RISK FACTORS AND PREVALENCE OF DIABETIC RETINOPATHY IN ADULT DIABETIC PATIENTS CONSULTING AT KIGALI UNIVERSITY TEACHING HOSPITAL

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ABSTRACT

Objectives: Determine risk factors and prevalence of diabetic retinopathy in diabetic patients consulting at Kigali University Teaching hospital.
Methods: 226 Adult patients with diabetes mellitus consulting at Kigali University Teaching Hospital between January and June 2012 were screened for diabetic retinopathy.
Results: Diabetic retinopathy was found in 70 cases (31%), mild non proliferative diabetic retinopathy (NPDR) was present in 17.3%, moderate to severe in 6.2% and proliferative diabetic retinopathy (PDR) in 8%. The mean duration since diagnosis of diabetes mellitus in patients who had retinopathy was longer than mean for those without retinopathy (10.59 ± 7.1 years versus 5.92 ± 5.4 years; p < 0.0001). The mean of HbA1c of patients with retinopathy was higher than the mean HbA1c % of those without retinopathy (8.17 ± 1.8% versus 7.96 ±1.9%). A big percentage of patients with diabetic retinopathy (45%) had diabetes for more than 10 years compared to 16% of those without retinopathy (p < 0.001; OR=5, with 95% CI (2.55-10.25). 74.2% of patients with diabetic retinopathy had elevated HbA1c of 7% and above; whereas 54.4% in the group with normal retina had HbA1c of 7% and above [(p = 0.0076, OR=3.2, 95% CI (0.87-4.7)]. The prevalence of patients with diabetic retinopathy (50%) was higher in hypertensive patients compared to normotensive (37%) [p = 0.02; OR=1.6, 95% CI (1.13- 5.7)]. 60% of those with retinopathy were on insulin [p < 0.053; OR=1.75; CI= (0.9-3.11)]. There were no significant differences regarding gender, BMI, smoking, serum lipids and obesity in patients with or without diabetic retinopathy.
Conclusion: Longer duration of diabetes, uncontrolled blood sugar and hypertension were the most significant independent risk factors of diabetic retinopathy. Prevalence of diabetic retinopathy was high despite the fact that this prevalence was better than that of many studies from developing countries. However a population based study is warranted to identify the risk factors as well as the prevalence of diabetic retinopathy.

Keywords: Prevalence - risk factors - diabetic retinopathy

RESUME

Objectifs: Déterminer les facteurs de risque et la prévalence de la rétinopathie diabétique chez les patients diabétique traités au Centre Hospitalier et Universitaire de Kigali.
Méthodes: 226 patients diabétique adultes ont été examinés et traités au Centre Hospitalier et Universitaire de Kigali de janvier à juin 2012 avec dépistage d'une rétinopathie diabétique probable.
Résultats: La rétinopathie diabétique a été diagnostiquée à 31%, la rétinopathie diabétique non proliférative minime représentait 17.3%, la rétinopathie diabétique non proliférative modérée à sévère dans 6.2% de cas et la rétinopathie diabétique proliférative à 8%. La durée moyenne de la maladie chez les patients avec rétinopathie était plus longue que celle des patients sans rétinopathie diabétique (10.59 ± 7.1 années versus 5.92 ± 5.4 années; p < 0.0001). La moyenne de HbA1c des patients avec rétinopathie était plus élevée que celle des patients sans rétinopathie (8.17 ± 1.8% versus 7.96 ±1.9%). Un pourcentage important des patients avec une rétinopathie diabétique (45%) avait le diabète depuis plus de 10 ans alors que ceux n'ayant pas de rétinopathie diabétique représentaient 16% (p < 0.001; OR=5, 95% CI (2.55-10.25). 74.2% des patients avec rétinopathie diabétique avait une HbA1c élevée (7% et plus); alors que 54.4% du groupe sans rétinopathie diabétique avait une HbA1c élevée [(p = 0.0076, OR=3.2, 95% CI (0.87- 4.6)]. La prévalence des patients avec une rétinopathie diabétique (50%) était plus élevée chez les diabétiques hypertendus que chez les diabétiques non hypertendus (37%) (p = 0.02; OR=1.6, 95% CI (1.13- 5.7). 60% des patients avec rétinopathie étaient sous insuline alors que seulement 45% du groupe sans rétinopathie diabétique recevaient de l'insuline (p < 0.053; OR=1.75; CI=0.9-3.11). Il n y a pas eu de différence statistique significatif entre le genre, l'indice de masse corporel, le fait de fumer, lipides du sérum et l'obésité entre les groups des patients avec ou sans rétinopathie diabétique.
Conclusion: La durée plus longue du diabète, la glycémie non contrôlée et l'hypertension étaient les facteurs de risque les plus significatifs associés à la rétinopathie diabétique. La thérapie d'insuline avait une association avec la rétinopathie diabétique quoique ce ne soit pas assez significatif, seulement dans la régression bivariante et quand on a considéré d'autre covariante dans l'analyse de régression multi variée l'effet a été perdu. La fréquence de la rétinopathie diabétique était haute malgré le fait que cette fréquence était meilleure que celle de beaucoup d'études des pays en voie de développement.

