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Quality of Care for Adult Type 2 Diabetes Mellitus at a University Primary Care Centre in Malaysia

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ABSTRACT

Background: Type 2 Diabetes Mellitus (T2D) with its concurrent cardiovascular risk factors such as hypertension and dyslipidaemia and its complications has now accounted for the majority of national and global morbidity and mortality.

Aims & Objective: The study aimed to determine the prevalence of complications appearing in diabetic patients despite therapy, addressing to an urban academic primary care centre.

Methods: This was a sub-analysis of a cross-sectional study on 212 patients with Type 2 diabetes mellitus (T2D) conducted from June to September 2006. Patients aged ≥ 30 years, non-smokers and under follow-up care of senior doctors were recruited. The average of the three most recent readings of fasting plasma sugar, HbA1c, systolic and diastolic blood pressure, and lipid profiles was taken as measures of respective disease control.

Results: Two thirds of the patients were female. The mean age was 62.7 (SD± 10.8) years and the duration of T2D was 11.74 (SD± 6.7) years. A total of 23.6% achieved HbA1c ≤ 7.0%, 26.2% attained LDL-C ≤ 2.6 mmol/L and 24.5% achieved target blood pressure < 130/ 80 mmHg. The most prevalent co-morbid condition was hypertension (77.3%). A total of 27.2% patients had diabetic complications, out of which 86.5% had one complication. Proteinuria < 1gm/L and coronary artery disease were the two most common complications. There were only 16% on subcutaneous insulin and this was significantly associated with fasting plasma glucose ($t = 5.38$, $df = 204$, $p < 0.0001$) and HbA1c ($t = 4.31$, $df = 206$, $p < 0.0001$).

Conclusions: Many T2D patients at this centre did not achieve treatment goals. Insulin and lipid-lowering drugs use should be optimized to improve control rates. More structured care processes are urgently needed in order to achieve good glycaemic control.

Keywords: *Primary Care, Type 2 Diabetes Mellitus, Disease managements, Diabetes complications, Hypoglycaemic agents*

Introduction

Type 2 Diabetes Mellitus (T2D) with its concurrent cardiovascular risk factors such as hypertension and dyslipidaemia and its complications has now accounted for the majority of national and global morbidity and mortality.[1,2] The International Diabetes Federation (IDF) predicts a 72% increase in the number of diabetics from 189 millions in 2000 to 224 millions in 2025 globally and a 100% rise of global cost of diabetes to $300 billions.[3] In Malaysia, the Third National Health Morbidity Survey(NHMS III) showed that the prevalence of T2D is 14.9%, an increase from 8.2% in the second survey ten years ago (NHMS II) despite health campaigns and efforts. This may be due to the lifestyle changes of socioeconomic shift to a higher level leading to more sedentary working adults and overweight children.[4-6]

The Diabetes Control and Complication trial (DCCT)[7] and UK Prospective Diabetes Study UKPDS [8] have shown that major diabetic complications can be markedly reduced by maintaining near normoglycaemia.[9,10] In the UK, it has also been shown that minimizing complications was associated with considerable cost savings, the mean costs per patient per year with no complications were £434, and for 1, 2, and 3 complications, the costs were £999, £1641, and £2642 respectively.[11] Therefore, early and sustained glycaemic control is essential to reduce patient morbidity and mortality as well as saving health care cost. In Malaysia, an urban government health clinic reported 28% of their diabetic patients achieved HbA1c < 6.5%;[12] public hospitals reported 41% of their diabetic patients attained HbA1c < 7% while private GP clinics reported 20% of their patients attained HbA1c < 7%.[13,14] Globally, the British general practitioners and urban academic centers in United States (US) reported 34% and 28.4% respectively of their patients achieving HbA1c ≤ 7%.[15,16] In US academic centers, 32% of their diabetic patients' attained low density lipoprotein cholesterol (LDL-C) ≤ 2.6 mmol/L and 19.9% achieved blood pressure ≤ 130/85 mmHg.[16]

In UK general practices, it has been shown that 33.3% T2D patients had one complication and 12.3% had at least two.[15] In United States, among 400,000 patients with diabetes and chronic kidney disease, it was noted that the risk of death over 2 years was 29% which was much more compared to the risk of developing end stage renal disease (ESRD) of 6%.[17] Similarly in the United Kingdom Prospective Diabetes study (UKPDS 64), death due to cardiovascular disease was far more common than the development of ESRD.[18] In the 11th Report of the Malaysian Dialysis and Transplant Registry 2004, diabetic nephropathy has been shown to be the major cause of new cases entering renal replacement therapy (RRT) and accounts for an increasing proportion of patients with ESRD, from 45% in 2000 to 51% in 2003.[19]

Academic centers usually handle more complicated cases. As data on T2D patients in these centers were lacking, this study thus aimed to determine the proportion of T2D patient attaining target diabetic control and suffering from diabetes associated complications in a teaching primary care clinic.

