Metabolic Control and Cardiovascular Risk Factors among Type 2 Diabetes in a Primary Care Clinic

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ABSTRACT

Background: Prevalence of diabetes is escalating both globally as well as in Malaysia. With the epidemic of diabetes and its related morbidities and mortalities, health care professionals are facing an unprecedented challenges in controlling the disease. **Objective:** To determine the metabolic control and the cardiovascular risk factors among type 2 diabetic patients in a primary care setting. **Method:** This was a cross sectional study conducted in a primary care clinic in Selangor, Malaysia. Inclusion criteria were all type 2 diabetic patients aged 18 and above and were being followed-up for more than six months prior to the recruiting period in May 2009. The demographic data were obtained through face-to-face interview. Height, weight and blood pressure of the patients were taken during the day of data collection. The co-morbidities and laboratory results were obtained from the medical records. **Results:** Two-hundred patients were recruited. The mean age was 58.6 (SD=10.5) with 79.0% of the patients aged more than 50 years old. The majority of the patients were female (62.5%). One-tenth (11.5%) were smokers. More than half of the patients (64.0%) had co-morbid of hypertension and half of them (50.5%) had dyslipidaemia. A total of 72.5% of the patients had 3 or more cardiovascular risk factors. Less than one fifth of the patients had achieved the target of control for glycaemia, blood pressure, LDL and BMI. Those age 60 and above had significantly higher proportion of patients achieving fasting blood glucose control (p=0.033). **Conclusion:** The majority of type 2 diabetic patients had multiple cardiovascular risk factors (3 or more risk factors) and had not achieved the recommended goals in metabolic control.

Keywords: **Type 2 diabetes mellitus, metabolic control, cardiovascular risk factors, primary care clinic**

INTRODUCTION

Type 2 diabetes mellitus (Type 2 DM) is a metabolic disease which contributes to high level of morbidity and mortality worldwide. The prevalence of diabetes is increasing in all age group and the total number of people with diabetes in the world is projected to rise to 366 million in 2030.[1] In Malaysia we have witnessed this alarming escalation between the last two National Health and Morbidity Surveys (NHMS); the prevalence of diabetes has progressively increased from 8.2% in 1996 to 14.9% in 2006.[2] Diabetes mellitus, hypertension, hyperlipidaemia, and obesity often cluster together. The prevalence of these cardiometabolic risk factor clusters has witnessed an alarming increment for all sociodemographic groups along with its detrimental economic effect both globally and in this country.[2, 3, 4]

This disease's burden is not primarily due to the disease alone but to its complications of cardiovascular diseases such as coronary artery disease, stroke, peripheral vascular disease and microvascular disease complications such as nephropathy, retinopathy and neuropathy.[5,6] Various studies have shown that with the optimal control of glycaemic level and other cardiovascular risk factors such as blood pressure, lipid and smoking, the risk of complications can be reduced.[7-11] In order to delay the development of cardiovascular complications, the management of diabetes should aim to achieve good metabolic control along with optimal control of multiple modifiable cardiovascular risk factors.

Previous studies done locally showed that there was poor glycaemic control and high prevalence of uncontrolled cardiovascular risk factors (cholesterol, blood pressure, weight control) both at private and public primary care clinics, as well as public and tertiary teaching hospitals.[12-18] In view of the current epidemic of diabetes, increasing efforts have been made from the higher authority to improve on the chronic care management in the primary care level such as non-communicable disease programme. Some of the measures taken in this programme include strengthening the knowledge of the health care providers through continuous medical education, improving dissemination of updated clinical practice guidelines, extending the services of nutritionist and dietician in the public health clinics and encouraging regular annual clinical audit to monitor the quality of care in diabetes management.[19] With the efforts

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and measures taken, it is hoped that there will be enhancement in quality of diabetic care management which should translate into improved metabolic profiles in these patients. The aims of this study were to determine the metabolic control and the cardiovascular risk factors among type 2 diabetic patients in a primary care clinic. It is hoped that the results will provide insight into the current status of metabolic control in diabetic patients, so that appropriate management plan can be implemented.

METHODS

This was a cross sectional study conducted in a public primary care clinic in Selangor, Malaysia and approved by the Medical Ethics Committee from the Ministry of Health Malaysia and the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. The inclusion criteria were all type 2 DM patients aged 18 years and above and being followed-up for more than six months. All type 2 DM patients who visited the clinic for follow-up from 7th May 2009 to 21st May 2009 and consented to the study, were recruited.

