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A Study Evaluating the Prevalence of Nephropathy among Type 2 Diabetes Patients Attending a Teaching Hospital in Malaysia

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Abstract

Background: Nephropathy is a major cause of illness and death of patients with type 2 diabetes mellitus (DM), Diabetic nephropathy has become the leading cause of end-stage renal disease; kidney failure that requires a lifetime of dialysis. It develops in about 20-40% of Type 2 Diabetes patients.

Objectives: The main objectives of this study were to evaluate the prevalence of diabetic nephropathy and to determine risk factors for, diabetic nephropathy among type 2 diabetes patients attending endocrinology clinics at Hospital Universiti Sains Malaysia, Teaching Hospital.

Subjects and methods: The study design was observational prospective longitudinal follow-up study, for a study period of one year (1st January 2008 till 31st December 2008), the study was conducted with sample of one thousand and seventy seven type 2 diabetes mellitus outpatient recruited via attended the diabetes clinics at Hospital Universiti Sains Malaysia (HUSM) in Kelantan. Logistic regression analysis was used to assess the independent variables that affect the development of nephropathy.

Results: Mean age of type 2 diabetes outpatients in the present study was 58.3 years and duration of diabetes was 11 years. The prevalence of nephropathy was 90.7%. Multiple logistic regression analysis revealed that being female (OR = 9.15; 95% CI = 4.43-18.89; $p < 0.001$), having a high creatinine clearance at first visit (OR = 1.18; 95% CI = 0.87-1.50; $p < 0.001$), and having a high triglyceride at fourth visit (OR = 2.6; 95% CI = 1.51-4.75; $p = 0.001$), were significantly associated with the development of diabetic nephropathy.

Conclusion: The prevalence of nephropathy is very high. The three main variables affecting the development of diabetic nephropathy were gender, triglyceride and creatinine clearance. Triglyceride and creatinine clearance were two modifiable risk factors for development of diabetic nephropathy. It is important for all diabetic patients to be screened for the triglyceride and creatinine clearance and get appropriate medications.

Keywords

Type 2 Diabetes mellitus, Prevalence, Nephropathy, Risk factors.

Introduction

Diabetic nephropathy (DN) is the leading cause of kidney failure and subsequent dialysis [1-3], and DN occurs in approximately one third of individuals with type 2 diabetes mellitus DM. Diabetic nephropathy is a clinical syndrome characterized by relentless albuminuria, a persistent decline in Glomerular filtration rate (GFR), raised arterial blood pressure and increased relative mortality for cardiovascular diseases.

High mortality in DN is due to an excess of cardiovascular mortality [4] and to end stage renal failure [5]. Presence of albuminurea in diabetes patients are 20 times more likely to die of cardiovascular disease than are non-albuminuric patients [6]. In Type 2 DM studies have repeatedly demonstrated that the susceptibility of a diabetic to future renal failure is best predicted by the presence or absence of renal disease in their diabetic relatives. The familial clustering of diabetic nephropathy is of far bigger predictive value than is the level of blood pressure or glycaemic control.

Clinical practice guideline (2004) [7] reported that known risk factors for the development of diabetic nephropathy include genetic predisposition, poor glycaemic control, hypertension and smoking.

The cumulative incidence of diabetic nephropathy for Type 2 DM with microalbuminuria can often occur more than 10 years after disease onset, whereas its prevalence is associated with the duration of diabetes and can reach 40-50% after 30 years of the disease. Prevalence of microalbuminuria in Type 2 DM is 10-42 % depending on the population and ethnicity. Higher prevalence is seen in Asians, Pima Indians, African American and the inhabitants of the Maori islands in the Pacific, compared to Europeans.

Genetic predisposition, ethnicity, diabetes duration, smoking and degree of glycaemic control are the principal factors for development of diabetic nephropathy.

Coexistence of diabetic retinopathy strengthens the possibility of a diabetic etiology of the nephropathy.

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

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 (1st January 2008 till 31st December 2008) in order to quantify the prevalence and factors associated with the development of diabetic nephropathy in Malaysian type 2 diabetic patients who attended diabetes clinics in Hospital University Sains Malaysia, 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. The research's protocol was approved by the Human Research and Ethics Committee of the School of Medicine in the Universiti Sains Malaysia. Signed informed consent was obtained from all patients.