Methods

This was a cross-sectional study conducted from July to September 2006 at a university primary care clinic in Kuala Lumpur. This is a sub-analysis of a study on the effect of religion and religiosity on the control of Type 2 Diabetes Mellitus (T2D).[20] Patients with T2D were defined as when their case record fulfilled all these criteria: (1) either

documented diagnosis of diabetes mellitus according to World Health Organisation (WHO) criteria or (2) those whose current treatment consisted of life-style modification, on oral anti-diabetics or insulin. Patients aged 30 years and above, non smokers, who were diagnosed with T2D for more than 3 years and were under follow-up care of the academic staffs and senior Family Medicine postgraduate trainees were recruited. Patients with these characteristics were chosen because of the initial study's design which was to recruit patients with more sustained effect of religions, and to exclude the effect of smoking on diabetic disease control and complications. Senior Family Medicine postgraduate trainees are doctors in their third and fourth year of master program training. Data on comorbidities and complications of diabetes after diagnosis such as hypertension (HPT), proteinuria, coronary artery disease (CAD), proliferative diabetic retinopathy (PDR), stroke, amputation, fasting plasma sugar (FPS), HbA1c, systolic blood pressure (SBP), diastolic blood pressure (DBP), LDL-C, Total-C, HDL-C and TG were collected from case records. The average of the three most recent readings of FPS, HbA1c, SBP, DBP and lipid profiles was taken as measures of respective disease control.

Data was entered and analyzed using the Statistical Package for the Social Sciences (SPSS version 18). Outliers and extreme values were double checked for transcription errors. One sample t test and Pearson's correlation coefficient was used to look for significant difference of continuous variables. Chi-square or Fisher's Exact tests or ANOVA (analysis of variance) were used to determine the association of categorical data. Test of significance were two-tailed, and a significance level was set at $p < 0.05$.

Results

A total of 212 patients participated. Two thirds were female and the mean age was 62.7 (SD± 10.8) years old. The three main ethnic groups were evenly represented (Table 1). The mean duration of T2D was 11.7 years (SD± 6.70). Majority were married (70.3%) and 21.5% were widowed. Two thirds had secondary education and above. Nearly half were retirees and 27.5% of them exercised more than three times per week. The mean BMI was 26.6 kgm^{-2} (SD 4.79).

The mean FPS was 9.0 (SD 2.76) mmol/l and the mean HbA1c was 8.1% (SD 1.41). There were 8% of patients who achieved FPS 6.0 mmol/L and below and 23.6% had HbA1c < 7%.The mean SBP and DBP was 134.5 (SD 12.75) mmHg and 78.6 (SD 6.66) mmHg respectively. About two thirds of the patients had SBP ≥ 130 mmHg and nearly half had DBP ≥ 80mmHg; a quarter (24.5%) had a blood pressure < 130/ 80 mmHg. The means for Total-C, HDL-C, LDL-C and TG were 5.0 mmol/L (SD 0.83), 1.2 mmol/L (SD 0.26), 3.1 mmol/l (SD 0.69) and 1.7 mmol/L (SD 0.82) respectively. A total of 42.5% of men and 43.5% of women reached targets for HDL-C (> 1.0 mmol/L and > 1.2 mmol/L respectively).

Regarding the proportion of patients who achieved target blood pressure and blood glucose profile using recommendation from different guidelines,[21-23] about one fifth (20.8%) reached the target HbA1c level of <7% and 10.8% achieved the target FPS ≤ 6.1mmol/l. The majority reached targets for HDL-C ≥ 1.1 mmol/l (61.3%) and TG ≤ 1.7 mmol/l (61.3%) but not Total-C ≤ 4.5 (29.7%) mmol/l and LDL-C ≤ 2.6 mmol/l (26.2%). There was no patient achieved target of control for all the eight parameters (FPS, HbA1c, SBP, DBP, LDL-C, Total-C, HDL-C and TG). Only 11(5.2%) patients achieved

targets for six out of the eight parameters, and 12 (5.7%) patients did not have a single parameter controlled to targets (see Figure 1).