The demographic data and smoking status of the patients were obtained through face-to-face interview. Height, weight and blood pressure of the patients were measured and recorded after the interview. The co-morbidities diagnosed and the most recent laboratory results available in 2008 and onwards were obtained from the patients' medical records. The laboratory results captured were glycaemic profile (fasting blood sugar, random blood sugar and glycosylated haemoglobin) and lipid profile (total cholesterol, triglyceride, low density lipoprotein and high density lipoprotein). The cardiovascular risk factors studied were: i) age (male > 45, female > 55) ii) gender (male) iii) smoking status iv) body mass index (BMI) ≥ 23.0 v)dyslipidaemia and vi) hypertension.

Obesity classification was defined as underweight (BMI < 18.5 kg/m^2), normal (BMI 18.5-22.9 kg/m^2), pre-obese (BMI 23.0-27.4 kg/m^2), obese 1 (BMI 27.5-34.9 kg/m^2), obese 2 (BMI 35.0-39.9 kg/m^2) and obese 3 (BMI ≥ 40 kg/m^2).[20] The target for metabolic control was defined according to the recommendation of Malaysian Clinical Practice Guidelines on Diabetes Management[21]: fasting blood glucose (FBS) ≤ 6.1mmol/l, glycosylated haemoglobin (HbA1c) < 6.5%, blood pressure (BP) ≤ 130/80 mmHg, triglyceride(Tg) ≤ 1.7 mmol/L, low density lipoprotein (LDL) ≤ 2.6 mmol/L, high density lipoprotein(HDL)≥ 1.1 mmol/L, body mass index (BMI) < 23.0 kg/m^2.

STATISTICAL ANALYSIS

Data were analyzed using SPSS version 18. For categorical data, the chi-square test was used to study the association between glycaemic control and various categorical variables. For categories with a number less than 5, Fisher's exact test was used. The significant level was two tails and set at p value <0.05.

RESULTS

Two hundred patients were recruited with a response rate of 100%. The majority were Chinese patients (48.5%). The mean age was 58.6 (SD=10.5) with 79.0% of the patients aged more than 50 years old and 62.5% were female. One-tenth (11.5%) of the respondents were smokers. 26.6% (20/75) male patients and 2.4 %(3/125) female patients were active smokers. More than half of the patients (64.0%) had co-morbid of hypertension; half of them (50.5%) had dyslipidaemia and 46.5% were obese. A total of 72.5% of the patients had 3 or more cardiovascular risk factors.

A summary of the demographic characteristic is shown in Table 1 and the clinical measurements are shown in Table 2.

Table 1.   Demographic Characteristics

Variables	Frequency (N=200)	Percentage (%)
Ethnicity		
Malay	53	(26.5)
Chinese	97	(48.5)
Indian	49	(24.5)
Others	1	(0.5)
Gender		
Female	125	(62.5)
Male	75	(37.5)

Continuation
Table 1.   Demographic Characteristics

Variables	Frequency (N=200)	Percentage (%)
Age Group		
≤30	1	(0.5)
31-40	7	(3.5)
41-50	34	(17.0)
51-60	80	(40.0)
61-70	48	(24.0)
71-80	28	(14.0)
≥81	2	(1.0)
Smoking status		
Yes	23	(11.5)
No	177	(88.5)
Co-morbidities		
Hypertension	128	(64.0)
Dyslipidaemia	101	(50.5)
Concomitant cardiovascular risk factors		
1 risk factor	20	(10.0)
2 risk factor	35	(17.5)
3 risk factor	65	(32.5)
4 risk factor	57	(28.5)
5 risk factor	16	(8.0)
6 risk factor	7	(3.5)

Table 2.   Clinical characteristics

Variables	Mean(SD) / median (IQR)*	Number of test available n (%)
Glycaemic parameter		
FBS (mmol/l)	7.7(3.8)*	172 (86.0%)
RBS (mmol/l)	11.1(4.9)	29(14.5%)
HbA1c (%)	8.0(2.75)*	88 (44.0%)
Lipid parameter		
Total cholesterol (mmol/l)	5.3(1.4)*	141 (70.5%)
Triglycerides (mmol/l)	1.5(1.3)*	141 (70.5%)
HDL (mmol/l)	1.3(0.6)*	62 (31.0%)
LDL (mmol/l)	3.9(1.3)	61 (30.5%)
Blood pressure		
Systolic (mmHg)	142(17)	200 (100%)
Diastolic (mmHg)	84(9)	200 (100%)

