetic retinopathy.
Conclusion: Regular screening for diabetic retinopathy besides prevention and strict control of risk factors is key to prevention and progression of blindness/ visual impairment due to diabetic retinopathy.

Keywords: Diabetic retinopathy, Ocular Morbidity, Prevalence, Risk factors

INTRODUCTION

Diabetes mellitus is an important metabolic disorder characterized by a raised blood glucose resulting from deficiency of insulin release and function. Earlier diabetes was considered to be a disorder restricted to the geriatric age group but now it has become a major health issue of not only the elderly but even the youth and middle aged persons**.** By 2030 developing countries will face an increase by 69% and industrialized countries by 20% of the number of patients with diabetes compared to 2010.[1] India is set to emerge as the diabetic capital of the world. According to the WHO, 31.7 million people were affected by diabetes mellitus (DM) in India in the year 2000. This figure is estimated to rise to 79.4 million by 2030, the largest number in any nation in the world.[2]

Macro and microvascular complications of long standing diabetes have made it an important cause of morbidity, mortality and disability in affected people. These complications especially the microvascular complications can affect different organ systems of the body including the eyes.

Diabetic microvascular complications in the eyes, especially diabetic retinopathy (DR) are an important cause of visual disability and blindness and are thus gaining importance in the present era of a rapidly increasing number of diabetics throughout the globe. Reasons for loss of vision in diabetics are diabetic maculopathy and complications of proliferative diabetic retinopathy (PDR) such as vitreous hemorrhage, tractional retinal detachment, and neovascular glaucoma. Another common diabetes complication is diabetic macular edema (DME), which is also a major cause of vision loss and, which can occur at any stage of DR. Diabetic retinopathy is the most common cause of blindness in the working-age population around the world.[3] The probability of DR increases with increasing duration of diabetes.[4]

As per Wisconsin epidemiologic study of diabetic retinopathy (WESDR) at 20 years of duration of diabetes mellitus more than 60% of patients with type 2 diabetes and almost all patients with type 1 have some degree of retinopathy.[5] These estimates are expected to rise further due to the increasing prevalence of diabetes, ageing of the population and increase in life expectancy of those with diabetes. Because of the disproportionately large number of patients with type 2 diabetes (90%-95%), this group comprises a substantial proportion of patients with visual impairment secondary to diabetic retinopathy, even though relative risk for developing diabetic retinopathy is higher in type 1 diabetes and is associated with more frequent and more severe ocular complications.[6]

The most clinically important risk factors for progression to vision loss include duration of diabetes, hyperglycemia and hypertension. Control of serum glucose and blood pressure have been shown to be effective in preventing vision loss due to DR. Although the major risk factors for DR have been examined in many epidemiologic studies and clinical trials, there is considerable variation in the consistency, pattern, and strength of these risk factors.[7] Thus, the importance of modifiable risk factors for these vision threatening stages of DR also remains unclear.

Despite the significance of this problem, and the rising prevalence of diabetes notably in countries such as India and China.[1,8] there are few precise contemporary estimates of the worldwide prevalence of DR. Generating a broader and more precise estimate of the prevalence of DR and its relationship with major modifiable risk factors is crucial for guiding public health education and optimal clinical management of diabetes. Authors therefore conducted this study to determine the prevalence of DR as well as its relationship to key risk factors.

METHODS

This cross sectional study was conducted in ophthalmic unit of Department of Community Medicine of Sher-i-Kashmir Institute of Medical Sciences, Srinagar, J&K, India. Study was conducted over a period of 1 year from July 2016 to June 2017. The study was conducted on the diabetic patients who were referred from Department of Endocrinology for ophthalmic examination. Over a period of one year 207 patients consented to participate in the study. All the diabetic patients above age 20 years with no previous diagnosis of diabetic retinopathy were included in the study. Pregnant women and women with gestational diabetes were excluded from the study.

The data was collected on a self-designed structured questionnaire after taking written informed consent from the participants. The ophthalmic examination was done by a single ophthalmologist. Best corrected visual acuity for distance and near were recorded. Intraocular pressure was also documented. After dilation fundus examination of both eyes was done using ophthalmoscope. Any changes attributable to diabetes were documented. All the recent investigations done from the same institute were also noted down in the questionnaire.