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 [8].

Laboratory results included fasting plasma glucose (FPG), postprandial plasma glucose (PPG), HbA1c level, and lipid profile. Dyslipidaemia was defined as fasting cholesterol (TCH) 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 [9].

Diabetic Nephropathy: was considered by positive persistant proteinurea for at least three consecutive reading per year, and/or serum creatinine >130mol/l and or GFR< 60 ml/min [10].

Diagnosis of retinopathy was diagnosed with presence of retinal hemorrahage , exudates and macular edema [10].

Neuropathy was diagnosed in presence of presented numbness, paresthesia, loss of hearing of tuning fork and sense of vibrations [10].

Coronary artery disease was diagnosed by documented angina symptoms and confirmed by performed an Electrocardiograph (ECG), or from results of percutaneous transcoronary angiography (PTCA) in patients record [11].

Cerebrovascular disease was defined by presence of transient ischemic attack or stroke in past medical history [11].

Statistical analysis

Statistical Package for the Social Sciences (SPSS) software version 12.0 (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 nephropathy.

Univariate analysis determined the links between nephropathy 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, waist circumference (WC), body mass index (BMI), diabetic medication) and model three clinical variables include (HbA1c, FPG, PPG, BMI, WC, low density lipoproteins (LDL), high density lipoproteins (HDL), total cholesterol, triglyceride, blood pressure, and creatinine clearance (CrCl)) at four visits. In simple logistic analysis, each independent variable was analysed to look at any significant association with dependent variable (nephropathy) 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 is more than one independent variable. 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.

Results

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.

Table 1: Demographic characteristics of type 2 diabetic patients.

Variable	n (%)
Gender	
Male	476 (44.2)
Female	601 (55.8)
Age (years)	
≤ 35 yaers	15 (1.4)
35-50 years	194 (18)
50-65years	626 (58.1)
>65 years	242 (22.5)
Race	
Malay	916 (85.1)
Chinese	150 (13.9)
Indians	11 (1.0)
Smoking History	
Current smoker	66 (6.1)
Previous smoker	81 (7.5)
Never smoked	930 (86.4)
Alcohol History	
Current drinker	10 (0.9)
Previous drinker	6 (0.6)
Never drink	1061 (98.5)
Physical activity	
Active ≥ 150 min/wk	471 (43.7)
Non active < 150 min/wk	606 (56.3)
Level of education	
Lower level of education	580 (53.9)
Higher level of education	497 (46.1)
Family history of diabetes	
Yes	141 (13.1)
No	936 (86.9)

Table 2: Univariate analysis of personnel characteristics factors affecting of the development of DN

Clinical characteristics	b[a]	Crude OR (95% CI)	P value
Gender			
Male	0	1	-
Female	1.12	3.07 (1.88,5.02)	< 0.001
Race			
Malay	0	1	-
Non-Malay	0.38	1.46 (0.76,2.81)	0.248
Age	0.13	1.14 (1.11,1.18)	< 0.001
Physical activity			
Active ≥ 150 min/wk	0	1	-
Non active < 150 min/wk	0.45	1.57 (1.04,2.38)	0.031
Level of education			
≥ Secondary school	0	1	-
< Secondary school	0.90	2.45 (1.59,3.78)	< 0.001
Smoking			
Non smoker	0	1	-
Smoker	0.79	2.22 (1.01,4.89)	0.047
Alcohol drinking			
Non alcohol drinker	0	1	-
Alcohol drinker	-0.03	0.71 (0.16,3.18)	0.657
Family history of diabetes			
No	0	1	-
Yes	-0.42	0.65 (0.38,1.13)	0.129

OR: Odds Ratio; CI: Confidence Interval

[a] Simple logistic regression (outcome as nephropathy complication)

References category gender: male, references category race: Malay, references category physical activity: no, references category level of education: more than secondary school, references category smoking history: no, references alcohol drinking: no, references category family history: has family history of diabetic

Factors affecting the development of diabetic nephropathy complications (DN)

In order to evaluate the factors influencing the development of nephropathy complications among the patients in the current study, several analyses were used; these are shown in the following:

Univariate analysis of factors affecting the development of DN

In simple logistic regression analysis, each independent variable was analysed to look at any significant (p value < 0.05) associated with the dependent variable (nephropathy complications).

