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Original Article

Risk factors associated with diabetic retinopathy among type 2 diabetes patients at teaching hospital in Malaysia

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ABSTRACT

Background: Diabetic retinopathy (DR) is the leading cause of blindness in the United States and it is the leading cause of new cases of blindness in adults aged 20–74. It is estimated that about 20% of patients with type 2 DM have evidence of diabetic retinopathy at diagnosis with diabetes.
Objective: To evaluate the prevalence of DR and to determine risk factors related to diabetic retinopathy among type 2 diabetes patients attending endocrinology clinics at Hospital Universiti Sains Malaysia (HUSM).
Subjects and methods: The study design was observational prospective longitudinal follow-up study, the study was conducted with sample of 1077 type 2 diabetes mellitus outpatient recruited via attended the diabetes clinics at HUSM. Diagnosis of retinopathy is based on finding the diagnostic signs of retinopathy on eye exams by fundoscopy. Logistic regression analysis was used to assess the independent variables that affect the development of retinopathy.
Results: The prevalence of retinopathy was 39.3%. It has been noticed from this study findings, that the progression of retinopathy is been influenced by five independent risk factors such as duration of diabetes, presence neuropathy, total cholesterol at second and third visit and createnine clearance.
Conclusion: DR is highly prevalent among type 2 DM. The progression of retinopathy is been influenced by five independent risk factors such as duration of diabetes, presence neuropathy, total cholesterol at second and third visit and createnine clearance. DR is a serious diabetic complication and public health strategies are required in order to reduce its risk factors and decrease its prevalence.

1. Introduction

Diabetic retinopathy (DR) is the leading cause of blindness in the United States [1–3]. It is the leading cause of new cases of blindness in adults aged 20–74. Retinopathy is responsible for 8% of all cases of legal blindness in the United States [4].

In fact it is estimated that about 20% of patients with type 2 DM have evidence of diabetic retinopathy at diagnosis with diabetes due to the long preclinical period often observed prior to diagnosis [6]. Diabetic retinopathy often has no early warning signs, therefore, it is recommended for patients with type 2 DM to have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist at diagnosis then annually in order to identify and treat patients early in the disease to help prevent its progression [5].

The identification of risk factors associated with the development of diabetic retinopathy is essential if preventive measures are to be developed. The prevalence of diabetic retinopathy depends on multiple factors. Several studies have identified risk factors for diabetic retinopathy and vision loss, including hyperglycemia, high blood pressure and hypercholesterolemia [8,7].

The occurrence of diabetic retinopathy increases with the duration of diabetes and is present in the majority of patients after 30 years. Voutilainen-Kaunisto et al. [9] suggested that when diabetes is diagnosed at an age below 30 years, after 10 years 50% of these patients would suffer from diabetic retinopathy and after 30 years this rate would increase to 95% compared to patients who presented with a shorter duration of diabetes. The duration of diabetes is known to be an independent, and perhaps one of the most important, risk factors for retinopathy [10,12,42,43]. Mitchell and Moffitt [13] reported an 8% increase in patients with diabetic retinopathy for each additional year of the diabetes duration.

Numerous significant risk factors for the development and progression of diabetic retinopathy have been documented, including unfavorable lipid profiles. Fong et al. [5] noted that

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patients with persistent visual loss had higher levels of cholesterol at baseline than those without persistent visual loss. United Kingdom Prospective Diabetes Study Group (1998) investigated 1148 hypertensive patients, 758 were allocated to tight control of blood pressure and 390 to less tight control with a median follow-up of 8.4 years. Tight blood pressure control resulted in a 37% reduction in microvascular diseases, predominantly reduced risk of retinal photocoagulation, compared with less tight control.

In Hoorn study by Van Leiden et al. [14] evaluated that the risk factors affecting the prevalence of retinopathy in type 2 diabetic, they found that the prevalence of retinopathy was positively related with BMI as well as hyperglycaemia, elevated blood pressure, serum cholesterol, and triglyceride in patients with normal glucose, impaired glucose metabolism, or newly diagnosed diabetes mellitus, and another study by Tapp et al. [10] concluded that HbA1c, duration of diabetes, and systolic blood pressure were risk factors of diabetic retinopathy.

The risk for diabetic retinopathy was five times more common in patients with diabetic neuropathy compared with those without neuropathy in a cross-sectional analysis of approximately 2500 European patients [15]. Study by Davis et al. [16] reported that presence of neuropathy increased the risk for development of proliferative diabetic retinopathy by 26% to 32% ($p < 0.0009$).

The objectives of this study were (1) to evaluate the prevalence of retinopathy and (2) to determine factors associated with the development of diabetic retinopathy in Malaysian type 2 diabetic patients who attended diabetes clinics in Hospital University Sains Malaysia.

