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Prevalence of Type 2 Diabetes and Cardiovascular Disease at the Universitas Kristen Indonesia General Hospital

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Abstract: - Diabetes mellitus (DM) is one of the most significant global health emergencies of the 21st century, characterized by high glycemic levels. Type 2 DM (T2DM) is the predominant form, accountings for approximately 90-95% of all diagnosed DM cases, and is associated with an increased cardiovascular risk. In this study, 138 patients with T2DM were examined, revealing that left ventricular hypertrophy (LVH) was prevalent. Coronary artery disease (CAD) was most common among patients aged 56-65 years, while LVH predominantly occurred in those over 65. The risk factors were identified as genetic and metabolic. Comprehensive and holistic management is essential for improving mortality rates.

Keywords: cardiovascular disease, coronary artery disease, epidemiology, type 2 diabetes.

I. INTRODUCTION

In a global landscape where the Diabetes mellitus (DM) is one of the most significant global health emergencies of the 21st century, characterized by high level of glycemic levels due to insulin hormone disruption, which is crucial for maintaining body homeostasis by lowering blood sugar levels.

According to the International Diabetes Federation (2017), there were 425 million people worldwide with DM including 82 million cases in Southeast Asia. This number, is projected to rise to 151 million by 2045 considering current lifestyle trends. [1] Indonesia rank sixth among the countries with the highest number of DM cases in Asia. [2] The Basic Health Research (RISKESDAS) (2018) reported that 8.5% or approximately 20.4 million people in Indonesia are diagnosed with DM. The prevalence of diabetes mellitus according to the Indonesian Society of Anesthesiology and Intensive Therapy (PERDATIN) (2018) is highest in the Special Region of Jakarta (3.4%) and lowest in East Nusa Tenggara (0.9%). [3, 4]

Type 2 DM (T2DM) is the predominant form, accounting approximately 90–95% of all diagnosed cases of DM. [5] According to Corina (2018), the most common chronic complications in T2DM patients were microvascular (57%), with diabetic neuropathy (45.6%) being the prevalent, and macrovascular (43%) including diabetic foot (29.9%), coronary heart disease (27.8%), and cerebrovascular disease (4%). [6] T2DM significantly increases cardiovascular risk, with patients experiencing a three-time higher CVD related mortality rate and a three-to-four-time increase in total mortality compared to the non-diabetic population of similar age and sex. [7, 8]

II. PATIENTS AND METHODS

This study used descriptive research methods to outline the prevalence of cardiovascular disease such as coronary artery disease (CAD) and left ventricular hyperthrophy (LVH), among T2DM patients. Data were collected from medical records between January until December 2023 at the internal medicine outpatient clinic of the Universitas Kristen Indonesia General Hospital. This study involved a total of 138 patients diagnosed with T2DM. confirmed using electrocardiogram (ECG) and echocardiogram examinations.

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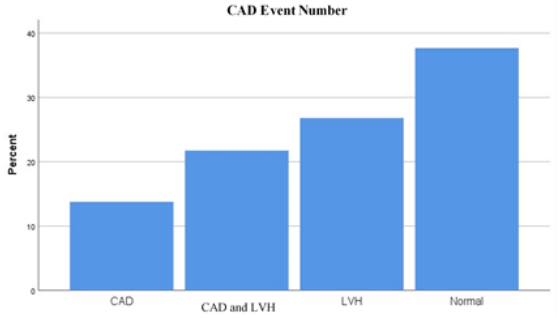
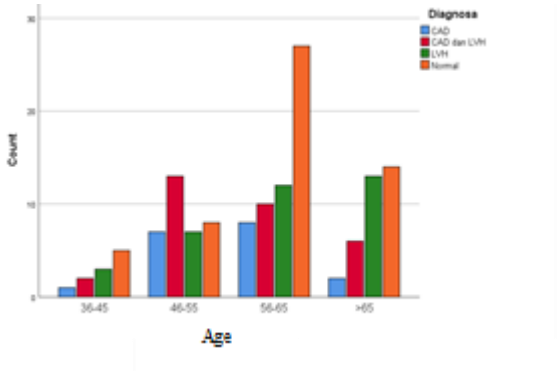
III. RESULTS

Among the 138 T2DM patients, 69 patients (50%) were male and 69 patients (50%) were female, aged between 36 years old and over than 65 years. Most patients (42%) were aged between 56 and -65 years. In terms of body mass index, 64 patients (46.4%) were overweight and 35 patients (25.4%) were class 1 obese.



Of all 138 T2DM patients, 19 patients (13.8%) had CAD, 37 patients (26.8%) had LVH, 30 patients (21.7%) had both CAD and LVH, and 52 patients (37.7%) were normal.



The majority of T2DM patients with CAD were women (61.1%), while men predominantly had LVH (60%). CAD was most prevalent among patients aged between 56 and -65 years old (44.,4%), while LVH was more common in those over 65 years (37.1%). In addition, 41.9% of T2DM patients had both CAD and LVH.

This study also found that the majority of T2DM patients with cardiovascular disease were class 1 obese 38.9% developed CAD, 48.6% develop LVH, and 38.7% developed both CAD and LVH.

IV. PATHOGENESIS OF CARDIOVASCULAR DISEASE WITH TYPE 2 DIABETES

Diabetes mellitus (DM) is an independent risk factor for heart failure, leading to diabetic cardiomyopathy. Approximately 80% of T2DM patients often also have coronary heart disease.