Univariate analysis of personal characteristics affecting the development of DN: This analysis produced crude odd ratio. Independent variables, which were significant when analysed with simple logistic regression, included gender, age, physical activity, education level and smoking history, were associated with the nephropathy. They were gender (OR = 3.07; P value < 0.001), age (OR = 1.14; P value < 0.001), physical activity (OR =1.57; P value = 0.031), education level (OR = 2.45; P value <0.001) and smoking (OR= 2.22; P value = 0.047) (Table 2).

Univariate analysis of health characteristics affecting the development of DN: The factors that enhance the development of nephropathy were BMI (OR = 0.80 at p value < 0.001), WC (OR = 0.92 at p value < 0.001), duration of diabetes (OR = 1.09 at p value < 0.001), macrovascular complications (OR = 5.56 at p value = 0.001), OR of antidiabetic medications were different and depend on the type of medications at p value 0.003, retinopathy (OR = 1.74 at p value 0.016) and neuropathy (OR = 2.24 at p value < 0.001) (Table 3).

Univariate analysis of clinical variables affecting the development of DN: Univariate analysis revealed that the clinical variables that were statistically significant were HbA1c at third and fourth visit, FPG at second and fourth visit, triglyceride at first, third visit, and fourth visit, systolic blood pressure at first visit, creatinine clearance at first three visits (Table 4).

Table 3: Univariate analysis of health characteristics factors affecting the development of diabetic nephropathy complication.

Health characteristics	b[a]	Crude OR (95% CI[b])	P value
BMI	-0.21	0.80 (0.77,0.84)	< 0.001
WC	-0.07	0.92 (0.90,0.94)	< 0.001
Duration of diabetes	0.09	1.09 (1.05,1.14)	< 0.001
Macrovascular complications			
No	0	1	-
Yes	1.71	5.56 (2.02,15.31)	0.001
Antidiabetic medications			0.003
Metformin	0	1	-
Gliclazide	1.00	2.72 (0.91,8.09)	0.071
Mixtard insulin	1.75	5.75 (1.24,26.62)	0.025
Metformin + Gliclazide	0.29	1.34 (0.66,2.71)	0.411
Metformin + Mixtard insulin	0.49	1.63 (0.67,3.99)	0.278
Gliclazide + Acarbose	2.15	8.57 (1.08,68.12)	0.042
Metformin + Gliclazide + Rosiglitazone	0.44	0.63 (0.28,1.45)	0.284
Metformin + Gliclazide + Acarbose	0.34	1.40 (0.59,3.30)	0.435
Metformin + Gliclazide + NPH insulin	1.15	3.17 (1.19,8.40)	0.020
Retinopathy			
No	0	1	-
Yes	0.55	1.74 (1.10,2.75)	0.016
Neuropathy			
No	0	1	-
Yes	0.81	2.24 (1.47,3.44)	< 0.001

OR: Odds Ratio; CI: Confidence Interval

[a]Simple logistic regression (outcome as nephropathy complication)

References category: macrovascular complication: no, references category: antidiabetic medication: metformin, references category retinopathy: no, references category neuropathy: no

Multiple logistic regression analysis of related variables on DN

Each model of similar variable categorically related (personal characteristics; health characteristics; clinical variables) was introduced together in one model of multivariate, using backward stepwise logistic regression and p value < 0.05 were accepted.

Multiple logistic regression analysis of personal characteristics affecting development of DN (model one): By performing multivariate analysis of personal characteristics factors showed that gender reached significant level at p value < 0.001 and odds ratio was 3.70 and odds ratio for age was 1.15 at P value < 0.001 (Table 5).

Multiple logistic regression analysis of health characteristics affecting the development of DN (model two): The results of multivariate analysis for model 2 (health characteristics) showed that possible factors influencing development of diabetic nephropathy. Five variables from health characteristics remained in the model. Odds ratio of BMI was 0.63 at p value < 0.001, OR of WC was 0.89 at p value 0.001, OR of duration of diabetes was 1.05 at p value 0.021, OR of neuropathy was 1.93 at p value 0.007 and OR of macrovascular complications 5.14 at p value 0.003 (Table 6).

