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# HYPERTENSION WITH NON-HEMORRHAGIC STROKE IN INDONESIA CHRISTIAN UNIVERSITY GENERAL HOSPITAL

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## Abstract

**Background:** Hypertension is a significant public health problem. It is estimated that 1.13 billion people suffer from hypertension worldwide. In Indonesia, hypertension ranks first in non-communicable diseases with the number of cases reaching 185,857 in 2018. One of the main complications of hypertension is stroke. Stroke is a common neurological disease in the form of focal and global neurological deficits. Stroke is divided into non-hemorrhagic (ischemic) and hemorrhagic.

**Objective:** This study evaluates hypertensive patients with Non-Hemorrhagic Stroke at the General Hospital of the Indonesian Christian University (UKI), Jakarta

**Methods:** The population in this study were hypertensive patients with non-hemorrhagic stroke, both inpatient and outpatient at UKI General Hospital for the period January 1 - March 31, 2019. The research used a description of design qualitative with secondary data from medical records. Hypertension criteria based on the Joint National Committee VIII.

**Results:** In this study, 30 samples were obtained that met the inclusion criteria at UKI General Hospital from January 1, 2019 – March 31, 2019. The most stage 2 hypertension, 11 patients (36.7%), for the most age regardless of gender, age 56- 65 years old 14 patients (43.3%), based on body mass index the most obesity type 1 as many as 16 patients (53.3%). The first attack occurred in 23 patients (76.7%). The most comorbidity was 10 diabetics (33.3%).

**Conclusion:** Stroke is one of the most common complications of hypertension besides coronary heart disease. For this reason, it is still necessary to do early prevention from health facilities, especially the first level so that the incidence of stroke does not increase.

**Keywords:** Hypertension, Non-Hemorrhagic Stroke, JNC VIII

## INTRODUCTION

### Background

According to data from the WHO in 2015 showed around 1.13 billion people in the world have hypertension, meaning that 1 in 3 people in the world is diagnosed with hypertension and every year it will continue

to increase. Hypertension is a non infectious disease that is one of the main causes of premature death in the world. WHO in 2019 estimates that the global prevalence of hypertension is 22% of the total world population. Of these patients, only less than a fifth who performs to control on their high blood pressure. The highest is in Africa while

Southeast Asia is third<sup>7</sup>. Attention should be given to this because hypertension is one of the main causes of death of cardiovascular disease and early death in the world. Meanwhile, according to the Indonesian Ministry of Health, hypertension is the first rank of non infectious disease diagnosed in health facilities with the number of cases reaching 185,857 in Indonesia in 2018. This figure is even 4 times higher than type 2 diabetes mellitus which is ranked second<sup>2</sup>. Meanwhile, the Percentage of Visitors to PTM Posbindu and puskesmas with high blood pressure by province in Indonesia in 2016 for the Jakarta area was 6178 people, which is the seventh highest in Indonesia<sup>3</sup>.

According to WHO, hypertension is diagnosed if when measured on two different days, with a duration<sup>60</sup> of at least one week, where the systolic blood pressure reading on the second day is  $\geq 140$  mmHg and or the diastolic blood pressure reading on the second day is  $\geq 90$  mmHg<sup>1</sup>.

According to Riskesdas KemenkesRI 2018, it is higher in women because it is related to an imbalance of the hormones estrogen and progesterone in the use of oral contraceptives, one of which affects the renin-angiotensin-aldosterone system so that fluid and electrolyte imbalances can occur and also disorders of the heart itself such as cardiac hypertrophy and increased response angiotensin II pressor via the RAS<sup>4</sup> pathway.

Based on measurements Hypertension Prevalence at Riskesdas 2018, the ratio of hypertension in urban and rural areas is slightly different from that in cities. According to the data recorded at the provincial riskesdas, the highest hypertension was in the South Kalimantan region, followed by West Java, while Jakarta was in 9th place.<sup>20</sup>

Hypertension is a major risk factor for hemorrhagic stroke. Blood pressure levels have been shown to be positively and continuously associated with stroke risk<sup>5</sup>. In some age groups, the risk of cardiovascular

disease doubles for every 20/10 mmHg increase in blood pressure, starting as low as 115/75 mmHg. This makes hypertension one of the main causes of stroke which can lead to disability<sup>6</sup>.

