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Glycated hemoglobin targets and glycemic control: Link with lipid, uric acid and kidney profile

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ABSTRACT

Aims: To compare uric acid, lipid, and kidney profile along with management and complications of Indonesian diabetic patients with good and poor glycemic control based on glycated hemoglobin profile. **Materials and Methods:** Data was obtained from medical records of Internal Medicine Clinic in Hermina Podomoro General Hospital for the period January-December 2015. Subjects were grouped into good and poor glycemic control groups based on their glycated hemoglobin (HbA1c) levels.

Results: Fifty-five subjects were obtained with an average age of 54 years, 29 with good glycemic control and 26 with poor glycemic control. All glycemic parameters were worse in poor compared to good glycemic control group ($p < 0.05$). Similar averages of urea, creatinine, uric acid, low-density lipoprotein (LDL) and a lower average of high-density lipoprotein (HDL) were found between both groups with statistically non-significant differences ($p > 0.05$). Main comorbidities were dyslipidemia, hypertension, and nephropathy. Fatty liver disease, urinary tract infection and neuropathy was also reported. Most patients were prescribed with oral anti-diabetics.

Conclusion: Diabetic patients regardless of glycemic control according to current guidelines have a greater average lipid and kidney profile than the optimum target. Therefore both are equally at greater risk for cardiovascular diseases, nephropathy, and other diabetic complications. Greater patient monitoring of these parameters is recommended to lower the risk of comorbidities and complications.

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1. Background

Diabetes mellitus (DM), a condition characterized by hyperglycemia, is currently one of the most common and important metabolic disorders in the world, affecting around 20% of the world's population. Rising diabetes prevalence has become an increasing public health concern worldwide. In 2017, 1 in 11 people suffers from diabetes with an estimated total of 422 million adults causing 3.7 million deaths caused by diabetes and high blood glucose each year [1,2].

In 2016, the World Health Organization reported that 7% of Indonesians suffer from diabetes, with a greater prevalence in men than women. In addition, an estimated 40% of Indonesians have impaired fasting glucose and 30% have impaired glucose tolerance [3,4].

Diabetes is a chronic disease mainly associated with an absolute or relative deficiency in insulin secretion and/or insulin resistance resulting in numerous comorbidities and complications. Chronic

uncontrolled hyperglycemia can lead to numerous microvascular and macrovascular complications including coronary artery disease and stroke, which constitutes 65% of all diabetic mortalities as well as diabetic nephropathy. Diabetic nephropathy is currently the number one cause of end-stage renal disease (ESRD) in the world today [5-7].

This study aims to compare lipid, kidney and uric acid profile along with comorbidities and management of diabetic patients based on glycemic control, hypothesizing that better glycemic control would lead to significant improvements in these metabolic parameters as well as result in a reduction in comorbidities.

2. Materials and methods

This is a cross-sectional study using data from medical records of patients admitted to the Internal Medicine Clinic in Hermina Podomoro General Hospital, Jakarta, Indonesia during the period of 1 January to 31 December 2015. The study was approved by the Research Review Board of Hermina Podomoro General Hospital and all procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the Helsinki declaration (Fig. 1).

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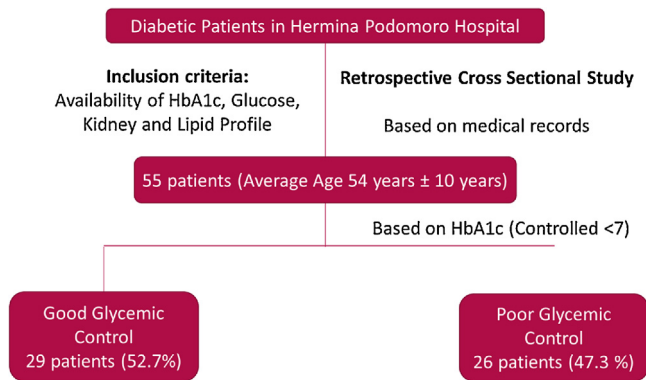


Fig. 1. Study Protocol Flow Diagram.

2.1. Participants

Adult patients (≥ 18 years of age) with type 2 diabetes which are diagnosed under ICD-10 coding of E-11 were included in this study. The inclusion criteria are patients with primary diagnosis of E11 and have visited the clinic at least twice with a complete record of glucose, uric acid, lipid and kidney profile. Participants were grouped into 2 groups – good and poor glycemic control based on their glycated hemoglobin (HbA1c) levels. Good glycemic control is defined according to the American Diabetes Association [8] and the Indonesian Association of Endocrinologists (PERKENI) [7] cut off of HbA1c < 7.0.