Multiple logistic regression analysis of clinical variables affecting the development of DN (model three): The results of multivariate analysis for model three (clinical variables) showed that possible factors influencing nephropathy complication in present study after controlling the confounding factors were creatinine clearance at all visits and triglyceride level at fourth visit. Odds ratio for creatinine clearance at first visit was 0.89 at p value < 0.001, OR for creatinine clearance at second visit was 1.05 at p value 0.022, OR for creatinine clearance at third visit was 1.24 at p value < 0.001, OR for creatinine clearance at fourth visit was 1.04 at p value < 0.001and OR for TG at fourth visit was 2.76 at p value < 0.001 (Table 7).

Table 4: Univariate analysis of clinical variables factors affecting development of DN.

Clinical variables	b[a]	Crude OR (95 % CI)	P value
HbA1c (1st visit)	-0.07	0.92 (0.85,1.00)	0.069
HbA1c (2nd visit)	-0.07	0.92 (0.85,1.00)	0.066
HbA1c (3rd visit)	-0.08	0.92 (0.85,0.99)	0.046
HbA1c (4th visit)	-0.09	0.90 (0.83,0.98)	0.024
FPG (1st visit)	-0.00	0.99 (0.94,1.04)	0.792
FPG (2nd visit)	-0.05	0.94 (0.89,0.99)	0.031
FPG (3rd visit)	-0.01	0.99 (0.93,1.04)	0.702
FPG (4th visit)	-0.05	0.94 (0.90,0.98)	0.008
PPG (1st visit)	0.03	1.03 (0.98,1.08)	0.226
PPG (2nd visit)	0.00	0.99 (0.95,1.04)	0.851
PPG (3rd visit)	0.01	1.01 (0.96,1.06)	0.674
PPG (4th visit)	0.02	1.02 (0.97,1.08)	0.367
TG (1st visit)	0.28	1.32 (1.01,1.74)	0.039
TG (2nd visit)	0.22	1.25 (0.95,1.64)	0.107
TG (3rd visit)	0.39	1.47 (1.10,1.96)	0.008
TG (4th visit)	0.66	1.94 (1.38,2.72)	< 0.001
TCH (1st visit)	0.11	1.11 (0.92,1.34)	0.239
TCH (2nd visit)	-0.03	0.96 (0.82,1.14)	0.695
TCH (3rd visit)	0.15	1.16 (0.97,1.40)	0.100
TCH (4th visit)	0.14	1.15 (0.97,1.37)	0.106
HDL (1st visit)	-0.02	0.97 (0.67,1.41)	0.892
HDL (2nd visit)	-0.29	0.74 (0.54,1.02)	0.072
HDL (3rd visit)	0.11	1.01 (0.92,1.10)	0.811
HDL (4th visit)	0.01	0.98 (0.97,1.00)	0.141
LDL (1st visit)	0.08	1.09 (0.89,1.32)	0.390
LDL (2nd visit)	-0.01	0.98 (0.83,1.17)	0.886
LDL (3rd visit)	0.00	0.97 (0.95,1.04)	0.906
LDL (4th visit)	0.01	1.01 (0.99,1.03)	0.147
SBP (1st visit)	0.02	1.02(1.00,1.03)	0.00l
SBP (2nd visit)	0.00	1.00 (0.99,1.02)	0.108
SBP (3rd visit)	0.00	1.01 (0.99,1.02)	0.181
SBP (4th visit)	0.01	1.00 (0.99,1.02)	0.140
DBP (1st visit)	0.00	1.00 (0.98,1.02)	0.588
DBP (2nd visit)	0.00	0.99 (0.97,1.01)	0.388
D BP (3rd visit)	0.00	0.99 (0.97,1.01)	0.679
DBP (4th visit)	0.00	1.00 (0.98,1.01)	0.936
Crcl (1st visit)	-0.10	0.90 (0.88,0.91)	<0.001
Crcl (2nd visit)	-0.08	0.91 (0.90,0.93)	<0.001
Crcl (3rd visit)	-0.10	0.90 (0.88,0.91)	<0.001
Crcl (4th visit)	0.00	0.99 (0.99,1.00)	0.472

OR: Odds Ratio; CI: Confidence Interval; (HbA1c): Hemoglobin A1c; (FPG): Fasting Plasma Glucose; (PPG): Postprandial Plasma Glucose; (LDL): Low Density Lipoproteins; (HDL): High Density Lipoproteins; (TCH): Total Cholesterol; (TG): Triglyceride; (SBP): Systolic Blood Pressure; (DBP): Diastolic Blood Pressure and (CrCl): Creatinine Clearance.