Hypertension was the most prevalent co-morbid condition (77.3%) (Table 2). There were 31(14.6%) patients with proteinuria; out of which 32.3% had more than 1 gm/L. A fifth of T2D patients had never been screened for proteinuria. A total of 72.8% patients did not have any diabetic complications and none had four or more complications. Of those who had complications, 86.5% had one complication, and CAD and proteinuria < 1gm/L were the two most common complications.

Figure 2 shows 84% of the patients were put on metformin as one of the anti-diabetic agent while 10.4% and 8.0% of the patients were on either metformin or a sulphonylurea monotherapy respectively. The most common anti-diabetic therapy was the combination of metformin and a sulphonylurea (57.5% patients). There were 15 (7.1%) patients on triple oral hypoglycaemic agents, and 16% on subcutaneous insulin. The association of means HbA1c and patients on insulin (9%) and not on insulin (7.9%) was significant (t= 4.3, df= 206, p < 0.001, 95% CI 0.6, 1.6%). Similar significant association was found between means FPS and patients on insulin (11.2 mmo/L) and not on insulin (8.6 mmol/L) (t=5.4, df = 204, p <0.001, 95% CI 1.6, 3.6 mmol/L). There were 69% of the patients on either an angiotensin converting enzyme inhibitor (ACEI) or an angiotensin receptor blocker (ARB). Statins and fibrates were prescribed to 69% and 4% of patients respectively. Statin usage was associated with a lower LDL-C (t = 2.38, df= 208, p = 0.018). Anti-platelet agents were given to 36% of these T2D patients and this was significantly associated with the presence of CAD (x^2 =31.63, p < 0.0001) and stroke (x^2 =11.19, p = 0.002).

Discussion

We found 23.6% % of T2D patients had achieved a HbA1c <7%. The finding is consistent with that found in private GP clinics and Outpatient Diabetes Clinic in Hospital Universiti Sains Malaysia, Kubang Kerian in Malaysia;[14,24] and the urban academic centers in the U.S.,[25] but far worse when compared to Hong Kong clinic-based T2D population, about 40% achieved HbA1c <7%.[26] However, it was less than that attained in Malaysian public hospitals (about 40%) and those achieved by British general practitioners (34%).[27,13,15] When comparing those achieving HbA1c < 6.5%, we found 9.4% attained this target while public health clinics had about one fifth attaining this target (Table 3).[28,12] The poorer diabetic control in this study population could be attributed to patients with more severe and longer duration of diabetes was seen at this center as indicated by the higher insulin treatment rate here when compared to other primary care clinics (see more discussion in paragraph below). This cohort of T2D patients was mainly overweight/ obese elderly women who were predominantly sedentary with a mean duration of diabetes of 11.7 years which could have affected the target achieved.

We found only a quarter of the patients achieved a BP target of < 130/ 80 mmHg. This is worse than the public health clinics but again very similar to those found in US academic centers and the NHMS III and the patients BP have not been optimized.[28,25,4]

This study shows that 16% of the patients were on subcutaneous insulin and this was more than those reported at the Malaysian (11.3%) as well Singaporean (13.8%) primary care clinics.[28,29] The use of subcutaneous insulin was associated with higher FPS and HbA1c. Probably, insulin was given because of a poor metabolic control, meaning higher

FPS and HbA1c. This similar phenomena was also observed amongst the Malaysian diabetes cohort under hospital care,[30] Hong Kong clinic-based T2D population and in a Jordan university teaching family health centre where there was a significant association of insulin alone or in combination therapy with increased odds of HbA1c > 7%.[26,31] This could suggest that the cohort of patients had more severe diabetes due to disease progression or their diabetes were poorly controlled that needed insulin therapy. Due to the limitation of cross-sectional study, we cannot determine whether glycaemic control was reached (i.e. reductions in HbAlc over time) with longer duration of therapy in patients with inadequate control.

Statins were prescribed in 73% of diabetic patients and this was still inadequate as the Heart Protection Study and Collaborative Atorvastatin Diabetes Study (CARDS) have shown that patients with diabetes benefit from statins independent of their baseline LDL-C levels.[32,33] Anti-platelets usage (36%) was even lower in these patients. This under-usage of anti-platelets was also reported in Thailand and American urban academic institutions, where 38.5% and 45.6% diabetic patients were prescribed anti-platelet therapy respectively.[34,16] Studies have reported the use of aspirin would significantly reduce first event of coronary heart disease and ischaemic strokes in diabetics.[25,35,36] Recent meta-analysis by the Antithrombotic Trialists' (ATT) Collaboration had discouraged the use of aspirin even amongst the T2D patients in primary prevention of cardiovascular disease citing the unacceptable risk of major bleeding.[37,38] However, others reiterated the recommendation of aspirin use based on cost effectiveness analysis.[39,40] This study showed that anti-platelets were still very much used for secondary prevention rather than primary prevention of cardiovascular disease.