Continuation
Table 2.   Clinical characteristics

Variables	Mean(SD) / median (IQR)*	Number of test available, n (%)
Anthropometric		
Height (m)	1.56(0.08)	200 (100%)
Weight (kg)	69.0(27.0)	200 (100%)
BMI (kg/m²)	27.1(7.4)*	200 (100%)

For metabolic control, less than one fifth of patients achieved the target control for glycaemia, BP, LDL and BMI as shown in Table 3. More than half of the patients did not have HbA1c; LDL and HDL results available (Table 2).

Table 3.   Metabolic Control in Type 2 Diabetic Patients

Variables	Number of test available (N)	Frequency achieved control (n)	Percentage (%)
Glycaemic control			
Fasting Blood Glucose ≤ 6.1mmol/L	172	39	(22.7)
HbA1c < 6.5 %	88	9	(10.2)
Blood pressure control			
Blood pressure ≤ 130/80 mmHg	200	31	(15.5)
Lipid profile			
Triglyceride ≤ 1.7 mmol/L	141	83	(58.9)
Low Density Lipoprotien (LDL) ≤ 2.6 mmol/L	61	9	(14.8)
High Density Lipoprotein (HDL) ≥ 1.1 mmol/L	62	45	(72.6)
BMI	200		
Underweight (< 18.5 kg/m2)		2	(1.0)
Normal (18.5-22.9 kg/m²)		23	(11.5)
Pre-obese 23.0-27.4 kg/m²)		81	(40.5)
Obese 1 (27.5-34.9 kg/m²)		71	(35.5)
Obese 2 (35.0-39.9 kg/m²)		17	(8.5)
Obese 3 (≥40 kg/m²)		6	(3.0)

Patients aged 60 and above had significant higher proportion achieving recommended glycaemic control than those less than 60 years old ($\chi2$=4.523 p=0.033). There was no significant association between the glycaemic (FBS or HbA1c) control groups and the gender, ethnicity, smoking status or those with various cardiovascular risk factors. (Table 4).

Table 4.   Association of glycaemic (FBS or HbA1C) control with gender, ethnicity, smoking status and number of cardiovascular risk factors

Variables	FBS ≤ 6.1mmol/L n(%)	P-value	HbA1c < 6.5 % n(%)	P-value
Age				
<60	15(15.9%)	0.033	2(4%)	0.036*
≥ 60	24(30.7%)		7(18.4%)	

Continuation
Table 4.   Association of glycaemic (FBS or HbA1C) control with gender, ethnicity, smoking
status and number of cardiovascular risk factors

Variables	FBS ≤ 6.1mmol/L n(%)	P-value	HbA1c < 6.5 % n(%)	P-value
Gender				
Male	12(19.3%)	0.555	3(10.0%)	1.000*
Female	27(24.5%)		6(10.3%)	
Ethnicity				
Malay	9(19.1%)			
Chinese	21(25.3%)	0.706		
Indian	9(21.4%)			
Smoking status				
Non smoker	33(21.6%)	0.489	8(9.9%)	0.543*
Smoker	6(31.6%)		1(14.3%)	
Concomitant cardiovascular risk factors				
≤ 3 risk factors	21(20.6%)	0.546	5(9.3%)	0.730*
>3 risk factors	18(25.7%)		4(11.8%)	

*p value for Fisher exact test

DISCUSSION

Sociodemographic

The predominant ethnic group, who attended this government health clinic because of their diabetes, was Chinese. The reasons for this in that the clinic is situated in a predominantly Chinese area and most patients with chronic diseases utilise government health facilities due to economic constraints. The majority of the patients were from the middle and the older age group. This was expected as the disease prevalence increases with age.[2, 22]

Cardiovascular risks

These patients were at very high risk of developing cardiovascular complications as almost three quarter of them had 3 and more other risk factors apart from diabetes itself.