Mots-clés: Prévalence - facteurs de risque - rétinopathie diabétique

INTRODUCTION

Diabetic retinopathy is a retinal microangiopathy secondary to diabetes mellitus (DM) characterized by vascular microaneurisms and neovascularisation at late stage. "The gravity of this problem is highlighted by the finding that individuals with diabetes mellitus are 25 times more likely to become legally blind than individuals without DM, blindness is primarily the result of progressive diabetic retinopathy and clinically significant macular edema" [1, 2]. Worldwide diabetic retinopathy is the fifth-leading cause of global blindness. It represents 4.8% of the world's blindness. Patients with long-standing diabetes mellitus eventually develop DR to some degree. At present, the world prevalence of DR in patients with diabetes is about 30%. However by 2025, 75% of people with diabetes will be living in developing countries, due to westernization of their way of living and this might cause the increase of prevalence of diabetic retinopathy [3, 4]. Among diabetic retinopathy risk factors some are modifiable and others are non-modifiable. Modifiable risk factors are: consistently

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elevated glycaemia, hypertension, dyslipidemia, smoking and pregnancy. Non modifiable risk factors are: duration of diabetes mellitus and age of the patient [5]. Duration of diabetes mellitus has been found strongly related with the onset of diabetic retinopathy. It was found that diabetic patients who develop diabetes before the age of 40 years; the duration of diabetes influences much the onset of DR in these patient than those who get the disease after the age of 40 [6, 7]. On the other hand we have modifiable risk factors as mentioned earlier which are: consistently elevated glycemia reflected by elevated glycated hemoglobin. A study carried out in Chine in 2011 showed that the risk of developing diabetic retinopathy starts to increase sharply when glycated hemoglobin reaches 6.5% [8]. Another modifiable risk factor is hypertension; it compounds and greatly increases the risk of microvascular complications, and thus the risk of vision loss, end-stage kidney disease and non-traumatic limb amputations. Furthermore dyslipidemia is also another risk factor of DR, serum cholesterol and serum low density lipoproteins have been found to be independent risk factors in some studies [9,10,11]. Smoking can also increase the risk of development of diabetic retinopathy [12]. Obesity is another risk factor that can lead to the development of diabetic retinopathy. It is the most prevalent metabolic disease in developed countries and its prevalence rates worldwide are increasing rapidly [13]. In addition, diabetic retinopathy can be predicted by other microvascular complications of diabetes mellitus which are nephropathy and peripheral neuropathy and among these, nephropathy has been found to be strongly associated with diabetic retinopathy than peripheral neuropathy [14]. On African continent some studies indicate even bigger percentage of diabetic retinopathy for instance a similar study carried out in Nigeria in 2008 indicated a prevalence of 42.1% [15]. Such big numbers of patients put a big burden on health systems especially those in developing countries with limited resources. It is in this context that we decided to perform this study so that data can be obtained for the current situation.