2. Material and methods

The medical records were studied either directly from the diabetes clinic after the patients consulted the doctors or from the patient medical record center. The patients selected were type 2 diabetic outpatients, aged over 18 years, with active follow-up at the diabetic clinic. The exclusion criteria for this study included patients who were suffering from juvenile diabetes, gestational diabetes, thyroid problems, obstructive liver disease, advanced renal failure, and tuberculosis. A prospective study was conducted for a study period of one year (2008) in order to identify the characteristics of type 2 diabetic outpatients in a tertiary center, and to determine the prevalence of diabetic retinopathy associated with outpatient diabetic care at HUSM, which is located in the state of Kelantan, Malaysia. The study design is an observational, prospective cross-sectional study. Non-probability sampling method (convenience sample technique) was applied.

2.1. Ethical considerations

The study was approved by the Human Research and Ethics Committee of the School of Medicine in the Universiti Sains Malaysia. Informed consent was obtained from all patients included in the study.

2.2. Data collection

The outpatient diabetic clinic recording lists of patients who attended the diabetic clinic in HUSM were captured from the diabetic clinic registration book. Based on glycaemic control tests (HbA1c, FPG, PPG), the medical records were then retrieved from the record office using the patient's name. The medical records review was undertaken by a single researcher, and the required information including demographic, co-morbidity characteristics, detailed physical and biochemical information and therapy to be reviewed and recorded in a data collection form. Socio-demographic characteristics included age, sex and race, alcohol, smoking history, physical activity and level of education. Physical examination included: pulse rate, height, weight and waist circumference. Blood pressure was measured twice and average reading was taken. Hypertension was defined as systolic blood pressure of >130 mmHg or diastolic blood pressure of >80 mmHg or current use of antihypertensive drugs also has been diagnosed as hypertension [44].

Laboratory results included fasting plasma glucose (FPG), postprandial plasma glucose (PPG), HbA1c level, and lipid profile. Dyslipidaemia was defined as a fasting cholesterol of greater than 4.5 mmol/l, LDL-C greater than 2.6 mmol/l, Triglyceride greater than 1.7 mmol/l, HDL-C less than 1.0 mmol/l in males and less than 1.3 mmol/l in females [45].

Diabetic retinopathy (DR) was diagnosed with the presence of retinal hemorrhages, exudates and macular edema [46]. Neuropathy was diagnosed in the presence of persistent numbness, paresthesia, loss of hearing of the tuning fork and sense of vibration [46]. Diabetic nephropathy (DN) was considered by positive persistent proteinuria for at least three consecutive readings per year, and/or serum creatinine (SCr) >130 l mol/L and/or GFR <60 ml/min [46].

Coronary artery disease was diagnosed by documented angina symptoms and confirmed by ECG, or from the results of percutaneous transluminal coronary angiography (PTCA) in patient's records [47]. Cerebrovascular disease was defined by the presence of transient ischemic attack or stroke in the past medical history [47].

2.3. Statistical analysis

Statistical Package for the Social Sciences (SPSS) software version 15.0 (Chicago, IL, USA) was used for data analysis. The data obtained were analyzed using descriptive statistics to determine the prevalence of nephropathy among diabetic patients. Logistic regression analyses were performed to assess the independent effect on development retinopathy.

Univariate analysis determined the links between retinopathy complications (present/absent) and each independent variable. Independent variables contain model one of personal characteristics which include (gender, race, age, physical activity, level of education, smoking history, alcohol history and family history). Model two include health characteristics (diabetes duration, WC, BMI, diabetic medication) and model three clinical variables include (HbA1c, FPG, PPG, BMI, WC, LDL-C, HDL-C, total cholesterol, triglyceride, blood pressure, and creatinine clearance) at four visits. In simple logistic analysis, each independent variable was analyzed to look at any significant association with dependent variable (retinopathy) and preceded to multiple logistic regressions to confirm the association after excluding confounders. The results of simple logistic regression analysis were recorded as beta, p value, crude odds ratio and 95% confidence interval. Multivariate analysis was done on numerical and categorical analysis variable by using binary logistic regression to eliminate confounding effect as there are more than one independent variables. The first step was to do variable selection. Second step for further multivariate analysis, and selection step was to do manual backward or forward analysis of each variables was excluded of p value which was more than 0.05. The third step was to find a model when all variables have a p value of less than 0.05.

3. Results

3.1. Characteristic of patients

A total of 1077 type 2 diabetic patients were involved in this study, demographic characteristics of type 2 diabetic patients were demonstrated in Table 1.