A STUDY ON GLYCEMIC CONTROL AMONG INSULIN-TREATED TYPE 2 DIABETES PATIENTS ATTENDING DIABETES CENTRE, HUSM, KELANTAN

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ABBREVIATIONS

ADA	American Diabetes Association
BMI	Basal Mass Index
CPG	Clinical Practice Guideline
CRF	Case Report Form
CV	Cardiovascular
CVD	Cardiovascular disease
DCCT	Diabetes Control and Complication Trial
DMC	Diabetes Mellitus Clinic
ED	Erectile Dysfunction
FLP	Fasting Lipid Profile
FPG	Fasting Plasma Glucose
GFR	Glomerular Filtration Rate
HbA1c	Glycosylated haemoglobin
HDL-C	High Density Lipoprotein
HUSM	Hospital Universiti Sains Malaysia
IDF	International Diabetes Federation
IDF-WPR	International Diabetes Federation Western Pacific Region
IFG	Impaired Fasting Glucose
IGT	Impaired Glucose Tolerance
IHD	Ischemic Heart Disease
KRK	Klinik Rawatan Keluarga

LDL-C	Low Density Lipoprotein
NCEP/ATP III	National Cholestrol Educational Program / Adult Treatment Panel III
NHANES	National Health and Nutrition Examination Survey
NHMS	National Health and Morbidity survey
NPH	Neutral Protamine Hagerdon
OAD	Oral anti-diabetic agent
OGTT	Oral Glucose Tolerance Test
PPG	Post Prandial Glucose
PS	Power and Sample size
RA	Research Assistant
RBS	Random Blood Sugar
RCT	Randomized Controlled Trial
SD	Standard Deviation
SMBG	Self Monitoring Blood Glucose
SPSS	Statistical Package for Social Science
T1DM	Type 1 Diabetes Mellitus
T2DM	Type 2 Diabetes mellitus
TC	Total Cholestrol
TG	Triglyceride
UKPDS	United Kingdom Prospective Diabetes Study
WC	Waist Circumference
WHO	World Health Organization

ABSTRAK

PENGENALAN

Matlamat utama dalam pengurusan pesakit-pesakit Diabetis Jenis 2 adalah untuk mencapai matlamat HbA1c untuk kawalan gula dalam darah. Oleh sebab itu, gabungan insulin dan ubat – ubat anti-diabetik atau penggunaan insulin secara menyeluruh adalah pilihan untuk mencapai kawalan diabetes yang berkesan. Data-data dari kajian terkini menunjukkan penggunaan insulin di dalam pengurusan pesakit-pesakit diabetes mampu mengurangkan HbA1c dan risiko-risiko komplikasi jangka panjang iaitu mikro dan makrovascular dan seterusnya mampu mengurangkan bebanan ekonomi negara akibat penyakit kronik tersebut.

OBJEKTIF

Kajian ini di jalankan untuk mengkaji kadar peratusan pesakit Diabetes Jenis 2 yang menggunakan rawatan insulin yang mempunyai kawalan gula yang bagus. Selain itu, ia juga untuk mengenalpasti faktor-faktor yang menyumbang ke arah kawalan gula yang bagus.

METODOLOGI

Kajian ini adalah kajian irisan lintang. Di dalam kajian ini, borang soal selidik atau proforma telah diisi oleh 236 pesakit Diabetes Jenis 2 yang menggunakan rawatan insulin di Pusat Diabetes dan Klinik Rawatan Keluarga, HUSM dari bulan Januari 2008 hingga

November 2008. Borang soal selidik ini mengandungi 2 bahagian. Bahagian 1 diisi oleh pesakit berkenaan sosiodemografi dan data klinikal, sementara bahagian 2 diisi oleh penyelidik berkenaan sejarah penyakit diabetes pesakit dan data klinikal yang di ambil dari rekod perubatan pesakit .

KEPUTUSAN

Kajian ini mendapati bahawa 21.2% pesakit Diabetes Jenis 2 yang menggunakan rawatan insulin mencapai tahap kawalan gula yang bagus (HbA1c $\leq$ 7.0%). Antara faktor-faktor yang menyumbang ke arah kawalan gula yang bagus adalah wanita, tahap pendidikan yang tinggi, rawatan yang menggunakan kombinasi insulin dan ubat diabetic, regim insulin "basal bolus" dan tahap gula di dalam darah semasa berpuasa. Sementara itu faktor-faktor yang menghalang dari mencapai tahap kawalan gula yang bagus adalah sumber kewangan dari diri sendiri dan pasangan, tahap LDL-C dan TC yang tidak terkawal dan pesakit yang bukan obese.