Of our cohort, 14.6% had proteinuria, 9.9% had documented CAD, 5.2% had stroke or transient ischemic episodes and 0.5% had an amputation. The Singapore National Healthcare Group Diabetes Registry also reported that renal and heart diseases were the two most common diabetes-related complications.[29] These observations reconfirm our knowledge that patients with diabetes often have concomitant cardiovascular diseases.[41,42] We found about a quarter of T2D patients had at least one complication which was similar to those found in general practice in the United Kingdom.[15] The true prevalence of diabetes complications may be misrepresented by the nature of the secondary data retrieval of this study.

Our data suggest that recommendations for aggressive lowering of HbA1c, FPS, SBP and LDL-C in patients with diabetes were not achieved. These could be attributed to the complex and challenging nature of diabetes management in association with its comorbidities. In addition, the time constraint in the primary care consultation could limit various issues to be addressed concurrently in patients with multiple complications. These could contribute to poor self-care behaviors and inadequate assessment for optimal therapy.[43,44] Furthermore, physicians' adherence to clinical practice guidelines could be a problem too.[45] The health care system that incorporated patient-oriented interventions, may be equally if not more important than skilled physicians in helping diabetic patients achieve disease control.[46] Hence, creating a primary care diabetes clinic with trained paramedics providing individual or group education, life-styles counseling and diabetic complications screening may improve diabetic control and insulin acceptance.[47,49] A computer-generated reminder system of due examinations or investigations could further assist in the management of this chronic disease. Greater effort is needed to further

improve the glycaemic control and management of patients with diabetes at this center.

Conclusion

Few of the relatively low risk group of T2D patients under the senior family physician's care has attained target glycaemic, blood pressure and LDL-C control. The use of subcutaneous insulin and statins could be further optimized. This study has again indicated the difficulty of providing optimal care and reaching treatment targets for adult T2D even at one of the country leading tertiary outpatient clinic. Proven measures may need to be taken to improve care for patient with diabetes to reduce morbidity and complications.[50,51] A more efficient diabetes care team and structured care process should be looked into and implemented urgently in order to reap cardiovascular benefit of early implementation of good glycaemic control.[52,53]

List of abbreviations

Independent-t test value (t)
Degree of freedom (df).
Confident interval (CI)
Type 2 diabetes (T2D)
Diastolic blood pressure (DBP)
Systolic blood pressure (SBP)
Coronary artery disease (CAD)
Proliferative diabetic retinopathy (PDR)
End stage renal disease (ESRD)
Hypertension (HPT)
Fasting plasma sugar (FPS)
Random blood sugar (RBG)
Angiotensin converting enzyme inhibitor (ACEI)
Angiotensin receptor blocker (ARB)
Triglyceride (TG)
Total cholesterol (Total-C)
High density lipoprotein cholesterol (HDL-C)
Low density lipoprotein cholesterol (LDL-C)
Cardiovascular disease (CVD)

IRB permissions: Medical Ethical Committee, University Malaya Medical Centre (UMMC), Malaysia approval on March 2006.

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Competing interests: None

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Table 1: Patient demography, n (%)

Mean (SD) Age, years	62.7 (10.8)
Female	139 (65.6)
Race	
Malay	68 (32.1)
Chinese	69 (32.5)
Indian	72 (34.0)
Others	3 (1.4)
Marital status	
Married	147 (70.3)
Living with a partner	4 (1.9)
Divorced	2 (1.0)
Widowed	45 (21.5)
Separated	2 (1.0)
Single	9 (4.3)
Educational level	
Primary	53 (25.0)
Secondary	102 (48.1)
Tertiary (college)	42 (19.8)
None	15 (7.1)
Employment status	
Employed	46 (21.7)
unemployed seeking work	4 (1.9)
retired	93 (43.9)
home manager	69 (32.5)
Exercise	
None	65 (30.8)
Up to 3 times a week	88 (41.7)
more than 3 times a week	58 (27.5)

Table 2: Prevalence of hypertension and diabetic complications, n (%)