METHODS

This is a cross sectional study conducted in the departments of ophthalmology and internal medicine at Kigali University Teaching Hospital. Patients were enrolled in the study since January 2012 up to May 2012. Were included in this study all adult patients (hospitalized and outpatients) with diabetes mellitus that accepted to be enrolled. Diabetic patients under the age of 15 years and those with corneal opacities or mature cataract that could hinder fundoscopy were excluded. Sample size calculation using the standard formula was performed, n=(□d(z□^2 x p x q))/α^2 . The number of patients for the study found was 226. The study population was drawn from the departments of internal medicine and ophthalmology at KUTH. Retinopathy status was assessed on fully dilated pupils with mydriaticum and indirect ophthalmoscopy was done by an experienced ophthalmologist. No fundus photography was available at the time of the study. Data collection included: age, gender, duration of diabetes, current diabetic medication, diagnosis of hypertension, smoking status, body mass index, HbA1c, serum total cholesterol, triglycerides, LDL, HDL, diabetic complications other than retinopathy as indicated in questionnaire. Diagnosis of hypertension was based on pre-existing history of hypertension with diagnosis indicated in patient's medical file. Body mass index (kg/m2) was calculated from weight and height measurements. The WHO classification for BMI was used to estimate the degree of obesity. Serum cholesterol and triglycerides were measured by enzymatic method using Dade Dimension. HbA1c was performed using turbid metric inhibition immunoassay. Glycemic control was categorized as good, acceptable or poor when HbA1c % was <7.0, 7.0-8.0 and >8.0 respectively. We considered HbA1c; considering the importance of this test and the fact that majority of patients, private and insured were informed about its importance in the management of the DM. Smoking status: any current smoking patient with diabetes mellitus was considered. Ocular examination comprised of subjective refraction, slit lamp examination as well as dilated fundoscopy with the use of 90D lens. A 20 lens was also used for patients with peripheral retinal diabetic lesions. Retinopathy was categorized from fundus ophthalmoscopy as: no diabetic retinopathy, mild non-proliferative diabetic retinopathy (NPDR), moderate to severe NPDR and proliferative diabetic retinopathy when there was neovascularization. Data management and analysis were conducted using the SPSS 19.0 version. Descriptive analysis was done using standard statistical methods. Odds ratio was used to ascertain the association. Statistical significant differences were considered at P value < 0.05 and odds ratio with 95% CI. The research protocol was reviewed and approved by ethical committees of KUTH and Faculty of medicine of National University of Rwanda. The purpose of this study was explained to the patients before being included in the study. The patients were free not to participate in the study, and this was explained to them in a detailed individual consent form. Confidentiality was granted too.

RESULTS

From a total of 226 patients enrolled in this study; there were 38.9% males and 61.1% females. The age ranged between 15 and 82 years with a mean age of 49.56 ± 15.1 years. Duration of diabetes mellitus ranged from 3 months to 30 years with a mean duration of 7.37 ± 6.4 years.

Table 1: Fundoscopy results & diabetic treatment

Characteristic	Frequency	Percentage	Confidence interval
Fundoscopy results			
Normal	155	68.6	(0.036, 0.102)
Mild NPDR	39	17.3	(0.124, 0.223)
Moderate-severe NPDR	14	6.2	(0.030, 0.094)
PDR	18	8	(0.045, 0.116)
Diabetic treatment			
Insulin	113	50	(0.435, 0.567)
Oral hypoglycemic	111	49.1	(0.426, 0.558)
Diet	2	0.9	(0.053, 0.128)

Any diabetic retinopathy was found in 70 (31%). Mild NPDR was observed in 17.3%, moderate-severe and PDR in 6.2% and 8% respectively. Half of the patients (50%) were on insulin therapy.