KESIMPULAN

Secara kesimpulannya, tahap kawalan gula yang baik di kalangan pesakit Diabetes Jenis 2 yang menggunakan rawatan insulin di Pusat Diabetes, HUSM adalah masih rendah. Kajian ini menunjukkan yang hanya 21.2% dari pesakit Diabetes Jenis 2 yang menggunakan rawatan insulin mencapai tahap kawalan gula yang baik seperti yang disarankan oleh ADA. Faktor-faktor yang dikenalpasti menyumbang ke arah kawalan gula yang bagus adalah wanita, tahap pendidikan yang tinggi, rawatan yang menggunakan kombinasi insulin dan ubat diabetik, regim insulin "basal bolus" dan tahap gula di dalam darah

semasa berpuasa. Sementara itu faktor-faktor yang menghalang dari mencapai tahap kawalan gula yang bagus adalah sumber kewangan dari diri sendiri dan pasangan, tahap LDL-C dan TC yang tidak terkawal dan pesakit yang bukan obese. Penilaian tahap kawalan gula sepatutnya di jalankan secara rutin semasa pesakit datang untuk rawatan. Dengan cara mengenalpasti faktor-faktor penyumbang ke arah tahap kawalan gula yang baik dapat membantu pengamal perubatan merangka program membaik pulih atau intervensi ke arah pencapaian tahap kawalan gula yang lebih baik dan seterusnya menurunkan kos untuk rawatan penyakit ini dan komplikasinya.

ABSTRACT

INTRODUCTION

The goal in management of Type 2 Diabetes Mellitus is to achieve control of HbA1c. Unfortunately, many patients with diabetes unable to achieve glycemic target. Due to this, combination insulin and oral anti-diabetic agent or full dose insulin is an alternative in order to improve the glycemic control. Emerging data indicates that the addition of insulin able to improve HbA1c and reduce the risk of micro and macrovascular diabetes complications and furthermore able to reduce economic burden to the country.

OBJECTIVES

The study was conducted to examine the percentage good glycemic control among insulin-treated T2DM patients and to study the factors that contribute to good glycemic control.

METHODOLOGY

This is s cross sectional study. In this survey a set of case report form (CRF) or proforma was completed by 236 insulin-treated T2DM patients attended Diabetic clinic AND Klinik Rawatan Keluarga, HUSM from January 2008 until November 2008. The CRF was divided into 2 sections. The section 1 consists of sociodemographic data while the section 2 comprised of background history of diabetes and clinical characteristics that was filled up by the researcher by reviewing the patients' case notes..

RESULT

The result showed that the percentage of good glycemic control of insulin-treated diabetes patients was 21.2% and the factors that contribute to good glycemic control were female gender, high education, combination of insulin and OAD regime, basal bolus insulin and fasting blood sugar. Factors that were found to be protective towards good glycemic control include financial support by the patient and the partner, high LDL-C, high TC and non-obese.

CONCLUSION

In conclusion, good glycemic control among insulin-treated T2DM attending the Diabetes Center, HUSM is still low. This study found out that only 21.2% of T2DM on insulin therapy achieved good glycemic control according to ADA recommendation. Factors that contribute to good glycemic control were female gender, high education, combination of insulin and OAD regime, basal bolus insulin and fasting blood sugar. Factors that were found to be protective towards good glycemic control include financial support by the patient and the partner, high LDL-C, high TC and non-obese. Assessment of glycemic control should be a routine during follow-up. By recognizing the factors that contribute to good glycemic control will help the health care provider to plan an intervention program to improve glycemic control and subsequently reduce the cost treating the disease and its complications.

CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW

CHAPTER ONE:

INTRODUCTION AND LITERATURE REVIEW

Type II diabetes mellitus (T2DM), which accounts for 90-95% of those with diabetes, was previously referred to as non insulin dependent diabetes or adult onset diabetes. It is a progressive disease characterized by insulin resistance and eventually insulin deficiency due to gradual decrease of insulin secretion following loss of beta-cell function (Polonsky, 1988). Most patients with this form of diabetes are obese and obesity itself causes some degree of insulin resistance. This statement is supported by a local study that had shown 35.5% of T2DM subjects were obese compared to normal subjects whom accounted about 24.1% (Mafauzy, 1999).