Insulin resistance in DM patients raises non-esterified fatty acids (NEFA) levels from triglycerides in body fat tissue, which the liver synthesizes into triglycerides, increasing triglyceride synthesis in the liver. Increasing secretion and synthesis of apolipoprotein B (apoB) and interfering insulin inhibition. This process results in a moderate increase in low-density lipoprotein cholesterol (LDL), triglycerides-rich lipoproteins, and very-low-density lipoproteins (VLDL). [9]

The damage to glucose-derived cell related to hyperglycemia is induced by the overproduction of mitochondrial reactive oxygen species (ROS), leading to in defective ROS homeostasis and the inactivation of antioxidant responses. This also induces inflammatory cytokines which activate adhesion molecules and thicken the intima media, resulting in endothelial disfunction and impaired relaxation of arterial vascular smooth muscle cells. [10, 11]

Diabetes can also activate the renin-angiotensin-aldosterone system (RAAS) pathway, which accelerates atherosclerosis, reduce cardiomyocytes, and causes extensive myocardial fibrosis. As a consequence, diabetic patients often experience diastolic dysfunction with preserved ejection fraction due to the remodeling process in the myocardium. [12]

V. Morbidity And Risk Factor Of Cardiovascular Disease With Type 2 Diabetes

DM patients have a 2.1-time higher risk of CAD. The WHO Prevention of Recurrences of Myocardial Infarction and Stroke (WHO-PREMISE) study of 10,000 patients across 10 countries found that 85% of the population suffered from coronary heart disease (CHD), with 31.5% also having DM. [13]

The risk of T2DM is influenced by genetic and metabolic factors. Peng et al. (2013) stated that elevated HbA1C levels are associated with worse cardiovascular conditions and higher metabolic risks than normal HbA1C levels. Other risk factors include ethnicity, family history of DM, older age, overweight and obesity, and a sedentary lifestyle. Dyslipidemia and hypertension are recognized as risk factors for CVD, contributing to atherosclerosis in both diabetic and nondiabetic individuals. [14]

This study found, that among the 138 T2DM patients, 19 patients (13.8%) had CA), 37 patients (26.8%) had LVH, and 30 patients (21.7%) had both CAD and LVH. Einarson et al. stated that CHD incidents occurred in 32.2% of the samples and caused a 9.9% death rate in T2DM Patients, representing 50.3% of all deaths, with PRISMA indicating CAD as the most common CVD (21.2%). [1]

In this study, the majority of T2DM patients with T2DM patients with CAD were women (61.1%), while men predominantly had LVH (60%). This is consistent with the findings of Hongwei-et al that T2DM patients female patients consistently have a greater risk of CVD than male patients. [15] This study is also consistent with Rancho Bernardo that DM female patients DM a 3.5 time greater risk of ischemic heart disease death., compared to DM male patients a 2.4 time risk. [16] Moreover, the INTERHEART study confirmed that diabetes is a more significant coronary risk factor for women than men; odds ratios of T2DM patients with acute myocardial infarction at 4.3 (95% CI: [3.5–5.2]) in women and 2.7 (95%CI: [2.4–3.0]) in men. [17] Estrogens are believed to play a role in inducing an early increase of LDL receptors, which are responsible for the uptake of plasma lipoproteins, and decreasing 3-hydroxy-3-methylglutaryl-coenzyme, resulting in enhanced biliary secretion of cholesterol. A history of gestational diabetes could also serve as a marker for early atherosclerosis. [18, 19]

In terms of age, the majority of T2DM patients with CAD fall within the age range of 56-65 years (44,4%), while LVH predominantly occurred in patients over 65 years (37.1%). In addition, 41.9% of the T2DM patients developed a combination of CAD and LVH. CVD are significantly more common in the elderly-onset group and those with the longest diabetes duration. [20] A study conducted by Xuelin Yao (2023) indicated that CVD complications in T2DM patients are more prevalent in those with elderly-onset (60-74 years) than in those with younger onset (≤59 years). [8] However, the American Heart Association (AHA) stated that there is a 14-time higher myocardial infarction risk in those diagnosed with DM at 45 years of age which is associated with considerably higher BMI, poor lifestyle choices, smoking habits, and worse lipid profiles. [21]

This study also found that the majority of T2DM patients with cardiovascular disease were classified as class 1 obesity, with 38.9% developing into CAD, 48.6% developing into LVH, and 38.7% developing both CAD and LVH. Patients with early-onset DM were characterized by higher level of BMI and weight, and were more likely to be obese compared to those with late-onset DM. According to Yao, there is significant proportion of metabolic disorders and insulin resistance among patients with early-onset DM, which increases the risk of developing macrovascular complications. This is attributed to lipid metabolism disorder and hyperlipidemia caused by dysfunction in insulin biological regulation. [8]

VI. Prevention Cardiovascular Disease For Type 2 Diabetes Patient

Lifestyle changes, smoking cessation, appropriate diabetes and CVD treatment, maintaining HbA1c at 7- 8% or <6.5% for young individuals with a diabetes duration and no ischemic vascular disease are essential for reducing complications and all-cause mortality. [22]

VII. Editorial Policy

The submitting author is responsible for obtaining agreement of all co-authors and any consent required from sponsors before submitting a paper. It is the obligation of the authors to cite all relevant prior work.

Authors of rejected papers may revise and resubmit them to the journal.

VIII. Publication Principles

The contents of the journal are peer-reviewed and archival. The International Journal of Engineering and Innovative Technology (IJEIT) publishes scholarly articles of archival value as well as tutorial expositions and critical reviews of classical subjects and topics of current interest.

IX. CONCLUSION

Diabetes mellitus (DM) is condition characterized by high glycemic levels caused by insuline hormone. Among the 138 T2DM patients, 19 patients (13.8%) had coronary artery disease (CAD), 37 patients (26.8%) had both left ventricular hypertrophy (LVH), and 30 patients (21.7%) had CAD and LVH. The risk of Type 2 DM is influenced by genetic and metabolic factors. Comprehensive and holistic management can reduce the risk of complications and lower mortality rates

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