ORIGINAL ARTICLE

Prevalence and Risk Factors for Diabetic Retinopathy - A Study of 217 Patients from University of Malaya Medical Centre

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Summary

Two hundred and seventeen diabetic patients attending the eye clinic were examined to determine the prevalence of retinal changes, and the association between diabetic retinopathy and risk factors. A detailed fundus examination was done, after dilating the pupils, using 90 D lens and slitlamp biomicroscope. Diabetic retinopathy was detected in 112 patients (51.6%). Background retinopathy was seen in 40 out of 217 (18.4%), pre-proliferative retinopathy in 11 (5.1%), proliferative retinopathy in 61 (28.1%) and maculopathy in 58 (26.7%) patients. Factors significantly associated with occurrence of retinopathy were duration of diabetes, presence of hypertension and presence of systemic complications (diabetic foot ulcer, lower limb amputation, nephropathy, and peripheral neuropathy).

Key Words: Diabetic retinopathy, Risk factors, Diabetes mellitus, Hypertension

Introduction

In Malaysia, diabetic eye disease is the commonest cause of visual loss in the adult working age group[1]. The prevalence of diabetic retinopathy in Malaysia has been reported to range from 44.1%[2] to 48.6%[3]. Significant risk factors for diabetic retinopathy such as long duration of diabetes, proteinuria and elevated serum creatinine levels were reported from Malaysia[3]. However, no significant association between the prevalence of retinopathy and high levels of serum cholesterol, C-peptide levels, associated hypertension, and glycaemic control of diabetes mellitus were reported in that study.

Diabetic retinopathy is characterised by varying degrees of microaneurysms, haemorrhages, hard exudates, cotton wool spots, venous changes, new vessel formation, and macula thickening. It can involve the peripheral retina, the macula, or both. These changes can be grouped into background, preproliferative, proliferative, and advanced retinopathy. Maculopathy can occur in any stage of diabetic retinopathy[4].

Diabetes and its complications are likely to become increasingly prevalent worldwide and will impose a heavy burden on the health system in any country[5]. This study was conducted to determine whether the prevalence of retinopathy has increased in Malaysia compared to earlier reports and to determine the association between diabetic retinopathy and the risk factors (gender, age, duration of diabetes, control of diabetes and other concurrent systemic problems such as hypertension, ischaemic heart disease, hypercholesterolaemia and smoking habits) in diabetic patients attending the eye clinic of University of Malaya Medical Centre (UMMC). An attempt was also made to

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determine the relationship between retinopathy and other ocular complications of diabetes (glaucoma, cataract, rubeosis iridis, vitreous haemorrhage, tractional retinal detachment), or systemic complications (diabetic foot ulcers, lower limb amputation, nephropathy and peripheral neuropathy).

Materials and Methods

Two hundred and seventeen diabetic patients who attended the eye clinic in UMMC, between November 2004 to end of January 2005, were included in the study. The data was collected on age, gender, race and occupation of the patients. A full medical history was noted from each patient including the type of diabetes --- insulin dependent diabetes mellitus (IDDM) or non insulin dependent diabetes mellitus (NIDDM) according to the classification laid down by the WHO[6], age of onset of the diabetes, duration of diabetes, history of hypertension, ischaemic heart disease, hypercholesterolaemia, and presence of any systemic complication of diabetes.

After recording the visual acuity, the anterior segment of the eye was examined with the slit-lamp and intraocular pressure was measured using applanation tonometer. Then the pupils were dilated using tropicamide 1% and phenylephrine 2-5% eye drops, and a detailed fundus examination was done using 90 D lens and slitlamp biomicroscope. Patients with corneal opacity or dense lenticular opacities that precluded detailed fundus examination were not included in this study.

The modified Airlie House classification was used for grading of diabetic retinopathy- (i) Background retinopathy if microaneurysms, dot and blot haemorrhages or hard exudates were present, (ii) Preproliferative retinopathy (above changes plus cotton wool spots), (iii) Proliferative retinopathy (above changes plus neovascularization), and (iv) Maculopathy if hard exudates, retinal oedema or ischemia were present in the macula. The severity of diabetic retinopathy was determined based on the grading of the worse eye where there was a difference in findings between the two eyes. For patients who were already treated with laser photocoagulation, a review of their previous documentation of the ocular findings at the time of treatment, was done to stage these patients.

The data collected were analyzed using SPSS program. Statistical significance was assessed by using Pearson chi square test and Fisher's exact test. A value of 0.05 or less was taken as significant.

Results

Two hundred and seventeen patients comprising of 108 males and 109 females were examined. The majority of patients had NIDDM (210; 96.8%) and seven patients had IDDM (3.2%).