Table 2: Personal and clinical characteristics of diabetic patients with or without retinopathy (bivariate regression analysis)

Characteristic	No diabetic retinopathy	Any diabetic retinopathy	P value/ 95% CI
Gender			0.50/ (0.435, 0.567)
Male	63	25	
Female	93	45	
Age (years)			0.071/ (0.037, 0.105)
≤40	42	17	
41-50	41	9	
51-60	43	19	
>60	30	25	
Duration			0.000/ (-0.003, 0.005)
<5	92	23	
5-10	39	15	
>10	25	32	
HbA1c%			0.0076/ (-0.004, 0.019)
<7	71	18	
7-8	27	22	
>8	58	30	
Hypertension			0.09/ (0.053, 0.128)
Yes	58	35	
No	98	35	
Dyslipidemia			0.76/ (0.704, 0.817)
Yes	20	8	
No	136	62	
Current smoker			0.75/ (0.693, 0.808)
Yes	2	0	
No	154	70	
Diabetic treatment			0.053/ (0.024 0.083)
Insulin	71	42	
Oral hypoglycemic	83	28	
Diet	2	0	

In this bivariate analysis we note that longer duration of diabetes and uncontrolled blood sugar are highly associated with development of diabetic retinopathy. A big percentage of patients with diabetic retinopathy (45%) had diabetes for more than 10 years compared to 16% of those without retinopathy. Half of patients with diabetic retinopathy are also hypertensive. Among patients with diabetic retinopathy, 74.2% of them had elevated glycated hemoglobin compared to 54.4% for the group without diabetic retinopathy. In addition, 60% of those with retinopathy were on insulin therapy compared to 45% without retinopathy

Table 3: Bivariate regression analysis of risk factors of diabetic retinopathy

Factor	Adjusted Odds ratio (95% CI)	P value
DURATION OF DIABETES		
< 5 years	1	**0.000**
5-10 years	1.5 (2.5 -10.2)	
> 10 years	5 (2.55 – 10.25)	
HbA1c		
< 7%	1	**0.0076**
7 – 8%	3.2 (1.49 – 6.9)	
> 8	2.04 (1.03 – 4.0)	
HYPERTENSIVE		
No	1	**0.09**
Yes	1.6 (0.95 – 2.9)	
GENDER		
Male	1	**0.50**
Female	1.21 (0.67 – 2.1)	
DYSLIPIDEMIA		
No	1	**0.76**
Yes	0.88 (0.36 – 2.10)	
DIABETIC TREAMENT		
Oral hypoglycemic	1	**0.053**
Insulin therapy	1.75 (0.98 – 3.11)	
AGE		
≤ 40	1	**0.071**
41 – 50	0.5 (0.21 – 1.35)	
51 – 60	1.09 (0.5 – 2.38)	
> 60	2.05 (0.94 – 4.46)	

Bivariate regression analysis of duration of diabetes shows an OR of 5 with p value of 0.001 for patients with diabetes mellitus for more than 10 years. Patients with uncontrolled glycemia with HbA1c of 7 or above had an OR of 3 with P value of 0.0076. Mode of diabetic treatment specifically insulin therapy was associated with development of diabetic retinopathy with OR of 1.73 and P value 0.05.

Table 4: Multivariate regression analysis of risk factors of Diabetic retinopathy

Factors	Odds ratio	P value	95% CI
Duration of diabetes > 10 years	6	0.000	(2.64 – 15.28)
HbA1c 7 – 8%	4	0.002	(1.65 – 9.71)
Hypertension	2.5	0.02	(1.13 - 5.57)
Gender (females)	1.33	0.41	(0.67 – 2.64)
Diabetic Nephropathy	0.98	0.97	(0.42 – 2.29)
Age > 60 years	0.96	0.93	(0.34 – 2.67)
Dyslipidemia	0.69	0.49	(0.24 – 1.98)
Diabetic treatment With insulin	0.87	0.72	(0.40 – 1.87)

After multiple logistic regression analysis only longer duration of diabetes, uncontrolled blood sugar and hypertension were the most significant independent factors. There were no significant differences regarding gender, BMI, smoking, serum lipids and obesity in patients with or without diabetic retinopathy.

