ORIGINAL ARTICLE

Prevalence of Microvascular Complications in Newly Diagnosed Type 2 Diabetes Mellitus in Primary Healthcare Clinics

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ABSTRACT

Introduction: Delayed diagnosis of type 2 diabetes mellitus (T2D) increases the risk of presenting late with microvascular complications due to untreated long-standing hyperglycaemia. This study aimed to determine the prevalence of microvascular complications in newly diagnosed T2D patients in primary healthcare clinics. **Methods:** This was a cross-sectional study carried out in three government primary healthcare clinics in the state of Selangor, Malaysia. Malaysian aged 18 years and above with newly diagnosed T2D (≤ 6 months of diagnosis) were invited to participate in the study. Data collected included the sociodemographic characteristic and the clinical profile (weight, height, waist circumference, blood pressure, lipid, glycaemic, urine albumin, microalbuminuria and renal profile). The assessment of nephropathy, peripheral neuropathy and retinopathy were performed using standard protocol. Multivariate logistic regression analysis was used to identify the significant factors that contribute to the presence of microvascular complications. **Results:** A total of 162 newly diagnosed patients were recruited. The majority was women (64%). The mean age was 51 (SD 11) years. About one-third of the patients (27.7%) had developed at least one microvascular complication. Nephropathy was the commonest microvascular complication (19.2%), followed by peripheral neuropathy (8.6%) and retinopathy (6.5%). Poor glycaemic control was found to be a significant factor contributing to the presence of microvascular complications (OR 5.8, 95%CI:1.466, 23.288). **Conclusion:** There is a high prevalence of microvascular complications among the newly diagnosed T2D. There is a need to develop appropriate strategies to increase the awareness and early detection of T2D.

Keywords: Type 2 diabetes mellitus, Retinopathy, Neuropathy, Nephropathy, Malaysia

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INTRODUCTION

Diabetes mellitus is a major non-communicable disease and its prevalence has been increasing rapidly in low- and middle-income countries including Malaysia, a middle-income country (1, 2). The Malaysia National Health and Morbidity Survey (NHMS) had showed the increase of prevalence of type 2 diabetes (T2D) among adults aged 18 years and above, from 15.2% in 2011 to 17.5% in 2015 (3, 4).

Diabetes mellitus is known to cause significant morbidity and mortality. In 2012, it causes 1.5 million death in the world (2). It can lead to microvascular (nephropathy, retinopathy, and neuropathy) and macrovascular complications (ischemic heart disease, stroke and peripheral vascular disease) (2).

International Federation of Diabetes has reported that 1 in 2 adults with diabetes is undiagnosed (1). In Malaysia, 90% of the diabetes is T2D and it was also found that more than half of these patients were undiagnosed (9.2% out of 17.5%), hence are at high risk of presenting late with complications due to untreated long-standing hyperglycaemia (4).

Microvascular complications such as retinopathy, nephropathy and peripheral neuropathy are common in patients with T2D (1, 2). The undiagnosed T2D is not a benign condition and significant of complications could have present at diagnosis or years before diagnosis (5). Literature has showed that there was high prevalence of microvascular complications among newly diagnosed T2D (6–8), for example nephropathy was present in 50% of the newly diagnosed patients in one of the study

in India (6) and 24% in Pakistan (9).

To our knowledge, there is paucity of data locally on the prevalence of microvascular complications among patients with newly diagnosed T2D in Malaysia. There was only one study examine reported the prevalence of microvascular complication from the tertiary teaching hospital-based clinic in Kelantan (8). Our study aimed at assessing the prevalence of microvascular complications in newly diagnosed T2D at primary healthcare setting. A high prevalence of such complications, if documented will help to emphasise the need and importance of early screening for these complications at diagnosis in all newly diagnosed T2D and vigorous screening campaign to increase the awareness of public to undergo health check for early diagnosis of T2D. The primary objective of this study was to determine the prevalence of microvascular complications and the secondary objective was to identify factors that contributed to the presence of microvascular complications.

