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Research Article

Diabetic eye screening in multi ethnic population of Malaysia: epidemiological risk factors for development of diabetic retinopathy

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ABSTRACT

Background: The objective of this study is to evaluate epidemiological risk factors for development of diabetic retinopathy.
Methods: The cases of type-2 diabetes mellitus attending Melaka Manipal medical college, Malaysia were retrospectively reviewed. The epidemiological characteristics of diabetic retinopathy were estimated. The cases were graded according to degree of retinopathy in to: non-diabetic retinopathy group and diabetic retinopathy. Clinical and biochemical studies were used for studying the risk factors associated with development of retinopathy.
Results: The prevalence of diabetic retinopathy in the population was 21% in known diabetic subjects and was significantly higher in men than in women (21.3% vs. 14.6%) with increasing age and duration of diabetes. Ethnicity is a complex, independent risk factor for diabetic retinopathy. Sight threatening diabetic retinopathy, and clinically significant macular edema was higher in people of Malaysia (20%) when compared with Chinese (16%) and Indonesians (12%). In all, 55 percent of patients with known diabetes mellitus had never undergone an eye examination. Among patients who had undergone eye examinations, 32.8 percent had the last examination within the last one year, 49.8 percent within the last one to two years, and 17.4 percent more than two years ago.
Conclusion: Diabetic retinopathy is highly prevalent in the patients with type-2 diabetes mellitus in Malaysia. Besides blood glucose, many factors are associated with the present and development of diabetic retinopathy.

Keywords: Diabetic retinopathy, Risk factors, Type-2 diabetes mellitus

INTRODUCTION

Diabetic retinopathy is a dreadful sight threatening complication. Every part of the eye is susceptible to the harmful effects of diabetes.

Diabetes mellitus affects various systems of our body including the eyes, kidneys and the peripheral nerves. Retinal damage caused by changes in diabetes known as Diabetic retinopathy is an important cause of blindness and visual disability in the working age group. The number of people with retinopathy increases as the diabetic population as well as diabetic age increases. Small blood vessels and the capillaries of retina are damaged which results in weakening of the vessel wall and subsequent leakage of the blood elements, proteins and lipids. This results in the fundus picture of micro aneurysms, haemorrhages and exudates. At later stages the retina which is deprived of oxygen produces chemicals like vasoformative growth factors resulting in proliferation of abnormal new blood vessels into the vitreous which bleed into the vitreous with devastating

complications like vitreous hemorrhage and retinal detachment. In advanced stages iris and angle neovascularisation develops leading to neo vascular glaucoma and loss of the eye. These complications can be prevented or delayed by simple fundus examination by ophthalmoscope or retinal photography and referral of patients with vision threatening fundus changes to the ophthalmologist.

Diabetic retinopathy progresses from mild non-proliferative abnormalities, characterized by increased vascular permeability, to moderate and severe Non-Proliferative Diabetic Retinopathy (NPDR), characterized by vascular closure, to Proliferative Diabetic Retinopathy (PDR), characterized by the growth of new blood vessels on the retina and posterior surface of the vitreous. Macular edema, characterized by retinal thickening from leaky blood vessels, can develop at all stages of retinopathy. Pregnancy, puberty, blood glucose control, hypertension, and cataract surgery can accelerate these changes.

Vision-threatening retinopathy is rare in type 1 diabetic patients in the first 3-5 years of diabetes or before puberty. During the next two decades, nearly all type 1 diabetic patients develop retinopathy. Up to 21% of patients with type 2 diabetes have retinopathy at the time of first diagnosis of diabetes, and most develop some degree of retinopathy over time.

Diabetic retinopathy is the leading cause of visual impairment in the Western world, particularly among persons of working age.[1,2] It is estimated that diabetic retinopathy develops in more than 75% of diabetic patients within 15 to 20 years of diagnosis of diabetes.[3,4]

Several epidemiologic studies have provided valuable information on the prevalence of diabetic retinopathy in Western countries that is useful for identifying subgroups at risk and for the planning of public health policies. The eye diseases prevalence research group collates data on eye diseases in the United States, and provides information on the health services burden due to eye diseases, including diabetic retinopathy.[5]

However there is paucity of data on the prevalence of diabetes-related eye diseases in developing countries such as Malaysia.