Diabetes and impaired glucose tolerance (IGT) is one of the criteria in diagnosing metabolic syndrome (International Diabetes Federation {IDF}, 2005). Metabolic syndrome refers to the cardiometabolic risk factors including abdominal obesity plus three other criteria namely hypertension, dyslipidemia (hypertrigliceridemia and / or low high density lipoprotein {HDL-C}) and elevated fasting blood glucose (FBG) (IDF, 2005). If diabetes is not already present, the metabolic syndrome is a strong predictor for its development, which is five times more likely than those without the syndrome (Stern, 2004). It is estimated that a quarter of the world's adult population have metabolic syndrome (Dunstan, 2002). They are twice as likely to die from and three times as likely to have cardiovascular disease compared to people without the syndrome (Isomaa, 2001). The

more components of the metabolic syndrome that are evident, the higher is the cardiovascular mortality rate (Hu, 2004).

Nowadays, T2DM is considered as a major public health problem as it causes considerable amount of disabilities, premature mortality as well as increasing demands on the existing health care facilities. In T2DM, metabolic control deteriorates as the duration of diabetes increases and beta cell function is progressively lost. Therefore, managing T2DM patients is very challenging. This is because prolong metabolic derangement is related directly to the development of long term complications such as coronary artery diseases, peripheral vascular disease, stroke, diabetic retinopathy, amputations, renal failure and blindness resulted in increasing disability, premature mortality and loss of productivity in which can deteriorate patients' quality of life (Morgan, 2000). These complications had imposed a huge burden on health care services. Furthermore, T2DM is also associated with other risk factors such as hypertension, adverse lipid profiles and obesity that will amplify the underlying risk of cardiovascular disease.

The essential components of such treatment must include education, counseling, monitoring, self management and pharmacological treatment with insulin or oral hypoglycemic agents to achieve specific glycemic goals. Lowering HbA1c to below or around 7% has been shown to reduce the macrovascular and neuropthic complications of type 1 and type 2 diabetes (American Diabetes Association (ADA), 2009). Conversely, less stringent HbA1c goals than the general goal of less than 7% may be appropriate for patients with a history of severe hypoglycemia, limited life expectancy, advanced

microvascular or macrovascular complications, extensive co-morbid conditions and those with long standing diabetes (ADA, 2009).

Patients were put on insulin treatment in an attempt to attain normal glycemic target which is 7% or less (ADA, 2009) even though they are at risk of developing side effects such as hypoglycemia and weight gain. New insulin analogues have been reported to have less number of complications and could overcome the above complications. Hence, this should not hinder the early use of insulin. The benefit of insulin that can bring the blood sugar to target promptly and delayed the development of diabetic complications has overcome the insulin side effects. Furthermore, patient undergoing intensive diabetes management do not face deterioration in the quality of their life (The Diabetes Control and Trial Research Group, 1996).

Self-monitoring of blood glucose level enabled diabetic patients to see how meals, physical activities and diabetic medication affect their blood sugar level. In addition, self-titration of insulin dose is important in bringing the blood sugar to target.

Successful patient self-management in insulin-treated diabetes requires considerable behavioral change. High levels of practical skill must be learned and put into practice. This requires cooperation from patients as well as support and encouragement from the health professional.

1.1 Prevalence of Type 2 Diabetes Mellitus

Globally, there is a rising trend in the prevalence of diabetes due to many factors such as increase in population, urbanization and increasing prevalence of obesity and physical inactivity (rephrase). According to World Health Organization (WHO), there are over 170 million people with diabetes world wide and it is projected to increase to 366 million by 2030. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030 (Wild, 2004).

IDF predicts by 2025, the South East Asia region would have an estimated diabetes prevalence of 7.5% (81.6 million) and IGT prevalence of 13.5% affecting 120.5 million people (IDF Diabetes Atlas, 2003).

In Malaysia, the disease has almost double in magnitude over the last decade. As shown in the National Health Morbidity Survey (NHMS) II in 1996, the prevalence of diabetes in Malaysia was 8.3% and the prevalence increased to 14.9% in 2006 (NHMS III). As for impaired fasting glucose (IFG), the prevalence increased from 4.3% (NHMS II) to 4.7% (NHMS III) among adult 30 years old and above. However, the increase prevalence is also partly due to difference methodology between NHMS II and III. NHMS II only covered peninsular Malaysia whereas NHMS III covered both peninsular Malaysia and East Malaysia. The diabetes and IFG diagnostic tools were also differs where NHMS II used 2 hours post prandial blood glucose (PPG) but in NHMS III, FPG was used. Looking at the

Malaysian's lifestyle and eating habits, it is not surprise that the increament in the prevalence of diabetes is a true figure despite the difference in the methodology used.