[a] Simple logistic regression (outcome as nephropathy complications).

Table 5: Multiple logistic regression analysis of personal characteristics factors affecting the development of DN

Independent variables	b	Adjusted OR (95 % CI)	P value
Gender			
Male	0	1	-
female	1.31	3.70 (0.15, 0.46)	< 0.001
Age	0.145	1.15 (1.12, 1.19)	< 0.001

OR: Odds Ratio; CI: Confidence Interval

Final model of multivariate analysis of factors affecting the development of DN

Using forward stepwise logistic regression, all factors found to be significant at p value < 0.05 during the previous analysis were introduced together in one multivariate analysis. P value < 0.05 were accepted. Three variables remained in the final model. Those were gender, triglyceride at fourth visit and creatinine clearance at first visit as seen in table 8.

Discussion

Nephropathy is a major cause of illness and death in patients with type 2 DM, with the majority of cases occurring in proteinuric patients due to the complications of end-stage renal disease (ESRD), and particularly due to cardiovascular events [12]. Nephropathy accounts for 45% of the causes of chronic kidney disease [13]. In another study by [14], it was reported that nephropathy is a major cause of chronic disease, and that it contributed to 57% of new patients requiring dialysis in 2007 in Malaysia.

Table 6: Multiple logistic regression analysis of health characteristics factors affecting the development of diabetic nephropathy complications.

Health characteristics	b	Adjusted OR (95% CI)	P value
BMI	-0.44	0.63 (0.55,0.73)	< 0.001
WC	-0.11	0.89 (1.05,1.19)	0.001
Duration of diabetes	0.05	1.05 (1.00,1.10)	0.021
Neuropathy complication			
No	0	1	-
Yes	0.64	1.93 (1.19,3.13)	0.007
Macrovascular complication			
No	0	1	-
Yes	1.62	5.14 (1.76,15.00)	0.003

OR: Odds Ratio; CI: Confidence Interval

[a] Multiple logistic regression

Table 7: Multiple logistic regression analysis of clinical variables factors affecting the development of DN.

Clinical variable	b[a]	Adjusted OR (95 % CI)	P value
TG (at fourth visit)	1.01	2.76 (1.59-4.82)	< 0.001
CrCl (at first visit)	-0.11	0.89 (0.85,0.92)	< 0.001
CrCl (at second visit)	0.051	1.05 (1.00-1.10)	0.022
CrC1 (at third visit)	-0.09	1.24 (0.87, 1.60)	< 0.001
CrC1 (at fourth visit)	0.04	1.04 (1.01,1.08)	0.001

OR: Odds Ratio; CI: Confidence Interval

Table 8: Factors significantly associated with development of DN.

Independent variables	b[a]	Adjusted OR (95 % CI)	P value
Gender			
Male	0	1	-
Female	2.21	9.15 (4.43,18.89)	< 0.001
Creatinine clearance at first visit	0.11	1.12 (0.87,1.50)	< 0.001
TG at fourth visit	0.98	2.6 (1.51,4.75)	0.001

OR: Odds Ratio; CI: Confidence Interval; References category gender: male.

The results of this study showed that the overall prevalence of nephropathy was 90.7%. This is considered a high percentage in comparison to other studies on diabetic nephropathy; for example, [15] found diabetic nephropathy in 40% of diabetic patients, and the American Diabetes Association [16] reported that diabetic nephropathy occurs in 20-40% of patients with diabetes and is the single leading cause of end-stage renal disease (ESRD).

In the current study, three factors affected the development of diabetic nephropathy. They were gender (OR = 9.15), creatinine clearance rate at the first visit (OR = 1.12) and triglycerides at the fourth visit (OR = 2.6).