DISCUSSION

The prevalence of diabetic retinopathy was found to be 31% in our results; this prevalence is higher than prevalences reported in some previous studies [16, 17]. This high prevalence might be due to the fact that patients do not understand well the importance of doing regular medical follow up and funduscopy. Another possible explanation could be the inclusion of type 1 diabetic patients known to have increased incidence of diabetic retinopathy compared to type 2 diabetics.

However some similar studies showed higher prevalences of DR compared to that seen in our study: the prevalence of DR reported by Afaf MS Al- Adsani [12], Adeyinka et al [15] and Raman et al [18] respectively 40%, 42% and 33%. Even though our prevalence is high, Rwanda has an organized health system with almost all people having medical insurances encouraging to some extent diabetic patients to consult medical personnel on regular basis. The next step could be to determine why people are still leaving with diabetes mellitus without consulting health services and developing more and more diabetic retinopathy. Differences in prevalence of diabetic retinopathy observed in different studies could be explained by methods used to diagnose diabetic retinopathy, sample size calculations used in each study, the way health systems are organized in each country or parts of each country, financial status of populations, availability of medical personnel and the way diabetic patients are followed up. There are many risk factors of diabetic retinopathy reported in different studies [19, 20, 21]. Some of these risk factors are modifiable and others are none modifiable. Modifiable risk factors that were significantly associated with diabetic retinopathy in our study are hypertension and poor glycemic control. The