One-tenth of the respondents were smokers and the majority were male (86.9%). This was consistent with a previous study in health centres in Melaka Tengah District which reported that 16% of their diabetes patients were smokers and 89% of them were male.[15] Screening for smoking status of male diabetes patients is essential and advising them to quit smoking could help them reduce their cardiovascular risks. Similar to other studies there was high prevalence of co-morbidities of hypertension and dyslipideamia. Previous local studies reported that about 70% to 90% of diabetes patients had hypertension and 60% to 70% of patients had dyslipideamia [12, 15, 17] Thus the management of these patients would involve multifactorial intervention. Comprehensive diabetes care is needed to reduce not only the sugar profiles, but also the blood pressure, dyslipidaemia, weight and smoking.[7, 23] The optimal management of these cardiometabolic risk factors would render the effective means of avoiding the cardiovascular sequelae among diabetic patients.

Metabolic control

Overall the glycaemic control was poor in the studied population and a high proportion of the patients did not achieve the recommended FBS (77.3%) or HbA1c (89.8%) targets. This glycaemic control was no better than in previous studies where the control rate ranged from 10% to 30%.[12, 13, 15] To achieve the target is not an easy task and even with the implementation of non-communicable disease programme and the establishment of multidisciplinary care in a primary care clinic, the proportion of patients who achieved HbA1c target was still around 20%.[24] Although efforts have been made to improve the glycaemic control, the outcome may not be as expected due to various problems and

barriers (e.g. patient adherence, resources available in the clinic, competency of health care providers) faced during the process of implementation. Patient education and counselling are of the utmost importance to improve adherence to the clinical programmes. Clinical audit would be useful to rectify the problems in the clinics as further measures can be planned.

This study showed that the proportion of patients who achieved glycaemic control was higher in older patients. This phenomenon of sup-optimal glycaemic control in the young was also seen in the Malaysia diabetes registry.[25] The reasons for this observation are uncertain. One of the possibilities is that the older diabetic patients were the cohort who survived into old age by having personal positive factors such as by adhereding more to therapy, by being more appreciative of the disease and having adopted the necessary life style changes to successfully gain good control of the disease. Henceforth, the young diabetic patients are the one who need to receive particular attention and more intensive treatment during management of diabetes care.

As for the lipid profile, there was under screening and monitoring of this parameter as only one third of the patients had HDL and LDL tested. Out of these, the proportion that achieved target LDL was very low (14.8%) compared to other local study.[26] This was unexpected in the Chinese predominant samples as usually they show better lipid control rate as compared to other ethnic groups.[25] Although anti-lipid medication is widely available in government health clinic, the control rate will not improve without more screening, treatment initiation and monitoring.

Despite 64.0% of the patients diagnosed as having hypertension, only 15.5% of the study population achieved target blood pressure control. The poor control rate could be due to miss-diagnosis and suboptimal treatment of hypertension which was not captured in this study. Hence, further study is needed to explore factors contributing to poor blood pressure control.

As shown in literature, obesity predisposes to diabetes and these two are often present together to cause more morbidity and mortality.[6] In this study 87.5% of the patients were either overweight or obese. As obesity aggravates insulin resistance, beta cell failure and cardiovascular risk,[6, 27] this modifiable risk factor should be appropriately managed to improve glycaemic control with improvement in insulin sensitivity.

Generally, the results showed that the rate of metabolic control in this study was not satisfactory. The non-communicable disease programme implementation in the clinic had yet to improve to meet the goal of disease control. The more comprehensive intervention which consists of elements of chronic disease care model may be useful for further improvement of diabetic care. This chronic disease care model was piloted via research project locally by the Ministry of Health Clinical Research Centre. This study showed encouraging results, whereby 50% to 70% of the hypertensive, diabetic and hyperlipideamia patients in the intervention group had achieved blood pressure, glycaemic and LDL target control.[28] However, the sustainability and cost effectiveness of this strategy is yet to be investigated in real-life day to day practice. Chronic care model may be the guide to improve diabetic care management, however each local clinic would have to rectify its own deficiencies to suit their local needs.

Further studies are needed to explore the problems and barriers faced in health care providers when implementing such programmes as well as factors influencing the patient's adherence to intervention strategies.

Among the limitations of this study was the small sample size which could have skewed the results and did not represent the overall diabetic care in the country.

CONCLUSION

The majority of the diabetic patients had multiple cardiovascular risk factors (3 or more risk factors) and did not achieve the recommended goals in metabolic control. There is an urgent need to implement more effective care and aggressive therapeutic strategies to improve on the cardiometabolic control among the type 2 DM patients at this clinic.

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