The most common complication, stroke can result in impaired mobility or rational, depending on the disturbance in the brain and the duration of the attack. Stroke is the leading cause of disability in the world. It is the second leading cause of death. 70% of all strokes occur in low and middle-income countries, which also account for 87% of stroke-related deaths and disability-adjusted years of life. The capacity of primary health care facilities to manage risk factors, including hypertension and diabetes, is often limited and there is also a lack of awareness. Likewise access to acute and emergency stroke care, as well as services for post-stroke rehabilitation<sup>7</sup>. Meanwhile, data from the World Health Organization (WHO) shows that 7.9% of all deaths in Indonesia are caused by stroke<sup>8</sup>.

## LITERATURE REVIEW

### 1. Hypertension

The definition of hypertension is an increase in blood pressure both systolic and diastolic, which is divided into 2 types<sup>22</sup>. 1. namely essential hypertension which is the most common and secondary hypertension caused by renal disease or other causes, then 2. Malignant hypertension is severe hypertension and is often found in these 2 types<sup>59</sup> of hypertension.

Recently, the European Society of Hypertension/European Society of Cardiology Hypertension Guidelines set a universal target of  $<140/90$  mm Hg for all patients, except for the oldest segment of the population (target,  $<150/90$  mm Hg for those 80-years of age)<sup>10</sup>.

Hypertension is a risk factor for atherosclerosis cardiovascular disease, heart failure, stroke, and kidney failure

characterized by <sup>12</sup> systolic blood pressure of more than 140 mmHg and diastolic blood pressure of more than 90 mmHg, based on two or more measurements<sup>11</sup>.

In the record, the systolic blood pressure is written first than the diastolic<sup>13</sup> blood pressure, and has a higher number. According to the association of heart doctors in the United States, AHA, in 2017, blood pressure is classified as follows; <sup>2</sup> Normal: below 120/80 mmHg, Elevated: ranges from 120-129 for systolic pressure and >80 mmHg for diastolic pressure, Hypertension level 1: 130/80 mmHg to 139/89 mmHg, Hypertension level 2: 140/90 or higher<sup>12</sup>. So, it can be concluded<sup>22</sup> that the definition of hypertension is an increase in blood pressure with systolic pressure  $\geq 140$ mmHg and/or diastolic in 2 days  $\geq 90$ mmHg.

### Classification

Below in table 1 is the classification of the results of the Comparison of Hypertension Guidelines according to the latest American College of Cardiology (ACC)/American Heart Association (AHA) and European Society of Cardiology (ESC)/European Society of Hypertension (ESH)<sup>13</sup>.

Table 1. Comparison<sup>21</sup> of Hypertension Guidelines according to ACC / AHA and ESC / ESH

Parameter	ACC/AHA	ESC / ESH
Hypertension Definition	>130/80 <sup>2</sup>	>140/90
Normal Blood Pressure grading	Normal: <120/80	Optimal <120/80
	Elevation: 120/129/<80	Normal 120-129/80-24
Hypertension Grading	Grade 1: 130-139/80-89	High Normal 130-139/85-89
	Grade 2: $\geq 140/90$	Grade 1: 140-159/90-99 Grade 2: 160-179/100-109

### Etiology And Risk Factors

Etiology:

- a. Genetic and racial essential/primary hypertension are the causes of essential

hypertension including stress, moderate alcohol intake, smoking, environment and lifestyle<sup>14</sup>.

- b. Secondary hypertension: The cause can be detected such as renal vascular disorders, thyroid gland disorders, hyperaldosteronism, parenchymal

### Risk Factor

There are two Hypertension<sup>14</sup> Risk Factors, namely those that cannot be changed and those that can be changed. Risk factors that cannot be changed include: Age<sup>2</sup>, Gender, Genetics<sup>15</sup>, race.

For risk factors that can be changed, among others; Excess weight<sup>16</sup>, smoking, lack of activity, excessive salt consumption<sup>17</sup>, stress<sup>18</sup> use of hormonal contraception<sup>19</sup>, kidney disorders<sup>20</sup>.

### Pathophysiology

Increased blood pressure in the arteries can occur in several ways, namely; Structural and Functional Changes in Blood Vessels And Heart<sup>21-22</sup>, Changes in Kidney Function<sup>23</sup>, Gerontological considerations<sup>12</sup>.

**Clinical Manifestations.** Most of the clinical symptoms that arise are headache when awake which is sometimes accompanied by nausea and vomiting due to increased intracranial blood pressure.