non modifiable risk factor that significantly associated with diabetic retinopathy was longer duration of diabetes mellitus. Longer duration of diabetes was found to be the most significant independent risk factor in our study. 50.9% of patients had diabetes mellitus for less than 5 years; however our study results show a sharp increase of the risk of developing diabetic retinopathy after duration of diabetes of more than 10 years with 45.7% of those with diabetic retinopathy compared to 16% of those without diabetic retinopathy. (p = 0.001; OR=5; CI=2.55-10.25). This supports what is already known and this finding correlates with reports of Afaf MS Al-Adsani [12] describing that the risk of diabetic retinopathy increased from 8.6% in patients who had diabetes for less than 5 years to 45.0% in patients who had diabetes between 5 - 10 years and 76.4% in patients who had diabetes for more than 10 years. Varma R et al in Los Angeles [6] report longer duration of diabetes mellitus among significant independent risk factors associated with diabetic retinopathy (OR= 1.08, p< 0.0001). Adeyinka Ashaye in Nigeria reported also 53.1% of patients with retinopathy had diabetes for more than 10 years, compared to 21.4% for those without retinopathy. (p= 0.005; OR= 2.5; 95% CI= 1.3 -4.8) [15]. A literature review done in UK in January 2010 on raisons why patients still require surgery for the late complications of proliferative diabetic retinopathy [22] showed that longer duration of diabetes mellitus was the most independent factor associated with diabetic retinopathy among non-modifiable risk factors. Poorly controlled glycemia was also a significant independent risk factor as indicated in our results. The risk of developing diabetic retinopathy increased mostly in patients with glycated hemoglobin of 7% and above (p value = 0.002; OR=4; CI=1.65- 9.71) as indicated in multiple logistic regression analysis. This finding has been also reported in many other similar studies where it is said that persistently elevated blood sugar leads to development and progression of diabetic retinopathy. Rasmieh et al [23] in the study on diabetic retinopathy among Jordanian patients with type 2 diabetes reported that uncontrolled glycemia was among statistically significant risk factors of DR (OR = 1.40, 95% CI = 1.17 – 1.68). This finding is consistent with our findings where poor glycemic control comes on first line among diabetic retinopathy risk factors with OR=4, p value of 0.002. The degree of glycemic control was poorer in diabetics with retinopathy compared to those without [15]. This is in concordance with our results in which 74.28% in diabetics with retinopathy had poor glycemic control compared to 25.7% in diabetic patients with retinopathy with good glycemic control. Adeyinka et al in Nigeria [15] report also that a larger proportion of those with diabetic retinopathy had poor glycemic control, post-prandial plasma glucose greater than 200 mg/dl in comparison with those without retinopathy (58.3% vs 27.0%; p = 0.014; OR = 2.2; 95% CI= 1.2–4.0). Pradeepa R et al in South India [19] report elevated HbA1c among risk factors associated with the risk of developing diabetic retinopathy. Alkharji F et al [24] report in the study on prevalence and risk factors for diabetic retinopathy that higher levels of HbA1c was found to be related with higher frequency of diabetic retinopathy from 10.6% at levels < 7% to 33.7% at levels > 10%. This difference was highly significant (p< 0.0000). This is similar to our findings in which diabetic retinopathy was seen to increase in diabetic patients with HbA1c of 7% and above. Hypertension has been reported as an important risk factor for onset and progression of diabetic retinopathy. In our study patients with hypertension were at risk of developing diabetic retinopathy compared to those with normal blood pressure. 50% of diabetic patients with diabetic retinopathy were hypertensive compared to 37.1% hypertensive diabetic patients without retinopathy (OR=2.5, p=0.02, 95% CI=1.13-5.57). This finding is in concordance with what is reported in previous studies. Varma R et al [12] described hypertension as an independent risk factors associated with diabetic retinopathy (OR=1.26, p=0.002). It was also found to be independently associated with development of proliferative diabetic retinopathy (per 20mmHg, OR = 1.44, p = 0.01). Tomina P et al [25] in their study on dyslipidemia and hypertension in patients with type 2 diabetes and retinopathy report that systolic blood pressure correlated significantly with prevalence of retinopathy (p = 0.031) and they report also that it was not correlated with severity of retinopathy. Diastolic blood pressure on the other hand correlated with both presence and severity of diabetic retinopathy (p=0.004 and p = 0.003) respectively. In a cross-sectional study done by Rani PK et al [26] in India on risk factors of diabetic retinopathy, hypertension was associated with development of diabetic retinopathy (per 10 mmHg, OR = 1.18). Chatziralli et al [27] report that patients with coexisting hypertension had higher risk of developing diabetic retinopathy and they presented with more severe diabetic retinopathy compared to those without hypertension. Afaf MS AL-Adsani [12] indicated that prevalence of hypertension was higher in diabetic patients with retinopathy compared to those without diabetic retinopathy (70.8% versus 49.5%, p < 0.01). Haddad O et al [28] report that systolic high blood pressure carried a significant increased risk for developing diabetic retinopathy. It was also observed. In our study the use of insulin was associated with diabetic retinopathy as noted in bivariate regression analysis. This association might be explained by the fact that patients on insulin therapy indicate the severity of the condition. However this association was not maintained when other covariates were considered as indicated in multivariate regression analysis. This finding is in concordance with reports by Adeyinka et al in Nigeria [15] with 18.8% of patients with diabetic retinopathy on insulin therapy compared to 2.4% on insulin therapy without diabetic retinopathy (p = 0.02; OR= 7.7; 95% CI= 0.97- 60.7). Varma R et al [12] described insulin therapy among factors that significantly were associated with diabetic retinopathy (OR=1.6, P=0.01). Insulin therapy in this particular study also figured among factors that independently associated with proliferative diabetic retinopathy (OR=3.2, P<0.0001). In a study carried out by Raman R et al [18] on relationship between prevalence of diabetic retinopathy and age of onset of diabetes, insulin use was associated with diabetic retinopathy with OR of 4.21). The study done by Alkharji Fatma et al [24] on prevalence and risk factors for diabetic retinopathy showed that the prevalence of any diabetic retinopathy differed in patients treated with insulin (43.1%) and patients treated with oral hypoglycemic or diet only (15%). This difference was found to be significant using chi-square test (p< 0.000). In our study dyslipidemia was not significantly associated with diabetic retinopathy. This

