

Characteristics of hypertension in type 2 *Diabetes mellitus* patient at Internal Medicine Outpatient Clinic Prof. Dr. I. G. N. G. Ngoerah General Hospital in 2022

Características da hipertensão em paciente com *Diabetes mellitus* tipo 2 no Ambulatório de Medicina Interna Prof. I. G. N. G. Ngoerah General Hospital em 2022

Características de la hipertensión en un paciente con *Diabetes mellitus* tipo 2 en el Ambulatorio de Medicina Interna Prof. Dr. I. G. N. G. Ngoerah General Hospital en 2022

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Abstract

Type 2 diabetes mellitus (DM) is a chronic disease that often occurs alongside hypertension. Hypertension itself is a risk factor for vascular complications related to type 2 DM which will reduce the patient's quality of life in the long term. This study aims to determine the characteristics of hypertension in type 2 DM patients. The research design was descriptive observational study using a total sampling technique by taking secondary data from medical record. The research sample was type 2 DM patients at the Internal Medicine Outpatient Clinic Prof. Dr. I. G. N. G. Ngoerah General Hospital in 2022 who meets the inclusion and exclusion criteria. Data analysis using Microsoft Excel and SPSS programs. Of the total 154 samples, hypertension in type 2 DM was mostly found in the 50-59 year age group (43.5%), male gender (62.3%) with duration of type 2 DM in the category <10 years (84.4%), normal total cholesterol levels (67.5%), abnormal LDL cholesterol levels (67.5%), normal triglyceride levels (59.1%), abnormal HDL cholesterol levels (63%) and normal e-LFG levels (51.9%). Further analysis is needed to determine the relationship between research variables and treatment history for dyslipidemia and kidney disease.

Keywords: Hypertension; Type 2 Diabetes Mellitus; Age; Gender; Duration of type 2 DM; Lipid level; Kidney function.

Resumo

O diabetes mellitus tipo 2 (DM) é uma doença crônica que frequentemente ocorre juntamente com a hipertensão. A hipertensão em si é um fator de risco para complicações vasculares relacionadas ao DM tipo 2 que reduzirá a qualidade de vida do paciente em longo prazo. Este estudo tem como objetivo determinar as características da hipertensão em pacientes com DM tipo 2. O desenho da pesquisa foi um estudo observacional descritivo com técnica de amostragem total por meio da coleta de dados secundários do prontuário médico. A amostra da pesquisa foram pacientes com DM tipo 2 do Ambulatório de Medicina Interna Prof. I. G. N. G. Ngoerah General Hospital em 2022 que atendem aos critérios de inclusão e exclusão. Análise de dados utilizando programas Microsoft Excel e SPSS. Do total de 154 amostras, a hipertensão no DM tipo 2 foi encontrada majoritariamente na faixa etária de 50 a 59 anos (43,5%), sexo masculino (62,3%), com duração do DM tipo 2 na categoria <10 anos (84,4%), níveis normais de colesterol total (67,5%), níveis anormais de colesterol LDL (67,5%), níveis normais de triglicérides (59,1%), níveis anormais de colesterol HDL (63%) e níveis normais de e-LFG (51,9%). Análises adicionais são necessárias para determinar a relação entre as variáveis de pesquisa e o histórico de tratamento para dislipidemia e doença renal.

Palavras-chave: Hipertensão; Diabetes Mellitus Tipo 2; Idade; Gênero; Duração do DM tipo 2; Nível lipídico; Função renal.

Resumen

La diabetes mellitus (DM) tipo 2 es una enfermedad crónica que a menudo ocurre junto con la hipertensión. La hipertensión en sí misma es un factor de riesgo de complicaciones vasculares relacionadas con la DM tipo 2 que

reducirán la calidad de vida del paciente a largo plazo. Este estudio tiene como objetivo determinar las características de la hipertensión en pacientes con DM tipo 2. El diseño de la investigación fue un estudio observacional descriptivo utilizando la técnica de muestreo total tomando datos secundarios de la historia clínica. La muestra de la investigación fueron pacientes con DM tipo 2 en la Clínica Ambulatoria de Medicina Interna Prof. Dr. I. G. N. G. Ngoerah General Hospital en 2022 que cumplen con los criterios de inclusión y exclusión. Análisis de datos mediante programas Microsoft Excel y SPSS. Del total de 154 muestras, la hipertensión en DM tipo 2 se encontró mayoritariamente en el grupo de edad de 50 a 59 años (43,5%), género masculino (62,3%) con duración de DM tipo 2 en la categoría <10 años (84,4%), niveles normales de colesterol total (67,5%), niveles anormales de colesterol LDL (67,5%), niveles normales de triglicéridos (59,1%), niveles anormales de colesterol HDL (63%) y niveles normales de e-LFG (51,9%). Se necesitan más análisis para determinar la relación entre las variables de investigación y el historial de tratamiento de la dislipidemia y la enfermedad renal.