MATERIALS AND METHODS

Study Design and Setting

A cross-sectional study was conducted for a study period of 6 months (1st July 2017 to 31st December 2017) in three government primary healthcare clinics located in the state of Selangor, Malaysia. The government primary healthcare clinics were selected as majority of the patients with chronic diseases were treated in the government primary healthcare clinics due to affordable cost that was highly subsidized by the government (10). The diabetic care of all these three government primary healthcare clinics were managed by a diabetic team that consisted of family medicine specialists, medical officers and diabetic educators. These clinics were equipped with the facilities of fundus camera and laboratory services. Both oral anti-diabetic agents and insulin were available in these clinics. The attendances of patients with diabetes varied among three clinics, ranged from 30 to 100 patients a day.

Study population

Malaysian nationality of age 18 years and above with newly diagnosed T2D (≤ 6 months of diagnosis) were included in the study. Diagnosis was made based on the Malaysian Clinical Practice Guidelines of Management of Type 2 Diabetes Mellitus (11). Those with known history of congestive heart failure, renal disease or renal impairment, chronic liver disease, history of stroke affecting the legs, hypothyroidism and alcoholism were excluded from the study. Pregnant women and acutely ill patients who need emergency treatment were also excluded from the study.

Sample size estimation

Sample size was calculated using Kish L. survey sampling (12), based on the prevalence of 8.3% and confidence interval of 95% from the previous study on risk factor of peripheral neuropathy among newly diagnosed T2D patients in primary care clinic at tertiary teaching hospital (8). We also added the non-response rate of 30% to the calculated sample size which contributed to the total number of 152 patients.

Data collection

All newly diagnosed T2D patients who fulfilled the inclusion criteria were invited to participate in the study. Participants were approached at the registration counter that dedicated for giving out a diabetic checked book for all newly diagnosed patients. The diabetic checked book is a structured clinical record that includes the essential clinical monitoring checklist for diabetes management. This counter was identified to be the place of recruitment as all newly diagnosed T2D patients would refer to this counter for getting the diabetic checked book. Participants were explained about the study using participant information sheet. Written consent was obtained from those who agreed to participate in the study.

Information about sociodemographic (age, race and occupation), lifestyle characteristics (smoking) and co-morbidities (hypertension, dyslipidaemia) was obtained through face to face interview at the time of recruitment.

The clinical parameters assessment (weight, height, waist circumference, blood pressure, eye and foot examinations) and laboratory investigations (glycated haemoglobin (HbA1c), fasting serum lipid including low-density lipoprotein cholesterol (LDL), high-density lipoprotein cholesterol (HDL), triglyceride (TG), urine albumin, microalbuminuria and renal profile) were performed at the subsequent follow up ranged from 2 weeks to 3 months duration based on the appointment given by the treating physician.

Waist circumference was measured using measuring tape at the midpoint between the inferior margin of the last rib and top of the iliac crest in a horizontal plane. Clinical systolic blood pressure (SBP) and diastolic blood pressure (DBP) was measured in the sitting position using digital blood pressure monitor. All data was recorded using data collection sheet.

Assessment for Microvascular Complications

All participants were undergone a medical examination for assessment of peripheral neuropathy and fundus camera examination for retinopathy. These assessments were performed by trained and credentialed medical assistants or nurses in the diabetic care team. Laboratory tests (urine albuminuria or urine microalbuminuria and renal function) were carried out for assessment of nephropathy. The results were interpreted by the medical officers.

Retinopathy was assessed by using non-mydriatic fundus camera. It was examined for changes of diabetic

retinopathy and classified as non-proliferative diabetic retinopathy, proliferative diabetic retinopathy and maculopathy. Patients with cataract was excluded from the analysis of retinopathy and referred for to hospital for further assessment.