Statistical Analysis

The data was entered and analysed using SPSS version 20.0. Categorical data was presented as frequency and percentage and various risk factor assessment was done using Chi square test and calculation of Odds Ratio. The p-value of <0.05 was considered as significant.

RESULTS

In this cross sectional study a total of 207 known diabetic patients consented to participate. Out of 207 participants 136 (65.7%) were females and only 71 (34.3%) were males. 120 (58%) were in the age group of 41-60 years, 53 (25.6%) of age >60 years and only 34 (16.4%) were belonging to age group 20-40 years. The mean age being 53.13± 10.85 (range=28-80) years. 140 (67.6%) were illiterate and only 67 (32.4%) were literate. 155 (55.6%) had monthly income of ≤10000 INR and only 14 (6.8%) had income of >30,000 INR. Majority 162 (78.3%) of the participants had sedentary lifestyle and 93 (44.9%) had family history of diabetes. (Table 1)

Figure 1 shows the disease characteristics of the participants. While majority 206(99.5%) of them had type 2 diabetes mellitus only 1 (0.5%) had type 1 diabetes mellitus. 110(53.1%) were diagnosed <5 years before and only 13(6.3%) had diabetes for >15 years. 140(67.7%) were taking OHG agents only, 56(27.1%) were on insulin and 11(5.3%) were on both OHG agents and insulin. Investigations showed that 125(60.4%) of them had controlled blood sugars and 82(39.6) had uncontrolled blood sugars. Majority 159(76.8%) were also hypertensive and 48(23.2%) had normal blood pressure.

Table 1: General characteristics of the study population.

	Frequency (N=207)	Percent
Gender		
Male	71	34.3
Female	136	65.7
Age		
20-40 Years	34	16.4
41-60 Years	120	58.0
> 60 Years	53	25.6
Mean age = 53.13±10.85 (28-80) years		
Education		
Illiterate	140	67.6
Literate	67	32.4
Income/month (Rs)		
≤10000	115	55.5
11000-20000	50	24.2
21000-30000	28	13.5
>30000	14	6.8
Physical activity		
Heavy worker	4	1.9
Moderate worker	41	19.8
Sedentary worker	162	78.3
Family history of DM		
Yes	93	44.9
No	114	55.1

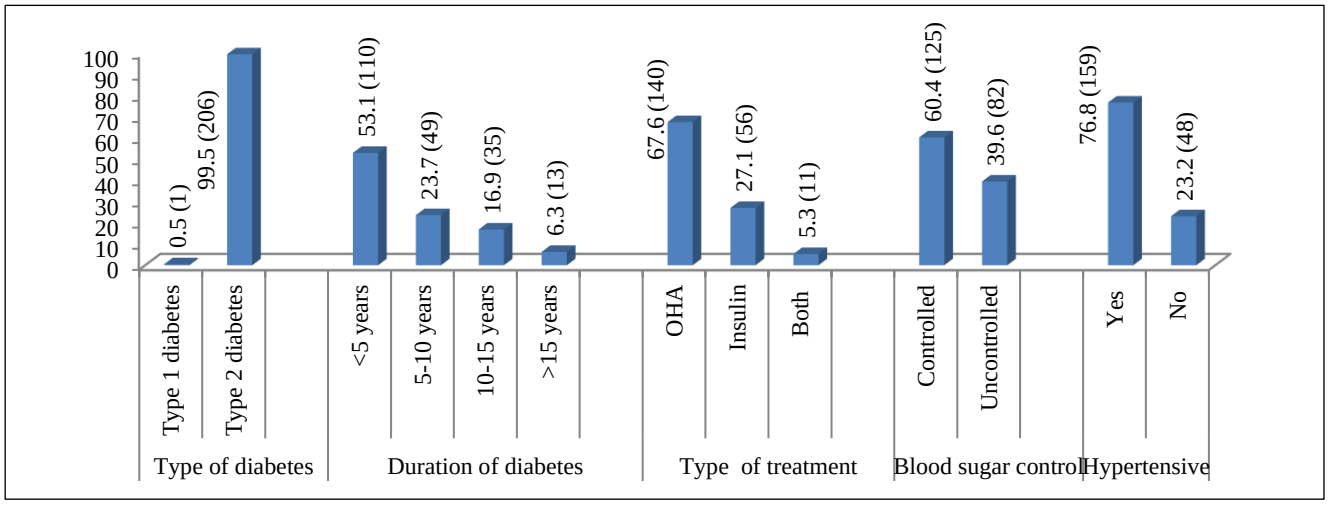

Figure 1: Disease characteristics of the study population.