finding correlates with findings in some previous studies: in the study done by Afaf Al Adsani [12] on risk factors of diabetic retinopathy in Kuwaiti type 2 diabetic patients, diabetic patients did not show any association between serum lipids and diabetic retinopathy. Wong et al []29 report that diabetic retinopathy was found not be significantly associated with dyslipidemia with a P value of 0.49. However in some other studies it was reported that dyslipidemia well correlates with presence and severity of diabetic retinopathy especially in reduced HDL and high LDL. Tomina P et al [25] in their study on dyslipidemia and hypertension in patients with type 2 diabetes and retinopathy report that dyslipidemia correlated well with the presence and severity of diabetic retinopathy especially HDL-Chol ($p = 0.001$) and LDL-C ($p= 0.000$). Although triglycerides were higher in patients with diabetic retinopathy in this study, there was no statistical significance ($p = 0.57$). The difference between findings of many studies could be explained by the fact that the obesity in our population in general is not yet a public health problem. In a study done by Rajendra-P et al [19] serum triglycerides were among common risk factors of the three microvascular complications of diabetes (diabetic retinopathy, diabetic nephropathy and diabetic neuropathy). In this study we only saw two current smokers out of 226 diabetic patients enrolled in our study. This is due to the fact that in our population smoking has been abandoned following sensitization of the population on healthy problems caused by smoking. However smoking is reported as one of strong risk factors associated with diabetic retinopathy in other studies. Tomina P et al reported that 31.35% of non-smokers had diabetic retinopathy compared to 63.6% of smokers with $p = 0.003$ [25]. This finding does not correlate with our result due to rarity of smokers in our study population. It was observed no significant association between age of diabetic patients and development of diabetic retinopathy in this study. In a study carried out by Chatziralli et al [27] on risk factors associated with diabetic retinopathy in patients with diabetic mellitus type 2 report that severity of diabetic retinopathy was positively associated with patients' age at univariate analysis (Spearman's rho = 0.4869, $p< 0.0001$) but after multivariate ordinal logistic regression analysis, its statistical significant association was lost and they concluded that the effect of age seems to be a confounding association. However age is reported as an important risk factor associated with diabetic retinopathy in some other similar studies. Haddad O et al. [28] found that the mean age of patients with diabetic retinopathy was not much different from that of patients without retinopathy (40.2 years versus 36.9 years); but when patients were segregated into two categories one including those less than 40 years and others with 40 years or older, they found that patients less than 40 years of age were at more risk than patients with 40 years or more of age with risk increase of 1.6 times for every standard deviation decrease in the age of patients less than 40 years of age ($p = 0.006$). Nyamperumalsamy P. et al [30] in the study on prevalence and risk factors for diabetic retinopathy report that above 50 years of age is a significant risk factor for prevalence of diabetic retinopathy. Lim MC et al [31] in the study on diabetic retinopathy in diabetics referred to a tertiary center from a national wide screening program report that younger age was among predictors for vision threatening diabetic retinopathy. In our study longer duration of diabetes mellitus, uncontrolled blood sugar and hypertension were the most significant predictors associated with diabetic retinopathy. These findings are in concordance with results reported from Los Angeles eye study in Keck School of medicine university of California where factors that independently associated with diabetic retinopathy were longer duration of diabetes, higher glycosylated hemoglobin, hypertension and insulin treatment [6]. In this present study insulin therapy showed some association with diabetic retinopathy in bivariate regression analysis but the association was lost when other covariates were considered. Gender and obesity did not also show any association with diabetic retinopathy in this study. This finding is also reported by Afaf in his study [12].

CONCLUSION

Longer duration of diabetes mellitus, poorly controlled blood sugar and hypertension were the most significant risk factors associated with diabetic retinopathy. Insulin therapy had association with diabetic retinopathy though it was not significant enough, only in bivariate regression and when other covariates were considered in multivariate regression analysis the effect was lost. Prevalence of diabetic retinopathy was high despite the fact that this prevalence was better than that of many studies from developing countries.

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