Peripheral neuropathy was assessed by using 10-g monofilament and examinations of Achilles tendon reflex, pin prick, vibration sense by tuning fork (128Hz) and proprioception (11). Presence of peripheral neuropathy was defined as abnormal monofilament test (no feeling in less than 8 out of 10 sites) and abnormal results of one of the above examinations.

Nephropathy was assessed by urine albumin, microalbuminuria and calculated GFR (e-GFR). It was defined as calculated GFR (e-GFR) less than 60 mL/min per 1.73m2 or persistent presence of albuminuria or microalbuminuria ≥30mg/mmol for 2 occasion 3 months apart (11, 13). If the urine test was negative for albumin, urine microalbumin (UMA) for microalbuminuria was performed. If albuminuria or microalbuminuria was detected, a repeat test was performed at 3 months (13). The e-GFR was calculated using CKD-EPI formula (13).

Analysis

The dependent variables were the presence of microvascular complications i.e. retinopathy, peripheral neuropathy or nephropathy. The independent variables were age, gender, race, smoking status, presence of co-morbidities such as hypertension and dyslipidaemia, BMI status, blood pressure status, control of HbA1c, TG, LDL and HDL status.

The BMI was categorized as underweight (<18.5), normal (18.5-22.9), overweight (23.0-27.4) and obese (≥ 27.5) (11). The participants were considered to be hypertensive if they were taking antihypertensive medication (as documented in clinic records) or SBP ≥ 135mmHg or DBP ≥ 75mmHg (11). Good glycaemic control was defined as HbA1c <6.5% (11). Diagnosis of dyslipidemia was made on the basis of fasting lipid profile, serum low density lipoprotein ≥ 2.6 mmol/L or serum triglycerides ≥1.7 mmol/L (11).

Data was entered and analysed using Statistical Program for Social Sciences (SPSS) 21 software. The categorical data was presented as frequency and percentage. The association between the dependent and independent variables was examined by Chi Square Test. Multivariate logistic regression was carried out using enter method to identify the significant factors that contributing to the microvascular complications. The confounding factors that were examined in the regression models were the age group, gender, race, comorbidities of hypertension, dyslipidaemia, smoking status, status of BMI, waist circumference and the control of blood pressure, glycaemic (HbA1c) and lipid profile (TG, HDL and LDL). The outcome was the presence of any microvascular complications. The level of significance was set at $p< 0.05$. Multivariate logistic regression model was presented as odds ratio (OR) with 95% confidence interval.

Ethics

Ethical approval for this study was obtained from the Medical Research & Ethics Committee, Ministry of Health Malaysia (NMRR-17-435-34672).

RESULTS

A total of 162 newly diagnosed T2D patients participated in the study. Majority was women (64%). The age ranged between 24 to 76 years with mean age of 51 (SD 11) years. About half of the patients had hypertension (62.4%) and dyslipidaemia (52.5%). Table I shows the sociodemographic characteristics of the patients.

Table I: Sociodemographic characteristic among patients with newly diagnosed type 2 Diabetes Mellitus

Variable	Clinic 1	Clinic 2	Clinic 3	Total, n (%)
Gender)	**N=96**	**N=39**	**N=27**	**N=162**
Male	35 (36.5)	15 (38.5)	8 (29.6)	58 (35.8)
Female	61 (63.5)	24 (61.5)	19 (70.4)	104 (64.2)
Age in years	**N=96**	**N=39**	**N=27**	**N=162**
≤39	19 (19.8)	8 (20.6)	1 (3.7)	28 (17.3)
40-49	25 (26.0)	10 (25.6)	5 (18.5)	40 (24.7)
50-59	29 (30.2)	10 (25.6)	13 (48.2)	52 (32.1)
≥60	23 (24.0)	11 (28.2)	8 (29.6)	42 (25.9)
Race	**N=96**	**N=39**	**N=27**	**N=162**
Malay	58 (60.4)	30 (76.9)	20 (74.1)	108 (66.7)
Chinese	17 (17.7)	5 (12.8)	4 (14.8)	26 (16.0)
Indian and others	21 (21.9)	4 (10.3)	3 (11.1)	28 (17.3)
Co-morbidities				
Smoking	11/84 (13.1)	2/39 (5.1)	3/27 (11.1)	16/150 (10.7)
Hyperten-sion	50/96 (52.1)	29 /39 (74.4)	22/27 (81.5)	101/162 (62.4)
Dyslipid-emia	38/96 (39.6)	29/39 (74.4)	18/27 (66.7)	85/162 (52.5)