The limitations of these studies underscore the need for large population-based studies involving a representative sample of the population including both self-reported and newly diagnosed diabetic subjects, by using standard documentation techniques and an international grading system. This formed the basis of the present study.

METHODS

A population based case control study was done over a period of one year in Melaka Manipal medical college, Malaysia patients attending the peringitt clinic, out-patient department and referral cases from diabetic clinic in Malaysia with long duration of diabetes history (5-10 years). Permission from institutional review board and written informed consent was obtained from subjects as per Helsinki declaration.

500 subjects, participated in the study (response rate: 90.4%), and all had type 2 diabetes as defined by the absence of ketosis and adequate insulin reserve. Individuals aged less than 40 years and duration of diabetes less than 5 years, children under 10 years were excluded from the study because less risk of retinopathy.

Parameters like fasting blood sugar, glycosylated haemoglobin (HBA_{1c}), urine albumin, triglycerides, BMI, total cholesterol, abdominal girth were inclusion criteria.

Clinical and biochemical studies

Anthropometric measurements including weight, height, and waist measurements were obtained using standardized techniques.

The Body Mass Index (BMI) was calculated by formula: weight in kilograms divided by height in meters squared. Blood pressure was recorded in the sitting position in the right arm to the nearest 2 mmHg with a mercury sphygmomanometer.

Fasting capillary blood glucose was determined with a glucose meter (One Touch Basic; LifeScan, Johnson & Johnson, Milpitas, CA) in all subjects after ensuring 8 hours of overnight fasting for estimation of plasma glucose and serum lipids with an autoanalyzer (Hitachi 912; Roche Diagnostics GmbH, Mannheim, Germany) using kits supplied by the manufacturer. Glycated haemoglobin (HbA_{1c}) was measured by High Pressure Liquid Chromatography (HPLC), using the variant machine (Bio-Rad, Hercules, CA).

Urine samples were collected in the early morning after an overnight fast. Urine creatinine was measured using Jaffe's method. Urinary protein was measured on spot urine by the sulfosalicylic acid technique. Expected protein excretion was calculated by the protein-creatinine ratio method, and overt proteinuria was defined as >500 mg/d.[6]

Ocular examination

Visual acuity was recorded with an illuminated Snellen chart and visual acuity was documented separately for each eye.

Retinal studies

Retinal examination was performed with direct ophthalmoscopy after dilating the pupils with 1 drop of phenylephrine (5%) and tropicamide (1%) in both eyes,

and the drops were repeated (2 times at intervals of 5 minutes) until the best possible mydriasis was obtained.

The minimum criterion for diagnosis of diabetic retinopathy was the presence of at least one definite microaneurysm in any field photographed. Photographs were assessed and assigned a retinopathy level, and the final diagnosis for each patient was determined from the grading of the worse eye according to the ETDRS criteria for severity of disease in the individual eye.[7]

Diabetic Macular Edema (DME) was defined as retinal thickening at or within 1 disc diameter of the center of the macula or the presence of definite hard exudates.[8] Clinically Significant Macular Edema (CSME) was diagnosed according to ETDRS criteria, when one or more of the following were detected: retinal thickening within 500 µm of the fovea, as hard exudates at/or within the same 500 µm if associated with retinal thickening, and as a >1 optic disc area of retinal thickening if any part of the oedematous area is within 1 disc diameter from the fovea.[8]

DME was diagnosed with a macular grid. It may be present in the non-proliferative (NPDR) or the proliferative DR stage.

However, once PDR was detected, the final grading was taken as PDR in this study.

Table 1: Disease grading protocol in national guidelines on screening for diabetic retinopathy grading in England and Wales screening programmes.