HPT	163 (76.9)
Normoalbuminuria	133 (62.7)
Urine not tested	48 (22.6)
Proteinuria < 1gm/L	21 (9.9)
> 1gm/L	10 (4.7)
PDR	6 (2.8)
CAD	21 (9.9)
Stroke	11 (5.2)
Amputation	1 (0.5)

HPT Hypertension, PDR Proliferative diabetic retinopathy, CAD Coronary artery disease

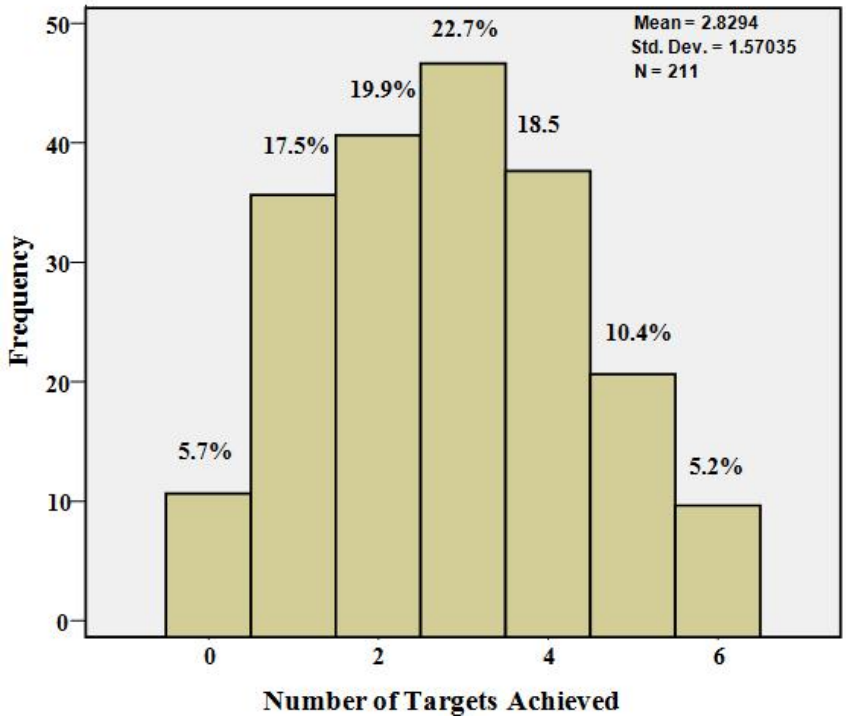

Figure 1: Frequency for the Number of Targets Achieved

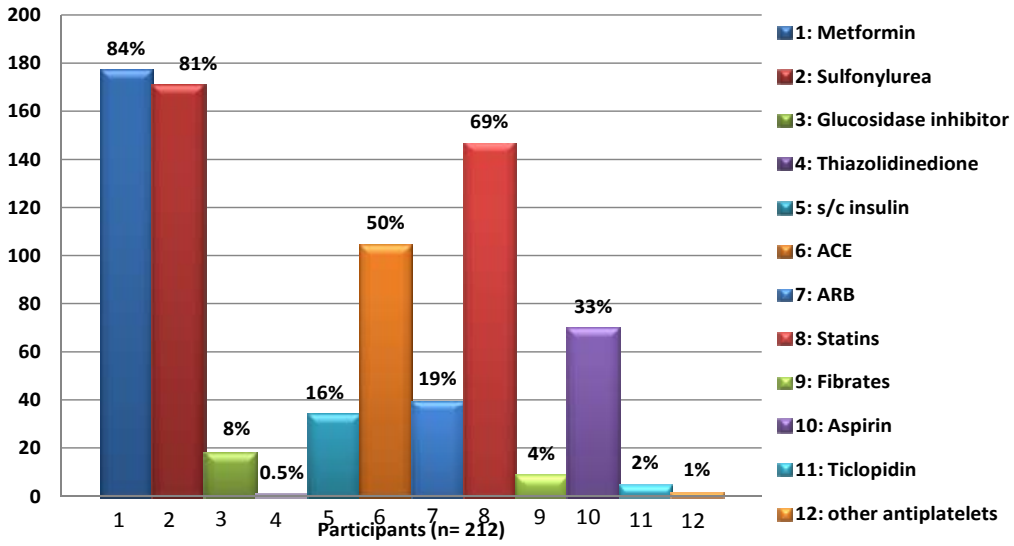

Figure 2: Pharmacological agents used