High proportion of the patients had poor clinical profile. About 90% of these patients were overweight or obese and near 80% of the patients did not achieve the target of blood pressure, LDL, HDL and glycaemic control (Table II).

About one third of the newly diagnosed patients (27.7%, 45/162) had developed at least one microvascular complication. We found that nephropathy was the commonest microvascular complication (19.2%, 28/146), followed by peripheral neuropathy (8.6%, 14/162) and retinopathy (6.5%, 10/154). Two patients had retinopathy and nephropathy and one patient had all three microvascular complications. For retinopathy,

Table II: Clinical profile among patients with newly diagnosed type 2 Diabetes Mellitus

Variable	n (%)
BMI (N = 160)	
<18.5	2(1.2)
18.5- 22.9	14 (8.8)
23.0-27.4	41(25.6)
≥ 27.5	103(64.4)
Waist circumference (N=160)	
Achieved (women <80cm and men <90 cm)	18 (11.3)
Not achieved	142 (88.7)
Blood pressure N=162	
≤135/75mmHg	29 (17.9)
>135/75mmHg	133 (82.1)
Lipid level (mmol/L)	
Triglyceride (N=161)	
≤1.7	96 (59.6)
>1.7	65 (40.4)
LDL (N=160)	
≤ 2.6	31 (19.4)
>2.6	129 (80.6)
HDL(N=160)	
Good control (man HDL>1, women HDL>1.2)	96 (60.0)
Poor control (man HDL≤1, women HDL≤1.2)	64 (40.0)
Glycaemic control (N=159)	
HbA1c ≤ 6.5%	31 (19.5)
HbA1c > 6.5%	128 (80.5)

eight patients had non proliferative diabetic retinopathy (NPDR), one had proliferative diabetic retinopathy (PDR) and one had maculopathy.

There were 16 cases did not turn up for the 2nd sample collection of urine albumin/microalbumin after the initial positive of urine albumin/microalbumin and thus unable to confirm their status of nephropathy. There were three cases did not undergo the fundus camera examination and another 5 cases were having cataract.

There was no association found between the sociodemographic and clinical variables and the presence of nephropathy, retinopathy and peripheral neuropathy (Table III & IV) using the bivariate analysis. However, multivariate logistic regression analysis showed that glycaemic control was a significant factor contributing to the presence of at least one microvascular complication. The odds of developing microvascular complications among patients with poor glycaemic control (HbA1c ≥6.5 %) was 5.8 times higher (OR 5.8, 95%CI:1.466, 23.288) compared to patients who had good glycaemic control (HbA1c <6.5 %) (Table V).

DISCUSSION

Summary of principle findings

This study found that about one third of newly diagnosed T2D patients has developed at least one microvascular complication. The highest prevalence of microvascular complications was nephropathy (19.2%) followed by peripheral neuropathy (8.6%) and retinopathy (6.5%).