Level	Equivalent disease severity level	Clinical features
Retinopathy		
R0	No retinopathy	
R1	Mild and moderate non-proliferative diabetic retinopathy	Microaneurysms, retinal retinal haemorrhages or exudates not within the definition of maculopathy
R2	Severe non-proliferative diabetic retinopathy	Venous beading / loop / reduplication; intraretinal microvascular abnormality Multiple deep, round or blot haemorrhages

RESULTS

Of 500 cases known diabetic patients, 58% had Non-Proliferative Diabetic Retinopathy (NPDR) with 20% <5 years, 26% >5-10 years and 12% >10 years duration.

Table 2: Prevalence rates of diabetic retinopathy in different population studies.

Population studied	No. of subjects	Age (years)	Prevalence of retinopathy (%)
Present study	500	40-49 = 25 patients 50-59 = 30 patients >60 = 50 patients	5% 6% 12%
The Los Angeles Latino eye study, Los Angeles, California.[9]	1217	≥40	46.9
Taiwan, Taipei, republic of China.[10]	11478	≥40	35.0
The Liverpool diabetic eye study, UK.[11]	395	13-92	33.6

Table 3: Prevalence of diabetic retinopathy in the study group.

	Number of positive cases	Percentage
Non-proliferative diabetic retinopathy	292	58%

Table 4: Risk factors associated in the study groups for development of diabetic retinopathy.

	Number of cases	Percentage
Gender		
Male	110	22%
Female	90	18%
Ethnic groups		
Malaysia	100	20%
China	80	16%
Indonesia	60	12%
Hypertension		
Yes	200	40%
No	300	60%
Hyperlipidemia		
Yes	150	30%
Smoking		
Yes	200	40%
BMI	150	30%
HBA_{1C}	200	40%
Duration of diabetes		
<5 years	100	20%
5-10 years	130	26%
>10 years	62	12%

DISCUSSION

Diabetic retinopathy is the leading cause of blindness among working adults.

The incidence of vision loss increases with increasing age, severity of retinopathy, duration of diabetes, presence of proteinuria and higher level of glycosylated haemoglobin.

All ethnic groups are susceptible to the established risk factors of diabetic retinopathy like hypertension, hyperlipidemia, smoking, body mass index and glycosylated haemoglobin such risk factors may include differential susceptibility to conventional risk factors, insulin resistance, difference in anthropometric measurements, truncal obesity, urbanization, variations in access to health care systems and genetic susceptibility.

Modification of the associated risk factors as well as early detection and treatment of sight-threatening diabetic retinopathy can prevent blindness.

Clinical practice guidelines recommend annual eye screening for patients with diabetes mellitus. The proportion of patients in Malaysia who adhere to this recommendation was initially unknown.

The prevalence of diabetic retinopathy with type-2 diabetic patients (Table 2 & 3) was 21% (105/500) from age 40 and above. In addition the risk factors in the study group (Table 4) associated with the development of Non-Proliferative Diabetic Retinopathy (NPDR) are male 22% (110)> female 18% (90), Malaysians 20% (100)> compared with Chinese 16% (80) and Indonesians 12% (60), hypertension 40% (200), hyperlipidemia 30% (150), smoking 40% (200), BMI 30% (150), HBA_{1C} 40% (200) and duration of diabetes <5 years 20% (100), 5 - 10 years 26% (130) and >10 years 12% (62).

The major risk factors for diabetic retinopathy in this study were duration of diabetes and degree of glycemic control, consistent with findings in previous studies.[9,10,11]

Logistic regression analysis revealed that for every 5-year increase in duration of diabetes, the risk for diabetic retinopathy was increased by 1.89-fold, whereas a 2% increase in HbA_{1C} resulted in a 1.7-fold increase in risk for diabetic retinopathy.

The strengths of this study are that it was based on retinal photography and standard grading techniques and the study included a large representative population.

CONCLUSION

The prevalence of diabetes mellitus observed among Malaysians, Chinese and Indonesians aged 40 and above is 48% percent; thus, there is a significant number of people with potential blinding diabetic retinopathy. Adherence to eye screening guidelines and the prompt referral of sight-threatening diabetic retinopathy are essential in order to reduce the incidence of blindness among patients with diabetes mellitus. This emphasizes the need for routine retinal screening of diabetic individuals to detect diabetic retinopathy in the early stages.

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