Ocular manifestations of diabetes in the study population are shown in Table 2. Majority 154(74.4%) had bilaterally normal vision, 19(9.2%) had unilateral impairment of vision and 34(16.4%) had bilateral impairment of vision. Cataract was present in 13(6.3%) of the participants. Fundus examination was normal in 147(71%) of the study subjects and 60(29%) had diabetic retinopathy of which 24(11.6%) had grade I diabetic retinopathy, 21(10.1%) had grade II diabetic retinopathy and 15(7.2%) had grade III diabetic retinopathy. Table 3 shows presence of diabetic retinopathy by general characteristics. 28.2% males had diabetic retinopathy against 29.4% in females. Again 32.4% and 28.3% each had diabetic retinopathy in the age group of 20-40 years, 41-60 years and >60 years, respectively.

Table 2: Ocular Manifestations in the study population.

	Frequency	Percent
Vision		
B/L Normal	154	74.4
U/L Impaired	19	9.2
B/L Impaired	34	16.4
Cataract		
Yes	13	6.3
No	194	93.7
Fundus		
Normal/No DR	147	71.0
Diabetic Retinopathy	60	29.0
Gr I DR	24	11.6
Gr II DR	21	10.1
Gr III DR	15	7.2

Only 22.3% with duration of diabetes ≤10 years had diabetic retinopathy against 50.0% in those with duration of diabetes >10 years. This difference was statistically significant (p=0.000) [OR= 3.417(95% CI =1.736-6.723)].

Diabetic retinopathy was almost equally present (29.0% vs 28.8%) in those with and without family history of diabetes. Those who had history of hypertension also, 32.7% had diabetic retinopathy against 16.7% in those with no history of hypertension and the difference was statistically significant (p=0.032) [OR = 2.430(95% CI = 1.061-5.563)].

The distribution of participants with or without diabetic retinopathy according to different biomarkers is shown in Figure 2.

Table 3: Diabetic retinopathy by general characteristics.

	Retinopathy		Total	Odds Ratio (95% CI)	p-value
	Present	Absent			
Gender					
Male	20	51	71	0.941 (0.498-1.776)	0.852
	28.2%	71.8%	100.0%		
Female	40	96	136		
	29.4%	70.6%	100.0%		
Age					
20-40 Years	11	23	34	-	0.894
	32.4%	67.6%	100.0%		
41-60 Years	34	86	120	0.826 (0.363-1.878)	
	28.3%	71.7%	100.0%		
> 60 Years	15	38	53	0.825 (0.324-2.101)	
	28.3%	71.7%	100.0%		
Type of diabetes					
Type 1 diabetes	0	1	1	-	1.000
	0.0%	100.0%	100.0%		
Type 2 diabetes	60	146	206		
	29.1%	70.9%	100.0%		
Duration of diabetes					
>10 years	24	24	48	3.417 (1.736-6.723)	0.000
	50.0%	50.0%	100.0%		
≤10 years	36	123	159		
	22.6%	77.4%	100.0%		
Family history of diabetes					
Yes	27	66	93	1.004 (0.549-1.836)	0.989
	29.0%	71.0%	100.0%		
No	33	81	114		
	28.9%	71.1%	100.0%		
History of Hypertension					
Yes	52	107	159	2.430 (1.061-5.563)	0.032
	32.7%	67.3%	100.0%		
No	8	40	48		
	16.7%	83.3%	100.0%		

The participants having total cholesterol of >200 mg/dl and ≤200 mg/dl had prevalence of DR 28.8% and 29.1%, respectively. This prevalence was 27.0% and 31.5% in those with triglycerides >150 mg/dl and ≤150 mg/dl, respectively. The participants with HDL ≤35 mg/dl and >35 mg/dl had prevalence of DR of 31.1% and 28.4%, respectively. The differences with respect to these different constituents of lipid profile where not statistically significant. Higher prevalence of DR (39.1% vs 27.7%) was found to be in those with serum urea of >40 mg/dl than that ≤40 mg/dl, respectively. Similarly, higher prevalence of DR (55.0% vs 22.8%) was found to be with respect to creatinine >1.1 mg/dl than that ≤1.1 mg/dl, respectively.