Table III: Association between sociodemographic and microvascular diabetic complications

Socio demographic characteristics	Nephropathy				Retinopathy				Peripheral Neuropathy			
	Yes N=28 n (%)	No N=118 n (%)	χ^2 value	P value	Yes N=10 n (%)	No N=144 n (%)	χ^2 value	P value	Yes N =14 n (%)	No N =148 n (%)	χ^2 value	P value
Age group (years)												
≤ 39	4 (14.3)	19 (16.1)			3(30.0)	25 (17.4)			4 (28.6)	24(16.2)		
40- 49	5 (17.9)	28 (23.7)	NA	NA	3(30.0)	37 (25.7)	NA	NA	2 (14.3)	38(25.7)	NA	NA
50- 59	8 (28.6)	43 (36.4)			2(20.0)	46 (31.9)			5 (35.7)	47(31.8)		
≥ 60	11 (39.3)	28 (23.7)			2(20.0)	36 (25.0)			3 (21.4)	39(26.4)		
Gender												
Male	11 (39.3)	39 (33.1)	0.391	0.532	4(40.0)	51 (35.4)	NA	NA	9 (64.3)	49 (33.1)	NA	NA
Female	17 (60.7)	79 (66.9)			6(60.0)	93 (64.6)			5 (35.7)	99 (66.9)		
Race												
Malay	19 (67.9)	75 (63.6)	0.182	0.669	8(80.0)	94 (65.3)	NA	NA	9(64.3)	99(66.9)	0.919	0.233
Non-Malay	9 (32.1)	43 (36.4)			2(20.0)	50 (34.7)			5(35.7)	49(33.1)		
Co-morbidities												
Hypertension	21 (75.0)	69 (58.5)	2.614	0.106	7(70.0)	87 (60.4)	NA	NA	9 (64.3)	92 (62.2)	0.025	0.875
Dyslipidaemia	15 (53.6)	59 (50.0)	0.115	0.734	6(60.0)	75 (52.1)	NA	NA	4(28.6)	81 (54.7)	3.509	0.061
Smoking	2 (7.4)*	13 (12.0)**	NA	NA	0(0.00)#	14 (10.5)##	NA	NA	4 (28.6)	12 (8.8)$	NA	NA

*N=27X **N=108 #N=9 ##N=133 $N=136 NA=not applicable as there were cells with expected count less than 5

Table IV: Association between clinical profile and microvascular diabetic complications

Clincal profile	Nephropathy				Retinopathy				Peripheral Neuropathy			
	Yes n (%)	No n (%)	χ^2 value	P value	Yes n (%)	No n (%)	χ^2 value	P value	Yes n (%)	No n (%)	χ^2 value	P value
BMI (kg/m²)	N=27	N=117			N=10	N=142			N=13	N=147		
≤ 22.9	0 (0.0)	16 (13.7)			1 (10.0)	15 (10.6)			3 (23.1)	13 (8.8)		
23.0-27.4	10 (37.0)	28 (23.9)	NA	NA	3(30.0)	34 (23.9)	NA	NA	3 (23.1)	38 (25.9)	NA	NA
≥ 27.5	17 (63.0)	73 (62.4)			6(60.0)	93 (65.5)			7 (53.8)	96 (65.3)		
Waist circumference	N=27	N=118			N=10	N=142			N=14	N=146		
Achieved*	1 (3.7)	15 (12.7)			1 (10.0)	17 (12.0)			3 (21.4)	15 (10.3)		
Not achieved	26 (96.3)	103 (87.3)	NA	NA	9 (90,0)	125 (88.0)	NA	NA	11 (78.6)	131 (89.7)	NA	NA
Blood pressure	N=28	N=118			N=10	N=144			N=14	N=148		
≤135/75mmHg	3 (10.7)	25 (21.2)			2 (20.0)	25 (17.4)			4 (28.6)	25 (16.9)		
>135/75mmHg	25 (89.3)	93 (78.8)	1.601	0.206	8 (80.0)	119 (82.6)	NA	NA	10 (71.4)	123 (83.1)	NA	NA
Triglyceride	N=28	N=118			N=10	N=143			N=14	N=147		
≤1.7	17 (60.7)	75 (63.6)			6 (60.0)	85 (59.4)			9 (64.3)	87 (59.2)		
>1.7	11 (39.3)	43 (36.4)	0.079	0.779	4 (40.0)	58 (40.6)	NA	NA	5 (35.7)	60 (40.8)	0.138	0.710
LDL	N=28	N=117			N=10	N=142			N=14	N=146		
≤ 2.6	4 (14.3)	26 (22.2)			2 (20.0)	26 (18.3)			3 (21.4)	28 (19.2)		
>2.6	24 (85.7)	91 (77.8)	0.867	0.352	8 (80.0)	116 (81.7)	NA	NA	11 (78.6)	118 (80.8)	NA	NA
HDL	N=28	N=117			N=10	N=142			N=14	N=146		
Good control#	16 (57.1)	74 (63.2)			7 (70.0)	86 (60.6)			11 (78.6)	85 (58.2)		
Poor control	12 (42.9)	43 (36.8)	0.358	0.550	3 (30.0)	56 (39.4)	NA	NA	3 (21.4)	61 (41.8)	2.205	0.138
Glycaemic control	N=28	N=116			N=9	N=117			N=14	N=145		
HbA1c ≤ 6.5%	5 (17.9)	24 (20.7)			1 (11.1)	25 (17.6)			19 (7.1)	30 (20.7)		
HbA1c > 6.5%	23 (82.1)	92 (79.3)	0.113	0.737	8 (88.9)	117 (82.4)	NA	NA	13 (92.9)	115 (79.3)	NA	NA