Palabras clave: Hipertensión; Diabetes Mellitus Tipo 2; Edad; Género; Duración del DM tipo 2; Nivel de lípidos; Función del riñón.

1. Introduction

Hypertension is one of the health problems with the largest number of sufferers in the world. Type 2 diabetes mellitus is a chronic disease that often occurs in accordance and overlaps with hypertension (Ohishi, 2018). The emergence of hypertension in type 2 DM has several risk factors such as age, gender, long suffering from type 2 DM, obesity, high salt intake, smoking habits and history of certain medications. The mechanism of hypertension in type 2 DM also involves hyperglycemia, insulin resistance and dyslipidemia (Akalu dan Belsti, 2020). Obesity is characterized by hypertrophy of adipose tissue associated with increased triglyceride levels, lipolysis rate and changes in lipid profile (Petrie et al., 2018). Changes in the lipid profile include an increase in triglyceride and LDL cholesterol levels accompanied by a decrease in HDL levels which are also characteristics of dyslipidemia (Ormazabal et al., 2018). In addition, hyperglycemia can disrupt cell osmolality and increase body fluid volume. As a result, there is an increase in cardiac output and an increase in blood pressure (Ohishi, 2018). In the endothelium, hyperglycemia can also retain LDL cholesterol, which ultimately accelerates atherogenesis and increases blood pressure (Akalu dan Belsti, 2020). In a state of insulin resistance, there will be disruption of NO synthesis which together with hyperinsulinemia can cause vasoconstriction, inflammation, sodium and water retention, resulting in hypertension (Ormazabal et al., 2018).

On the other hand, hypertension is a risk factor for vascular complications related to type 2 DM because hypertension is characterized by vascular damage (Petrie et al., 2018). The coexistence of hypertension and type 2 DM will further increase the risk of microvascular and macrovascular complications which in the long term will reduce the patient's quality of life (Yamakazi et al., 2018). This study aims to determine the characteristics of hypertension in type 2 DM patients.

2. Methodology

Research design and study population

This is a descriptive observational study to determine the characteristic of hypertension in type 2 DM patients at the Internal Medicine Outpatient Clinic Prof. Dr. I. G. N. G. Ngoerah General Hospital in 2022 based on secondary data from medical records. According to Auliya et al. (2020), descriptive research is a research to provide symptoms, facts and events systematically and accurately regarding a certain population. In descriptive research there is no need to look for relationship between variables and hypotheses testing. So this research only analyzes official documents in the form of patient medical records. The research sample was taken using a total sampling technique. The included study population was type 2 DM patient with hypertension at the Internal Medicine Outpatient Clinic Prof. Dr. I. G. N. G. Ngoerah General Hospital in 2022 with complete medical record data containing information on age, gender, duration of type 2 DM, lipid levels and kidney function. Type 2 DM patients with incomplete medical record data were excluded. Data collection was conducted from September to November 2023.

Definition and measurement

[1] Type 2 diabetes mellitus is confirmed if the patient meets one of the diagnostic criteria for diabetes mellitus which includes a fasting plasma glucose test of ≥ 126 mg/dL and/or a two hours plasma glucose test of ≥ 200 mg/dL after an oral glucose tolerance test (OGTT) with 75 grams of glucose and/or a random plasma glucose test ≥ 200 mg/dL with classic complaints and/or HbA1c $\geq 6.5\%$ (PERKENI, 2021). Apart from that, patients who have been diagnosed with type 2 DM and are currently undergoing DM treatment are also included in this variable.

[2] Hypertension or high blood pressure is defined when blood pressure is recorded as $\geq 140/90$ mmHg. Apart from that, based on the ESC/ESH guidelines, a diagnosis of hypertension is also given when the patient is taking antihypertensive medication and receiving the benefits of the treatment (William et al., 2018).

[3] Age is the length of a person's life time calculated in years as what is recorded in the medical record.

[4] Gender differentiates between men and women.