As in a Swedish study by [17], the only significant gender difference was found concerning albuminuria. The present study showed that females were more than nine times likely to have diabetic nephropathy compared to males. This is in contrast with [18], who showed that proteinuria was associated more with males than females. The creatinine clearance rate was found to be significantly different between patients with and without nephropathy, and the nephropathy group was associated with proteinuria. The United Kingdom Prospective Diabetes [19] study found that once microalbuminuria is present, the creatinine clearance rate declines at the rate that widely varies from patient to patient; the average reduction was 10-12 ml/min, and in study by [20], they found that creatinine clearance rate was significantly associated with diabetic nephropathy.

In the present study, it was found that the triglyceride level was also a factor that affected the development of diabetic nephropathy, similar to a study by [21].

The data of this study showed no significant association between the presence of nephropathy and some of the known risk factors, such as hypertension, degree of glycaemic control, age and duration of diabetes.

The Canadian Diabetes Association (2005) [22] and the American Diabetes Association (2008) [1] for the management of Type 2 DM recommend tight blood pressure control with systolic blood pressures less than 125 mmHg and diastolic blood pressures less than 75 mmHg in individuals with microalbuminuria, tight glycaemic control, and protein intake not exceeding 0.8 g/kg/day, along with lifestyle modifications; including exercise, weight loss, cessation of smoking, and reduction of salt intake. The majority of patients with diabetic nephropathy require two or more antihypertensive agents to effectively reduce blood pressure levels to recommended goal [23]. Thus, combination agents individually shown to reduce blood pressure and albuminuria as well as preserve renal function and morphology should be the preferred agents. Overwhelming evidence [24-29] supports the effectiveness of ACE inhibitors and angiotensin receptor blockers in slowing the progression of microalbuminuria and preventing the development of overt nephropathy.

Early and regular screening and intervention programmes should be implemented at diagnosis and risk factors should be treated aggressively.

Limitations

The analysis was based on type 2 DM patients; thus data from other centers are required to determine whether the findings of this study can be generalized to the other. Furthermore, the majority of patients were Malays; therefore, other ethnic groups were not equally covered. The population of this study was diabetic outpatients.

Conclusion

Three factors affecting nephropathy complication are gender, triglyceride and creatinine clearance. In this study, it is found that triglyceride and creatinine clearance were the two modifiable risk factor for diabetic nephropathy. The proper Creatinine clearance reduces the incidence of nephropathy, and slows its progression. More attention must be paid to female diabetic patients with high creatinine clearance with regard to regular kidney examinations and more practical education. Early detection of nephropathy, acceptance of multi factorial interventions targeting its main risk factors and the use of renal-protective agents such as ACE inhibitors and ARB might reduce the progression of renal disease. In conclusion the prevalence of nephropathy in Type 2 DM in HUSM is more than 91%. The risk factors are similar to those reported in other Asian countries. Because nephropathy complication affects survival subjects with Type 2 DM, more time, effort to be spent on them. Screening and intervention programs should be implemented early at the diagnosis, and risk factors should be treated aggressively.

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Conflicts of interest

We would like to declare that there were no conflicts of interest in conducting this research.