Age and ethnicity

The average age of the patients studied was 59.8 years, with a range of 23 - 81 years. The majority of patients (62 patients, 28.6%) were first diagnosed to have diabetes between 41 and 50 years age. All IDDM patients had onset of diabetes at less than 30 years age. Patients with diabetic retinopathy were slightly older at presentation with a mean age of 62.4 years, as compared to patients without diabetic retinopathy (mean age 57.3 years). The ethnic breakdown was 72 Malays (33.2%), 77 Chinese (35.5%), 66 Indians (30.4%) and 1 Eurasian (0.5%); NIDDM was seen mostly in Chinese patients (36.2%), followed by the Indians (33.3%) and the Malays (30.5%).

Prevalence and severity of retinopathy

The overall prevalence of diabetic retinopathy in our study was 51.6% (112 out of 217 patients). Diabetic retinopathy changes were seen in 108 out of 210 NIDDM patients (51.4%) and in 4 out of 7 IDDM patients (57.1%). There was no significant difference in the prevalence of retinopathy between IDDM and NIDDM patients ($p > 0.05$). Out of 112 (51.6%) patients with diabetic retinopathy, 28.1% had proliferative retinopathy (Table I). The prevalence of proliferative retinopathy was the highest among the Chinese (60%), and the lowest among the Indians (47.4%); while the prevalence of maculopathy was the highest among the Indians (63.2%), and the lowest among the Chinese (31.4%). (Table II).

Risk factors for retinopathy

The prevalence of retinopathy was significantly associated with age of onset and duration of diabetes. Among patients with retinopathy, 108 (49.8%) had the onset of diabetes after the age of 40 years. There was a significant correlation between the duration of diabetes and presence of retinopathy ($p<0.005$); 27 patients (79.4%) with more than 20 years duration of the disease showed retinopathy changes. Presence of concurrent hypertension was also found to be associated ($p<0.005$) with occurrence of retinopathy in

these patients. Retinopathy was not significantly associated with ischaemic heart disease, hypercholesterolemia and smoking habits (Table III).

Associations between diabetic retinopathy and ocular and systemic complications of diabetes mellitus.
Patients with retinopathy changes had significantly higher risk of vision threatening complications (tractional retinal detachment, rubeosis iridis and vitreous haemorrhage), ($p<0.005$). However, there was no significant association between the incidence of glaucoma and retinopathy; and since patients with dense cataracts had been excluded from the study, no association could be formed either. (Table IV). The diabetic patients with retinopathy had higher incidence of diabetic foot ulcers and lower limb amputation, nephropathy and peripheral neuropathy (Table V).

Discussion

In Malaysia, the prevalence of diabetes mellitus increased from 6.3% in 1986 to 8.2% in 1996[7]. With aging population, increasing affluence, over nutrition, physical inactivity, and urbanization , this prevalence is expected to rise. In this study, the overall prevalence of retinopathy was 51.6%, which was higher than the previous prevalence rate of 44.1% reported from University Hospital (U.H.), Kuala Lumpur in 1983[2] and 48.6% reported from USM Hospital, Kubang Kerian, Kelantan in 1996[3]. The differences in the rate of retinopathy from the same hospital (U.H.) could probably be due to increased life span of patients, and increase in the incidence of diabetes and its complications (including retinopathy) over a 20-year period. The prevalence of diabetic retinopathy in our study is also much higher than the figures reported from U.K. (22.7%) [8], Australia (32.0%) [9] and Japan (39.6%) [10].

In this study, type 2 diabetes was found to be more common (96.8%) compared to type 1 diabetes (3.2%). Since the number of type 1 diabetes patients was very small compared to type 2 diabetes, any differences in retinopathy between the two types of diabetes could not be ascertained.

The prevalence of proliferative retinopathy was found to be higher in our study when compared to the previous ones reported from Malaysia [2,3,11] (Table VI). This indicates that the incidence of retinopathy in our country is on the rising trend probably due to an increase in the life span of the people, better awareness of the disease, better medical care, and early detection of retinopathy.

Important risk factors established in the development of diabetic retinopathy are duration of diabetes, poor metabolic control, pregnancy, hypertension, nephropathy, smoking, obesity, and hypercholesterolaemia[4]. The prevalence of retinopathy was significantly associated with duration of diabetes in this study which is in agreement with previous studies [3,5,12,13]. The presence of hypertension has been reported to aggravate the prevalence of diabetic retinopathy[14]. A similar observation was also noted in our study.