[5] Duration of type 2 DM is the duration of the patient's suffering from type 2 DM from the first diagnosis, written in years.

[6] Lipid level in this study refers to changes in lipid levels to identify the occurrence of dyslipidemia in the incidence of hypertension in type 2 DM. Characteristics of dyslipidemia include increased levels of total cholesterol (>200 mg/dL), LDL cholesterol (>100 mg/dL) and triglycerides (>150 mg/dL) accompanied by a decrease in HDL cholesterol levels (<40 mg/dL) (PERKENI, 2021). The data will be divided into two categories: normal, if the levels of each lipid profile do not match the characteristics of dyslipidemia; and abnormal, if the levels of each lipid profile match the characteristics of dyslipidemia mentioned earlier.

[7] Kidney function can be identified by a decrease in glomerular filtration rate (GFR) <60 ml/minute/1.73m² (Eknoyan et al., 2013). Furthermore, the e-LFG level data will be categorized as normal, if the e-LFG level is not found to decrease (>60 ml/minute/1.73m²); and abnormal, if e-GFR levels are found to be decreasing (<60 ml/minute/1.73m²).

Ethical consideration and Data analysis

This research has been accompanied by an ethical clearance issued by the Ethics Commission of Prof. Dr. I. G. N. G. Ngoerah General Hospital with research protocol number 2023.01.1.0980 and a research permission approved by the Education and Research Departement of Prof. Dr. I. G. N. G. Ngoerah General Hospital. These two letters were used as a prerequisite for collecting research data. The collected data will then be adjusted and analyzed using Ms. Excel and SPSS. The data obtained will be displayed in tables and diagrams accompanied by descriptive explanations.

3. Results and Discussion

The number of diabetes mellitus patients registered at the Internal Medicine Outpatient Clinic Prof. Dr. I. G. N. G. Ngoerah General Hospital in 2022 without repeat visits are 855 patients. Data was then adjusted based on inclusion and exclusion criteria and only 154 patients were used as samples in this study. Table 1 shows the basic characteristics of the research sample.

Table 1 - Basic characteristics of the research sample.

Variables	Frequency (n)	Percentage (%)
Age		
<40	4	2,6
40-49	18	11,7
50-59	67	43,5
60-69	47	30,5
70-79	17	11,0
>80	1	0,6
Gender		
Male	96	62,3
Female	58	37,7
Duration of Type 2 DM		
<10 year	130	84,4
>10 year	24	15,6
Total Cholesterol		
Normal	104	67,5
Abnormal	50	32,5
LDL Cholesterol		
Normal	50	32,5
Abnormal	104	67,5
Triglycerides		
Normal	91	59,1
Abnormal	63	40,9
HDL Cholesterol		
Normal	57	37,0
Abnormal	97	63,0
e-GFR Level		
Normal	80	51,9
Abnormal	74	48,1
Total	154	100

Source: Authors.

3.1 Characteristics based on age

In this study, the highest frequency was in the 50-59 year age group, namely 67 people (43.5%). For the 60-69 year age group, there were 47 people (30.5%). There were almost similar results in the age groups 40-49 years and 70-79 years, namely 18 people (11.7%) and 17 people (11%). The lowest results were in the age group >80 years, namely only 1 person (0.6%).

The findings in this study are consistent with the results of previous studies. Based on research by Putra and Saraswati (2021) conducted at Sanglah General Hospital Denpasar, from 51 samples it was found that the average age of type 2 DM sufferers with hypertension was 67 years. Furthermore, the results of observations by Amani et al. (2023) also found that of 2057 patients, those suffering from type 2 DM with hypertension were mostly in the 55-64 year age range, namely 815 people (39.62%). In the research of Sabrini et al. (2022) from a total of 129 samples, the majority of type 2 DM with hypertension occurred in the age range 56-64 years, namely 56 people (43%). Another study by Akalu and Belsti (2020) of 378 type 2 DM patients found that hypertension in type 2 DM most often occurred in study participants aged ≥ 60 years, namely 150 people (39.7%).

Based on this presentation, it is proven that the incidence of hypertension in type 2 DM patients is found to be more common in elderly people. In addition, type 2 DM and hypertension each occur more significantly with increasing age (Grossman and Grossman, 2017). This may be because aging is associated with vascular changes. As a result, the arterial walls thicken and stiffen, reducing the elasticity of the blood vessels and disrupting blood flow, resulting in hypertension (Akalu and Belsti, 2020; Qiu et al., 2021).