NA=not applicable as there were cells with expected count less than 5 #Good control= HDL>1 for men and HDL>1.2 for women
*Achieved= waist circumference <80cm for women and waist circumference <90 cm for men

Poor glycaemic control was a significant risk factors for the presence of microvascular complications.

Interpretation of findings and comparison to previous findings

There is high prevalence of microvascular complications (27.7%) found in present study. Literature had consistently showed that there was a substantial proportion (ranged from 10% to 70%) of T2D patients had presented with microvascular complications at time of diagnosis (6, 7, 9, 14–18). This happened in both developed country such as Denmark (prevalence of 18%) (14), United State (prevalence of 50% for the underserved underinsured patients from Chicago) (18) and developing countries such as Egypt (prevalence of about 10%) (15), India (prevalence ranged from 10% to 50%) (6, 16, 17) and Pakistan (prevalence of about 70%) (9, 17) The high prevalence of microvascular complications at diagnosis in our study could imply the delayed diagnosis and failure of early detection of T2D in our population which was reflected in the results of Malaysia National Health and Morbidity Survey (NHMS); half of the patients with T2D reported in NHMS were undiagnosed cases (4). Thus, there is a need to promote vigorous screening programme to promote early detection of T2D. In addition, screening of these complications at diagnosis for all newly diagnosed T2D patients are required for early detection of these complications and better management.

We found nephropathy is the commonest microvascular complications, followed by peripheral neuropathy and retinopathy. It was unable to pin-point which microvascular complications was more susceptible as literature showed the results varied from one study to another. For example two studies from Pakistan showed the highest prevalence of microvascular complications for peripheral neuropathy (64.6% and 59.6% respectively) (7, 9); in India, one study found nephropathy as the commonest complication (50%) (6) whereas other studies from the same country found peripheral neuropathy (13%) (16) and retinopathy (9.5%) (17) being the commonest microvascular complications. A local study from the state of Kelantan, Malaysia found retinopathy (14.6%) be the commonest microvascular complication presented at diagnoses (8). For developed country, a study from Denmark showed that the commonest microvascular complication in its studied population was retinopathy (13%) and the prevalence for nephropathy and peripheral neuropathy was only 3% and 4% respectively (14). The difference of the findings could be due to the difference in inherent