Table I: Distribution of different types of retinopathy in 217 Diabetic Patients

Types of Diabetic Retinopathy	Number	Percentage
No retinopathy	105	48.4%
Background retinopathy	40	18.4%
Pre-proliferative retinopathy	11	5.1%
Proliferative retinopathy	61	28.1%
Maculopathy	58	26.7%

Table II: Distribution of diabetic retinopathy in the three main ethnic groups

Ethnicity	Type of Diabetic Retinopathy			
	Background No. (%)	Preproliferative No. (%)	Proliferative No. (%)	Maculopathy No. (%)
Malays (n=38)	9 (23.7)	7 (18.4)	22 (57.9)	22 (57.9)
Chinese (n=35)	12 (34.3)	2 (5.7)	21 (60)	11 (31.4)
Indians (n=38)	18 (47.4)	2 (5.3)	18 (47.4)	24 (63.2)

Table III: Association between risk factors and retinopathy in Diabetes Mellitus

Risk factors	Number	No. with Retinopathy	Percentage
Gender			
Male	108	62	57.4%
Female	109	50	45.9%
Age in years			
21 – 40	8	4	50.0%
41 – 60	113	73	64.6%
61 and above	96	35	36.5%
Duration of diabetes*			
Less than 5 years	55	12	21.8%
6 – 10 years	48	22	45.8%
11 -20 years	80	51	63.7%
More than 20 years	34	27	79.4%
Associated Hypertension*			
Present	161	90	55.9%
Absent	56	22	39.2%
Ischemic heart disease			
Present	54	30	55.5%
Absent	163	82	50.3%
Hypercholesterolaemia			
Present	99	53	53.5%
Absent	118	59	50.0%
History of smoking			
Present	33	22	66.6%
Absent	184	90	48.9%

*Fisher's exact test p<0.005

Table IV: Associations between diabetic retinopathy and ocular complications

Ocular complications	Number	No. with Retinopathy	Percentage
Glaucoma	45	21	46.7%
Tractional retinal detachment*	6	6	100.0%
Rubeosis iridis*	7	7	100.0%
Vitreous haemorrhage*	25	25	100.0%

* Fisher's exact test p< 0.005

Table V: Associations between diabetic retinopathy and systemic complications

Systemic complications	Number	No. with Retinopathy	Percentage
Diabetic foot ulcer	48	41	85.4%
Lower limb amputation	20	20	100.0%
Nephropathy	41	34	82.9%
Peripheral neuropathy	59	43	72.9%

Table VI: Comparison of prevalence of proliferative diabetic retinopathy (PDR) in different countries

Author	Country	Year	Number with Diabetic retinopathy	Percentage with PDR
Tosa[10]	Japan	1964	106	7.2%
Donovan[8]	UK	1978	704	5.5%
Teoh et al[2]	Malaysia	1981	145	6.2%
Shriwas et al[3]	Malaysia	1996	140	3.6%
Tan and Lai[11]	Malaysia	1996	90	22.2%
Present Study	Malaysia	2004/2005	112	28.1%

The effect of cigarette smoking on macrovascular disease is well recognized but its impact on microvascular disease is not well documented and evidence has not always been consistent[15]. Cigarette smoking, ischaemic heart disease, hypercholesterolaemia and pregnancy were not associated with retinopathy in this study.

All systemic complications in this study were highly correlated with the presence of diabetic retinopathy. Patients with early nephropathy as determined by the presence of microalbuminuria, invariably have a rise in blood pressure further adding to the risk of retinopathy. The incidence of retinal lesions was strongly related to the presence of complications such as loss of deep tendon reflexes and increased vibration-sensation threshold or in other words neuropathy[16].

Blindness in diabetic patients is usually due to maculopathy, vitreous haemorrhage, tractional retinal detachment and neovascular glaucoma. Therefore, early detection of retinopathy in diabetic patients is very essential by routine screening programmes by general practitioners and physicians, in order to refer them for further evaluation of fundus/ laser treatment by ophthalmologists. The indications for laser treatment are new vessels on the disc or elsewhere in the retina, advanced proliferative changes, clinically significant macular edema, and encroachment of hard exudates on the fovea. Vitreous haemorrhage/ tractional retinal detachment can be treated by vitrectomy and endolaser. It is also important to make all the diabetics aware of sight threatening eye complications through health education (posters) in the clinics so that they will seek the advice of ophthalmologists whenever they get eye problems.

Conclusion

The prevalence of retinal changes in diabetes mellitus was found to be 51.6%. Sight threatening proliferative retinopathy was seen in 28.1% and maculopathy in 26.7%. The significant risk factors associated with retinopathy in these patients were duration of diabetes, hypertension, and presence of systemic complications (diabetic foot ulcer, lower limb amputation, nephropathy, and peripheral neuropathy). It is ideal to conduct a prospective multicentre study throughout Malaysia (including Sarawak and Sabah) in order to get accurate prevalence rates of diabetic retinopathy including blindness so that an effective screening programmes could be planned and implemented by health care authorities.

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