3.2 Characteristics based on gender

This study found that hypertension in type 2 DM was more common in men, namely 96 samples (62.3%) than in women, namely 58 samples (37.7%). The results of this study are in line with the results of research by Akalu and Bestli (2020) where out of 378, compared to women, the majority of study participants who experienced hypertension with type 2 DM were found to be men, namely 225 people (59.5%).

However, the data findings in this study show different results from several similar studies regarding the incidence of hypertension in type 2 DM. This is in line with research by Putra and Saraswati (2021) which found that the number of type 2 DM sufferers with hypertension at Sanglah General Hospital Denpasar was more often found in women (56.9%) than men (43.1%). Similar research conducted at Al Ihsan Hospital in Bandung found that compared to men, more female patients (67.23%) suffered from type 2 DM with hypertension (Amani et al., 2023).

The studies above show that hypertension in type 2 DM is more significant in women than in men. Although the influence of gender differences is not yet completely clear, according to Waly and Hamed (2018) this is likely to occur due to differences in hormone levels, lifestyle, physiological conditions and level of compliance with taking medication which are considered to have an impact on controlling hypertension so that it occurs more significantly in women. The decrease in estrogen levels in menopausal women is related to the accumulation of excess fat in the abdominal area which can trigger insulin resistance as a risk factor for type 2 DM (Sabrini et al., 2022). In contrast, in this study, the majority of samples found were male. This is likely due to differences in the demographic characteristics of the target population that were determined, which influenced the final results of the data obtained.

3.3 Characteristics based on duration of type 2 DM

In this study, hypertension in type 2 DM was found to be higher in the type 2 DM duration category <10 years, namely 130 samples (84.4%) compared to the type 2 DM duration category >10 years, namely only 24 samples (15.6%).

Previous research conducted by Ayuthaya and Adnan (2020) showed that hypertension was found to be higher in the group with a long history of suffering from type 2 DM ≤ 10 years, namely 100 samples (44.64%) than in the group >10 years, namely 36 samples (52.94%). The results of a population study of 127,423 diabetes patients conducted in Guangzhou showed that the average duration of suffering from type 2 DM was 8.7 ± 5.7 years (Zhai et al., 2023). Furthermore, research by Vera et al. (2020) stated that of 680 research subjects, the average duration of suffering from type 2 DM was 9.99 years and dyslipidemia was found to occur significantly with longer duration of diabetes. A cross-sectional study by Akalu and Betsli (2020) of 378 patients found that the average duration of suffering from type 2 DM since diagnosis was 11.8 years.

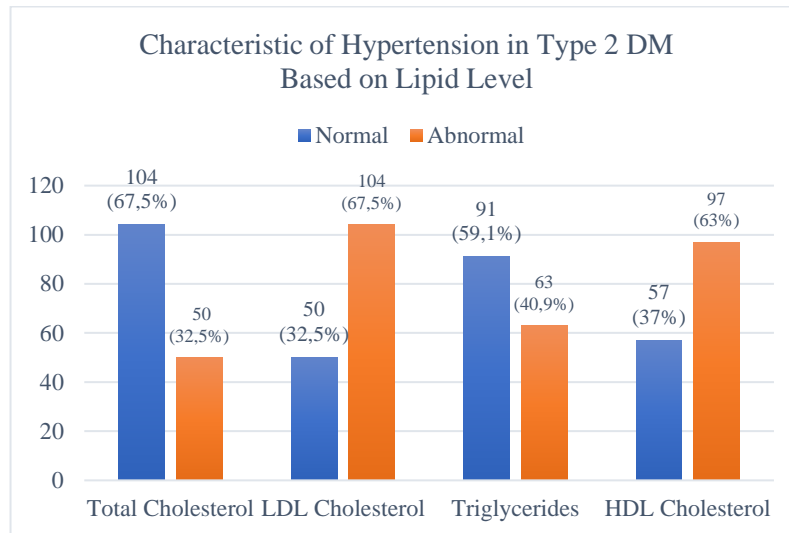
A study assessed that a one-year increase in the duration of type 2 DM could increase the likelihood of developing hypertension by up to 16% (Akalu and Betsli, 2020). This may be because as the duration of suffering from type 2 DM increases, the effects of hyperglycemia, dyslipidemia and insulin resistance as well as vascular inflammation will be more clearly visible. As the duration of suffering increases, changes due to type 2 DM such as microvascular damage, increased RAAS activation, decreased insulin sensitivity will continuously lead to the emergence of hypertension (Yamakazi et al., 2018; Akalu and Betsli, 2020). According to research by Mohammedi et al. (2017) the presence of microvascular and macrovascular disease in type 2 DM individuals with a median duration of suffering of 9.9 years is associated with a higher risk of death.