The differences in prevalence with respect to serum creatinine were found to be statistically significant (p=0.000) and odds of having DR was found to be 4.149 (95% CI=2.019-8.527) in those with creatinine >1.1 mg/dl. Those participants with proteinuria of >150 mg/24hr and ≤150 mg/24hr had prevalence of DR 31.4% and 28.5%, respectively. Higher prevalence of DR was found in those participants with uncontrolled blood sugar or HbA1c >6.5% (39.0% and 32.1%) with odds of having DR 2.217 (95% CI=1.203-4.085) and 10.384(95% CI=1.367-78.890) against those with controlled blood sugars or HbA1c ≤6.5%(22.4% and 4.3%), respectively. The differences with respect to blood sugar control and HbA1c were found to statistically significant (p=0.010 and 0.006, respectively).

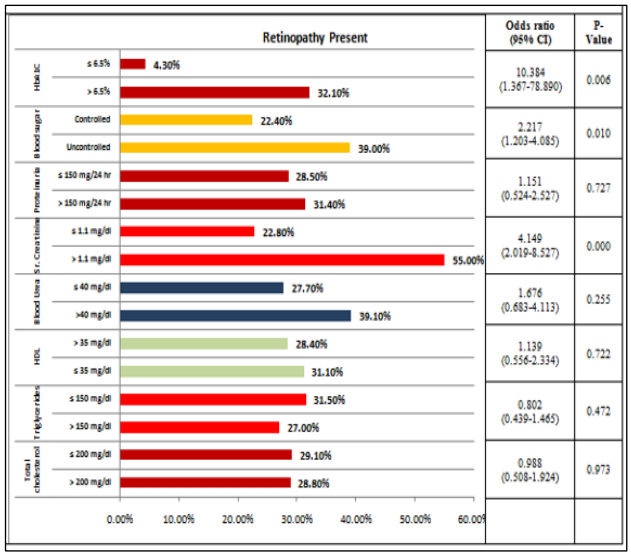

Figure 2: Diabetic retinopathy by biochemical markers.

DISCUSSION

This cross sectional study was carried out in a tertiary care hospital. A total of 207 known diabetic patients consented to participate of which 136 (65.7%) were females and only 71 (34.3%) were males. The mean age being 53.13±10.85 (range=28-80) years and only 67 (32.4%) were literate. The study group was similar to that of the study conducted by Qureshi T et al (2013) from Kashmir where 61.6% females and 38.4% males participated.[9] Contrary to this, Gadkari SS et al (2016).[10] in their study reported a preponderance of males (61.2%) and 88.6% were between 40 and 80 years of age. Similarly Idiculla J et al (2012).[11] Also reported a higher proportion of males (63.6%) in their study, with an age range of 32-85 yrs and mean (SD) of 56.41(+9.91) years. In our study majority 162 (78.3%) of the participants had sedentary lifestyle or were illiterate 140 (67.6%). 93 (44.9%) had family history of diabetes. In Gadkari SS et al (2016) study 53.9% had family history of diabetes.[10]

While majority 206(99.5%) of the participants in our study had type 2 diabetes mellitus, only 1(0.5%) had type 1 diabetes mellitus which is in accordance with study conducted by Qureshi T et al (2013) where 98% had NIDDM and only 2% had IDDM.[9] In our study110(53.1%) were diagnosed <5 years before and only 13(6.3%) had diabetes for >15 years. 140(67.7%) were taking OHG agents only, 56(27.1%) were on insulin and 11(5.3%) were on both OHG agents and insulin.