2.2. Data collection

Data such as age, sex, ethnic, education, BMI, glucose, uric acid, lipid, and kidney profile as well as comorbidities and type of drug used were collected from the patients' medical records. Comorbid conditions were defined as either concomitant hypertension, dyslipidemia, chronic kidney disease, hyperuricemia, or combinations of them as diagnosed in the medical records. Diabetic complications of interest include macrovascular (heart disease, stroke), microvascular (nephropathy, retinopathy, neuropathy) and a combination of both as well as infection (urinary tract infection, pneumonia). These complications were also based on the medical records. Management modalities included were lifestyle modification, use of oral antidiabetic medications or insulin, or both.

2.3. Analysis

Statistical analyses were carried out using Statistical Package for the Social Sciences (SPSS) version 21.0 for Windows. Categorical data, such as a sex, race, age group, education, BMI, comorbidities, medication and complications, are presented as proportions and percentages. Descriptive analysis was presented as mean with standard deviation for normally distributed continuous data and as median with interquartile range for data that was not normally distributed. Numerical data such as glucose profile, kidney, lipid and uric acid profile were compared using Independent T-Tests for parametric data and Mann Whitney Test for non-parametric data. A *p*-value of <0.05 was considered significant.

3. Results

3.1. Demographic profile

Fifty-five patients were obtained which fulfilled all the inclusion criteria. Of the total number of subjects, 65.5% were

Table 1
Demographic Characteristics of Study Participants.

Variable	Mean (\pm SD)	Range (Min-Max)
Age (Years)	54.0 (\pm 10.00)	35.0 – 75.0
Gender (%)		
Male	34.5	
Female	65.5	
Education (%)		
Primary	3.6	
Secondary	41.9	
Tertiary	54.5	
Body Mass Index	26.0 (\pm 3.74)	16.0 – 35.0
Underweight (%)	3.6	
Normal (%)	7.3	
Overweight (%)	26.6	
Obese (%)	65.5	

female and 35.5% of the subjects were males. The age range and mean age of female subjects was 37.0–75.0 years and 54.9 (\pm 10.6) years while the age range and mean age for male subjects was 35.0–70.0 years and 53.2 (\pm 10.5) years, respectively. The mean BMI of the participants was 26.0 (range: 16.0–35.0). The majority of patients in this study are obese. (Table 1)

3.2. Glycemic profiles

All of the average glycemic profiles were higher than the normal range and target for diabetics. The mean random plasma glucose, fasting plasma glucose (FPG), 2-h post-prandial glucose (G2PP), HbA1c and glycosuria were 254.2 (\pm 108.4), 158.4 (\pm 65.1), 227.3 (\pm 92.2), 7.42 (\pm 1.6) and 1.07 (\pm 1.2) respectively. (Table 2)

3.3. Kidney and uric acid profiles

The uric acid, blood urea nitrogen (BUN) and creatinine averages of the patients were within the normal range. Whereas proteinuria was found to be slightly higher compared to the normal value. (Table 2)

3.4. Lipid profiles

The patients were found to have averages of total cholesterol and low-density lipoprotein (LDL) cholesterol higher than the target range. Whereas the average high-density lipoprotein (HDL) cholesterol and triglyceride remain within the target range. (Table 2)

3.5. Comorbidities

Several main comorbidities were found among the patients, namely – dyslipidemia, hyperuricemia, hypertension and nephropathy with a prevalence of 45.5%, 45.5%, 38.2% and 20% respectively. In addition to these main comorbidities, other comorbidities such as urinary tract infection (4 patients), gastroesophageal reflux disease (GERD) (4 patients), neuropathy (3 patients), stroke (2 patients), fatty liver disease (1 patient) and diabetic foot (1 patient) were also found.

3.6. Management

Two types of pharmacologic therapy were found to be prescribed for the patients involved in this study, namely oral anti-diabetics (OAD) and insulin. Most patients were prescribed with oral anti-diabetics (83.6%) and only 9 were using insulin (16.4%). Biguanides (eg metformin) followed by sulfonylurea (eg glibenclamide) are the oral anti-diabetics of choice mostly

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