3.4 Characteristics based on lipid level

Characteristics of hypertension in type 2 DM patients based on lipid levels are shown in Figure 1. In this study the highest abnormal frequency value was for LDL cholesterol (>100 mg/dL), namely 104 samples (67.5%), followed by HDL cholesterol (<40 mg/dL), namely 97 samples (63%), then triglycerides (>150 mg/dL) in 63 samples (40.9%) and finally total

cholesterol (>200 mg/dL) in 50 samples (32.5%). However, total cholesterol and triglycerides in the abnormal category in this study were found to occur less frequently than in the normal category.

Figure 1 - Characteristics of hypertension in type 2 DM based on lipid level.



Source: Authors.

The results of this research are inversely proportional to the results of the study obtained by Sumertayasa et al. (2020) in Badung and Suharmanto (2022) in Lampung who found that the majority of research subjects were found to have abnormal total cholesterol levels (51.9%; 62.9%), abnormal triglycerides (53.9%; 51.8%). %, normal LDL cholesterol (63.5%; 80.9%) and normal HDL cholesterol (63.5%; 85.4%). Another finding by Waly and Hamed (2018) in type 2 DM patients with hypertension in Egypt found that an increase in total cholesterol occurred in 126 patients (62.1%) but an increase in triglycerides in only 88 patients (43.3%). In contrast to the results of the study by Vera et al. (2020) in Cantabria which showed that of 680 type 2 DM patients, 33.7% experienced an increase in total cholesterol and 46% of them were found to experience a decrease in HDL cholesterol.

Samples in this study were found to have abnormally elevated LDL cholesterol, HDL cholesterol and triglycerides. This finding is consistent with research by Ormazabal et al. (2018) who stated that changes in the lipid profile are characteristic of dyslipidemia induced by insulin resistance. The emergence of hypertension accompanied by dyslipidemia in type 2 DM will increase the risk of cardiovascular disease because it will trigger the formation of oxidative stress, endothelial dysfunction and the emergence of atherosclerosis (Waly & Hamed, 2018).

This study did not include data on patients who had undergone treatment or were taking medication to improve lipid status. This may have an influence on the final results of the research data.

3.5 Characteristics based on kidney function

The frequency values for normal and abnormal e-GFR levels in this study were found to be slightly different. Of the total 154 research samples, 80 samples (51.9%) were found in the normal e-LFG category. Meanwhile, there were 74 samples (48.1%) in the abnormal e-LFG category.

This finding is consistent with previous research conducted by Suharmanto (2022) in Lampung on type 2 DM patients who found that normal e-LFG levels in 728 samples (53.5%) were higher than abnormal e-LFG levels in 632 samples (46.5%). A similar thing was also found in a study by Vera et al. (2020) in Cantabria which showed that of 680 patients, there were around 77.1% of samples with e-GFR levels >60ml/minute/1.73m² and the remaining 22.9% with e-GFR levels <60ml/minute/ 1.73m².

Progressive decline in kidney function often occurs in diabetes mellitus patients with hypertension. Research by Polonia et al. (2017) stated that every year as many as 26.4% of type 2 DM patients show a decrease of more than 10% from their previous e-GFR levels and around 16.2% of type 2 DM patients experience a worsening of the stage of chronic kidney disease per year.

This study did not include data on patients who had undergone treatment or were taking medication to improve kidney function. This may have an influence on the final results of the research data.

4. Conclusion

Of the 154 research samples, hypertension in type 2 DM patients at the Internal Medicine Outpatient Clinic Prof. Hospital. Dr. I. G. N. G. Ngoerah in 2022 were mostly found in the 50-59 year age group (43.5%), male (62.3%) with the duration of type 2 DM in the category <10 years (84.4%). According to lipid levels and kidney function, the majority of samples were found to have abnormal LDL cholesterol (67.5%), abnormal HDL cholesterol (63%), normal total cholesterol (67.5%), normal triglycerides (59.1%) and normal e-GFR levels (51.9%).

The results of this research can be used for further research as a reference basis to explore and carry out more detailed analysis regarding the relationship between research variables and the history of treatment for dyslipidemia and kidney disease.

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