In our study majority 154(74.4%) had bilaterally normal vision, 19(9.2%) had unilateral impairment of vision and 34(16.4%) had bilateral impairment of vision. Cataract was present in 13(6.3%) of the participants. Fundus examination showed 60(28.9%) had diabetic retinopathy of which 24(11.6%) had grade I diabetic retinopathy, 21(10.1%) had grade II diabetic retinopathy and 15(7.2%) had grade III diabetic retinopathy. The results were similar to that of Qureshi T et al (2013) and Narendran V et al (2002) where prevalence of DR was found to be 27% and 26.2%**,** respectively.[10,12] In contrary to our results lower prevalence was seen in studies conducted by Raman R et al, (18.1%), Rema M et al. (17.6%), Namperumalsamy P et al. (10.6%) and Dandona L et al. (22.58%), however, most of these studies were conducted in the southern states of the country.[13-16] Higher Prevalence of DR was observed by Kai S et al (72%)with NPDR (59.3%), PDR (5.4%) and maculopathy (7.3%), Qoqonokana MQ et al. (2010) 86%with 76% NPDR and 10% PDR, Jain IS et al (1988) 42.9% and Jost BS et al.(2010) 38.4%.[6,17-19] Study by Javadi MA et al, (2009) also showed overall higher prevalence (37.5%) with 27.3% NPDR and 9.6% PDR. A meta-analysis by Yau JWY et al, (2012) provided data from 22,896 individuals with diabetes. The overall prevalence was 34.6% (95% CI 34.5–34.8) for any DR, 6.96% (6.87-7.04) for proliferative DR, 6.81% (6.74-6.89) for diabetic macular edema, and 10.2% (10.1-10.3) for VTDR.[20,21]

Diabetic retinopathy and risk factors

28.2% males had diabetic retinopathy against 29.4% in females in our study, the difference being statistically not significant. In contrary Rema M et al, (2005) found that prevalence of diabetic retinopathy was significantly

higher in males than in females (21.3% in males and 14.6% in females, p<0.0001).[14] Authors found that only 22.3% with duration of diabetes ≤10 years had diabetic retinopathy against 50.0% in those with duration of diabetes >10 years. This difference was statistically significant (p=0.000). The results were similar to all other studies. Qureshi T et al, in their study observed that 30 patients (12.8%) had diabetes of <5 yrs duration, 20% had a duration of 5-9 yrs, 47.2% had 10-14 yrs duration, 76.6% with DR had a duration of ≥15 year.[9] The prevalence of any DR increased from 21.1% to 76.3%, on comparing <10 with ≥20 years duration of diabetes in Yau JWY et al, meta-analysis. In Kai S et al, study, it was found that no patient with duration of diabetes less than 5 years had retinopathy, 73 patients (67% of those with retinopathy) were with duration of diabetes between 12-21 years. Yanko L et al. (1983) found that there was no evidence of retinopathy in diabetics with duration of diabetes less than 5 years and they also reported that highest prevalence of diabetic retinopathy among diabetics was with duration of diabetes more than 10 years (79.4%).[6,21,22] Kim CH et al. (1998) in their study on type 2 DM subjects found that mean duration of diabetes in subjects with retinopathy was 11.0±0.3 years as compared to 5.6±0.3 years in diabetics without retinopathy, difference being statistically significant (p<0.05).[23] Nevertheless, many studies, both in type 1 and type 2 diabetes found disease duration to be a significant risk factor for DR, and this is independent of adequacy of glycemic control.[24-27]

In our study it was also observed that diabetic retinopathy was almost equally present (29.0% vs 28.8%) in those with and without family history of diabetes. Those with history of hypertension, 32.7% had diabetic retinopathy against 16.7% in those with no history of hypertension and the difference was statistically significant (p=0.032).[28] The results were similar to Bajpai HS et al. (1979) where hypertension was associated with retinopathy in 31.4% of patients. Yau JWY et al, also noted that prevalence of any DR increased from 30.8% to 39.6% with increase in blood pressure from ≤140/90 to >140/90 mmHg.[21] Many other epidemiologic studies have identified hypertension as a risk factor for DR and DME. [26,27,29,30] Further in United Kingdom Prospective Diabetes Study (UKPDS) it was observed that tight blood pressure control of <150/85 mmHg in patients with type 2 diabetes reduced the risk of microvascular disease by 37 %, the rate of progression of DR by 34 %, and the risk of deterioration of visual acuity by 47 %.[31]