References

1. American Diabetic A (2008) Guidelines American Diabetic Assassociation. Diabetes Care. 31: S12- S554.
2. Fowler MJ (2008) Microvascular and macrovascular complications of diabetes. Clinical Diabetes: 26: 77-82.
3. World Health Organization (WHO) (2008) Retrieved September 9, 2008. from.
4. Zimmermann J, Schramm L, Mulzer E, Heidbreder E, Henrich HA, et al. (1997) [Cardiovascular risk factors in diabetic nephropathy]. Med Klin (Munich) 92: 74-78.
5. Knowles HC Jr (1971) Long-term juvenile diabetes treated with unmeasured diet. Trans Assoc Am Physicians 84: 95-101.
6. Borch-Johnsen K, Andersen PK, Deckert T (1985) The effect of proteinuria on relative mortality in type I (insulin dependent) diabetes mellitus. Diabetologia, 28: 590-596.
7. American Diabetes A (2004) Standards of medical care in diabetes. Diabetes Care 27: S15-S35.
8. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, et al. (2003) The seventh report of the joint national committee on prevention, detection, evaluation and treatment of high blood pressure. Hypertension 42:1206-52.
9. Asian-Pacific Type 2 Diabetes Policy Group (2005) Type 2 DM practical targets and treatments. (4th edn), International Diabetes Institute, Melbourne, Australia.
10. Alwakeel JS, Al-Suwaida A, Isnani AC, Al-Harbi A, Alam A (2009) Concomitant macro and microvascular complications in diabetic nephropathy. Saudi J Kidney Dis Transpl 20: 402-409.
11. A-Maskari F, E-Sadig M (2007) Prevalence of diabetic retinopathy in the United Arab Emirates: a cross-sectional survey. BMC Ophthalmol 7: 11.
12. Striker GE, Agodoa LL, Held P, Doi T, Conti F, et al. (1991) Kidney disease of diabetes mellitus (diabetic nephropathy): perspectives in the United States. J Diabet Complications 5: 51-52.
13. Al Wakeel JS, Mitwalli AH, Abu-Aisha H, Tarif N, Memon N, et al. (2002) Single Center Experience with Pre-dialysis Patients. Saudi J Kidney Dis Transpl 13: 363-370.
14. Lim T, Lim Y (2007) 15th Report of the National Dialysis and Transplant Registry. The National Renal Registry, Kuala Lumpur, Malaysia.
15. Parving, H. (1998) Benefits of and cost of antihypertensive treatment in incipient and overt diabetic nephropathy. J Hypertens Suppl 16: 99-101.
16. American Diabetes Association (2007) Standards of medical care in diabetes--2007. Diabetes Care 30 Suppl 1: S4-4S41.
17. Lundman B, Engström L (1998) Diabetes and it's complications in a Swedish county. Diabetes Res Clin Pract 39: 157-164.
18. Klein R, Klein BE, Moss S, DeMets DL (1988) Proteinuria in diabetes. Arch Intern Med 148: 181-186.
19. (1998) Economic consequences of diabetes mellitus in the U.S. in 1997. American Diabetes Association. Diabetes Care 21: 296-309.
20. Crook ED, Wofford P, Oliver B (2003) Diabetic nephropathy in african Americans: Advanced diabetic nephropathy disproportionately affects african-american females: cross-sectional analysis and determinants of renal survival in an academic renal clinic. Ethn Dis 13: 28-33.
21. Idogun ES, Unuigbe EI, Ogunro PS , Akinola OT, Famodu AA (2007) Assessment of serum lipids in Nigerians with type 2 diabetes mellitus complications. Pak J Med Sci, 23, 5, 708-712.
22. Canadian Diabetic A (2005) General information and national estimates on diabetes in the United States. Department of Health and Human and Human Services. National Diabetes Fact Sheet Atlanta, GA, U.S.
23. Bakris GL, Williams M, Dworkin L, Elliott WJ, Epstein M, et al. (2000) Preserving renal function in adults with hypertension and diabetes: A consensus approach. National Kidney Foundation Hypertension and Diabetes executive Committees working group. Am J Kidney Diseases 36: 646-661.
24. Parving HH, Lehnert H, Bröchner-Mortensen J, Gomis R, Andersen S, et al. (2001) The effect of irbesartan on the development of diabetic nephropathy in patients with type 2 diabetes. N Engl J Med 345: 870-878.
25. Viberti G, Wheeldon NM (2002) MicroAlbuminuria Reduction with VALsartan (MARVAL) Study Investigators. Microalbuminuria reduction with valsartan in patients with Type 2 DM: a blood pressure-independent effect. Circulation 106: 672-678.
26. Jerums G, Allen TJ, Campbell DJ, Cooper ME, Gilbert RE, et al. (2004) Long-term renoprotection by perindopril or nifedipine in non-hypertensive patients with Type 2 diabetes and microalbuminuria. Diabet Med 21: 1192-1199.
27. Ruggenenti P, Fassi A, Ilieva AP, Bruno S, Iliev IP, et al. (2004) Preventing microalbuminuria in type 2 diabetes. N Engl J Med 351: 1941-1951.
28. Lewis EJ, Hunsicker LG, Clarke WR, Berl T, Pohl MA, et al. (2001) Renoprotective effect of the angiotensin-receptor antagonist irbesartan in patients with nephropathy due to type 2 diabetes. N Engl J Med 345: 851-860.
29. Matos JP, de Lourdes Rodrigues M, Ismerim VL, Boasquevisque EM, Genelhu V, et al. (2005) Effects of dual blockade of the renin angiotensin system in hypertensive type 2 diabetic patients with nephropathy. Clin Nephrol 64: 180-189.