Table V: Factors associated with microvascular complications

Variable	OR	95%CI	P - value
Glycaemic control			
HbA1c ≤ 6.5%	ref		
HbA1c > 6.5%	5.843	1.466, 23.288	0.012
Lipid control (mmol/L)			
LDL ≤ 2.6	ref		
LDL >2.6	1.538	0.503,4.703	0.451
HDL good control#	ref		
HDL poor control	0.579	0.251, 1.338	0.201
TG ≤ 1.7	ref		
TG >1.7	0.716	0.307, 1.672	0.441
Blood pressure control (mmHg)			
BP ≤ 135/75	ref		
BP > 135/75	1.171	0.394, 3.475	0.776
Waist circumference (cm)			
Achieved*	ref		
Not achieved	1.727	0.304, 9.801	0.537
BMI (kg/m²)			
<22.9	ref		
23-27.4	1.374	0.218, 8.656	0.735
≥ 27.5	0.759	0.118, 4.881	0.771
Smoking			
Yes	ref		
No	0.528	0.115, 2,426	0.412
Dyslipideamia			
No	ref		
Yes	0.777	0.339, 1.780	0.550
Hypertension			
No	ref		
Yes	2.244	0.763, 6.599	0.142
Race			
Non-Malay	ref		
Malay	0.888	0.356, 2.213	0.798
Age group			
<45	ref		
45-54	0.483	0.161, 1.445	0.193
55-64	0.840	0.257, 2.750	0.773
≥ 65	0.330	0.059, 1.833	0.205
Gender			
Male	ref		
Female	0.679	0.260, 1.770	0.429

#Good control= HDL>1 for men and HDL>1.2 for women
*Achieved= waist circumference <80cm for women and waist circumference <90 cm for men
Multivariate logistic regression analysis: Nagelkerke R square= 0.168

ethnic or genetic susceptibility of an individual to the complications as well as exposure of difference lifestyle (dietary habit and physical activities) from one population to the other that could contribute to the risk factors for development of microvascular complications. In addition, the variability in the prevalence may be due to difference in age group of studied population, setting (hospital vs primary care) and diagnostic criteria employed in different studies.

Majority of newly diagnosed patients in present study had poor control of their clinical profiles that showed about 90% of the patients were overweight or obese and 80% of patients did not achieve the target of BP, glycaemic and lipid control. These findings are consistent with other studies conducted in Pakistan, India and United States (6, 9, 18). It could be due to the fact that the newly diagnosed patients were at the initial state of the treatment and optimisation of the control would need longer time.

Previous studies have identified that the risk factors for microvascular complications for newly diagnosed patients were age, triglycerides, HbA1c and BP status (14, 17, 18). In present study, poor glycaemic control was the only significant predictor for the presence of microvascular complications. This re-emphasized the importance of early detection of T2D for timely optimisation of the blood sugar to delay or prevent the microvascular complications.

Strength and limitation

This is a prospective study that enables the researcher to examine and capture for all the three microvascular complications i.e. retinopathy, nephropathy and peripheral neuropathy as compared to other studies that used the retrospective record review which more at risk of missing record.

Limitation of this study includes a relatively small sample size and the convenient sampling of the clinics. Sample size calculation was based on the prevalence of peripheral neuropathy only, and the sample size needed for other microvascular complications might not be similar. Thus, the results need to be interpreted with caution. Nevertheless, the results of this study provide an insight on the impact of delayed diagnosis. Future studies could use randomised sampling and covers more clinics and states for representative population. There were 16 cases did not turn up for the 2nd sample collection of urine albumin/microalbumin after the initial positive of urine albumin/microalbumin and thus unable to confirm their status of nephropathy. This could underestimate the total patients who have developed at least one microvascular complication.

CONCLUSION

There is high prevalence of microvascular complications among the newly diagnosed T2D patients. Hence screening of these complications at diagnosis for all newly diagnosed T2D patients are required at clinic level for early detection and better management. There is a need to develop appropriate strategies to increase the awareness and early detection of T2D at the community level for prevention or delaying the development of microvascular complications.

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