In our study the participants having total cholesterol of >200 mg/dl and ≤200 mg/dl had prevalence of DR 28.8% and 29.1%, respectively. This prevalence was 27.0% and 31.5% in those with triglycerides >150 mg/dl and ≤150 mg/dl and 31.1% and 28.4% with HDL ≤35 mg/dl and >35 mg/dl, respectively. The differences with respect to these different constituents of lipid profile where not statistically significant. Kai S et al, in their study also did not find any statistically significant association between serum lipid level and diabetic retinopathy.[6] Similarly in Idiculla J et al, study neither the occurrence of dyslipidemia nor the increased levels of the various components of serum lipids showed a statistically significant correlation with the occurrence and increasing severity of diabetic retinopathy. However, Chew EY et al, (1996) found that elevated serum lipids are associated with an increased risk of retinal hard exudates in persons with diabetic retinopathy and Chopra R et al, (2007) found that average Lp(a) levels in patients with diabetic retinopathy was (68.5mg%) significantly higher than in patients with no retinopathy (25.1mg%), p<0.001.[32,33] Also a trend was noticed towards a higher prevalence of VTDR stages, but not any DR, in people with cholesterol levels ≥4.0mmol/L by Yau JWY et al, Idiculla J et al, also observed that retinal hard exudate formation was found to have statistically significant correlation with the presence of dyslipidemia (p=0.02), increased total cholesterol (p=0.002) and LDL levels (p=0.001) and the correlation with triglyceride levels showed a trend towards significance (p=0.07).[11,21] As outlined in a previous review, the evidence for dyslipidemia as a risk factor for DR are inconsistent, and no single lipid measure had been consistently found to be associated with DR or DME.[34] In recent cohort studies, the Madrid Diabetes Study found an association between low density lipoprotein (LDL) cholesterol and incidence of DR.[35]

Higher prevalence of DR (39.1% vs 27.7%) was found to be in those with serum urea of >40 mg/dl and ≤40 mg/dl, respectively. Similarly higher prevalence of DR (55.0% vs 22.8%) was found to be with respect to creatinine >1.1 mg/dl and ≤1.1 mg/dl, respectively. The differences in prevalence with respect to serum creatinine were found to be statistically significant (p=0.000) and odds of having DR was found to be 4.149 (2.019-8.527) in those with creatinine >1.1 mg/dl. The results being in accordance with Kai S et al, study where only 22% of patients with retinopathy had altered renal function, but all the patients with altered renal function had some retinopathy, p-value = 0.0008 (Highly significant).[6]

Higher prevalence of DR was found in those participants with uncontrolled blood sugar or HbA1c >6.5% (39.0% and 32.1%) with odds of having DR 2.217 (1.203-4.085) and 10.384 (1.367-78.890) against those with controlled blood sugars or HbA1c ≤6.5% (22.4% and 4.3%), respectively. The differences with respect to blood sugar control and HbA1c were found to statistically significant (p=0.010 & 0.006, respectively). Our study results are similar to that of other authors. Yau JWY et al, observed that prevalence of any DR increased from 18.0% to 51.2% with increase in HbA1c (comparing levels ≤7.0 with > 9.0%).[21] Van Leiden HA et al, (2002) in their study observed that 7% of patients with retinopathy had normal glucose metabolism, 11% of patients had impaired glucose metabolism and 34% of patients with retinopathy were known cases of diabetes mellitus.[36] According to Kai S et al, study patients with blood glucose (Fasting) more than 126 mg% have more chances

of developing retinopathy (p<0.0001). A meta-analysis of three large population-based studies found a graded relationship between the level of glycemia and frequency of retinopathy signs.[37] The United Kingdom Prospective Diabetes Study (UKPDS) and the Diabetes Control and Complications Trial (DCCT) provided strong evidence that tight control of glycemia (HbA1c <7 %) reduces the risk of development and progression of DR in both type 1 and type 2 diabetes.[38,39] The DCCT showed that intensive glycemic control reduced the incidence of retinopathy by 76 % and progression from early to advanced retinopathy by 54 %.[39] This highlights that strict glycemic control is much more effective in preventing or delaying the onset of DR in patients with diabetes without DR, rather than limiting the severity of DR after it has occurred. In the case of DME, intensive glycemic control was associated with 46 % reduction in the incidence of DME at the end of the trial and a 58 % reduction 4 years later compared with those in the conventional group.[39]

CONCLUSION

Authors conclude that the prevalence of diabetic retinopathy in our study population was neither too high nor too low as compared to all other studies. Further the risk factors like hypertension, uncontrolled blood sugars and altered kidney function test put data in perspective. Besides regular retinal exams, good metabolic and blood pressure control is indispensable for reducing the risk of ophthalmic complications in diabetics.

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