Considering the difference method of survey, studies had reported similar increase in prevalence of T2DM in Kelantan. Mafauzy *et al.* (1999) reported an overall prevalence of T2DM was 10.5% and IGT was 16.5%. There was no difference in the prevalence of T2DM between males and females but the prevalence of IGT was higher in females (19.0%) than in males (11.5%). Subjects with T2DM were more obese (38.4%) than normal subjects (24.1%). They also had a higher prevalence of hypertension (12.9%) and hypercholesterolaemia (71.9%) than normal subjects. Subjects with IGT also had a higher prevalence of obesity (35.5%), hypertension (9.0%) and hypercholesterolaemia (63.0%) than normal subjects.

1.2 Complications of T2DM

Abnormal glycemic control predicts the risk of cardiovascular event. A significant increase in the risk for cardiovascular events and mortality has been reported in patients with HbA1c of more than 7% compared with those who had lower HbA1c values (Kuusisto *et al.*, 1994). The increased risk of cardiovascular morbidity and mortality associated with diabetes has led to the concept that hyperglycemia may be one of the risk factors for cardiovascular (Haffner *et al.*, 2003).

The rate of diabetic complications was high in Malaysia, as reported by few studies. The Diabcare-Asia project on the status of diabetes care and prevalence of diabetic

complications in private primary care in Malaysia showed that only 20% of the patients had HbA1c less than 7% and 11% had FPG less than 6.7 mmol/L. The most common complications was neuropathy (30.1%) followed by background retinopathy (23.5%), albuminuria (22.9%) and microalbuminuria (20.4%) (Mafauzy, 2005). Similar result was found in the same study that was done at public hospitals in Malaysia. Only 41.0% of the patients had HbA1c less than 7% and 18% had FPG less than 6.1 mmol/L. The most common complications was neuropathy (19.0%) followed by albuminuria (15.7%), background retinopathy (11.1%) and microalbuminuria (6.6%) (Mafauzy, 2006). The findings from both studies suggest that unsatisfactory controlled of blood sugar had associated with a high prevalence of complications.

There were similar findings regarding DM and complication in Thailand. According to the data from the Thailand Diabetes Registry Project, it showed high prevalence of complications among T2DM patients with mean duration of diabetes of 10 (7.6) years. With only 30.7% had an HbA1c of less than 7%, diabetic nephropathy was the most common complication accounted 43.9% followed by retinopathy (30.7%), ischemic heart disease (IHD) (8.1%) and cerebrovascular disease (4.4%) (Kosachunhanun *et al*, 2006).

Chronic diabetic complications (macrovascular and/or microvascular) contribute significantly to morbidity and mortality in T2DM. Chronic hyperglycemia is associated with long term dysfunction, damage and failure of various organs (Herman, 1999). UKPDS data showed that about 50% of newly diagnosed T2DM already had chronic complications at diagnosis (Stratton *et al.*, 2000). Thus, every T2DM patients should be

screened for complications at diagnosis and thereafter at yearly intervals (Malaysian CPG: Management of Type 2 Diabetes Mellitus, 2009; ADA, 2009).

Chih-Chen *et al* (2009) reported that 83.6% of T2DM patients was reported to have erectile dysfunction (ED) and among this, 43.2% had severe ED. HbA1c level adjusted for age and duration of diabetes was significantly associated with ED. HbA1c level, age, and duration of diabetes were significant independent risk factors for ED among the younger group (age 60 years or less), and only age and duration of diabetes were independent risk factors among the older group (age more than 60 years). For the risk of severe ED, compared with no and mild to moderate ED, HbA1c level, duration of diabetes and hypertension were independent risk factors among the younger group and only age was an independent factor among the older group (Chih-Chen *et al.*, 2009). From this study, better glycemic control probably would reduce the prevalence of ED and its severity among the younger men with type 2 diabetes. For the older group, aging was the major determinant for ED risk among this population with type 2 diabetes.

1.2.1 T2DM and vascular risk

It is important to evaluate of other markers related to cardiovascular health since they have significant contribution to the cardiovascular (CV) outcome. Specific recommendations were made by the ADA for management of hypertension and dyslipidemia; however, only 7% of primary care patients with T2DM have been shown to reach all three of the ADA goals for HbA1c (less than 7%), blood pressure (less than 130/80 mm Hg), and low-density lipoprotein (LDL-C) cholesterol (less than 100 mg per dL) (Span, 2006). Proper glycemic