**Complications** occur, hypertensive retinopathy<sup>22</sup>, transient brain ischemia, cardiac ischemia and infarction<sup>22</sup>, kidney damage<sup>23</sup>

### Non-Pharmacology Management

- Reducing salt/sodium which should not be more than 6 grams per day, with this being able to reduce blood pressure by about 2-8mmHg<sup>17</sup>.
- Increased Physical Activity: with physical activities such as brisk walking, cycling, even aerobics regularly at least 30 minutes

per day for a week can lower blood pressure 4-9 mmHg. Research says that an average exercise session can lower blood pressure by 5-7 mmHg<sup>16</sup>.

- Cease Smoking
- Weight loss: Weight loss to the ideal BMI can lower blood pressure by 5-20mmHg<sup>16</sup>.
- Reduction of Intake of Saturated Fat and Cholesterol: reducing consumption of fatty foods can reduce blood pressure by 6 mmHg for systole and 3 mmHg for diastole. Also, it was found that reducing saturated fat and cholesterol intake can reduce blood pressure by 8-14 mmHg<sup>16</sup>.
- Increased Consumption of Fruits and Vegetables: foods that are high in fiber and high in potassium can lower blood pressure by 8-14mmHg<sup>16</sup>.
- controlling stress: can be done by creating a relaxed state through meditation, yoga, or relaxation activities that can control the nervous system so that it can lower blood pressure<sup>19</sup>.

#### Pharmacological Management:

Administration of the drug is started with a small dose first and then increased slowly. Selection of suitable drugs and combinations is adjusted to the diagnosis and response of patients with hypertension. Types of Hypertensive Drugs in accordance with ESH recommendations are thiazide diuretics, ACE inhibitors, beta blockers, angiotensin receptor antagonists, and calcium antagonists. Target blood pressure is systolic blood pressure (TDS) <140 mmHg, and diastolic blood pressure (TDD) <90 mmHg<sup>12</sup>.

#### 2. Non-Hemorrhagic Stroke

Stroke is damage to brain tissue caused by a sudden reduction or cessation of oxygen supply in the blood. Brain tissue that has decreased oxygen supply in the blood will die and no longer function. Stroke is a clinical symptom caused by blood vessels to the brain

experiencing a decrease in blood supply such as heart disease. An emergency condition in which a neurological deficit occurs due to a sudden localized decrease in blood flow to the brain<sup>24</sup>.

Non-hemorrhagic stroke is a blockage of a blood vessel that causes blood flow to the brain to partially or completely stop. Non-hemorrhagic stroke can be in the form of ischemia or cerebral embolism and thrombosis, usually occurring after a long rest, just waking up or in the morning. There is no bleeding but there is ischemia which causes hypoxia and then secondary edema can occur<sup>25</sup>.

Signs and symptoms that arise can vary depending on the severity and location of the lesion. However, there are some signs and symptoms that are commonly found in non-hemorrhagic stroke patients, namely; Motor disturbances<sup>26</sup>, sensory disturbances, cognitive impairment, memory and attention. If these symptoms disappear within 24 hours it can be said as a temporary ischemic attack<sup>27</sup>.

#### Risk Factors And Etiology

There are two risk factors that influence non-hemorrhagic stroke including controllable risk factors and uncontrollable risk factors<sup>12</sup>.

**Modified Risk Factors**<sup>1</sup>: Have had a stroke, someone who has had a stroke, including TIA, vulnerable to recurrent stroke<sup>19</sup>. Hypertension<sup>16</sup> Heart Disease<sup>12</sup>. Diabetes mellitus

A person with diabetes mellitus is prone to atherosclerosis, hypertension, obesity, and blood lipid disorders. In a study in 2013 it was found that diabetes mellitus has a risk of 6.59 times compared to those without diabetes<sup>28</sup>. Hypercholesterolemia, smoking is caused by the nicotine substance in cigarettes making the heart work and the heart rate and blood pressure to increase. Nicotine also

reduces the flexibility of arteries which can lead to atherosclerosis<sup>29</sup>. Lifestyle<sup>30</sup>, a high-fat diet, lack of physical activity, and emotional stress can increase the risk of stroke. Someone who often experiences emotional stress can also affect the heart and blood vessels so that it has the potential to increase the risk of stroke.

**Unmodified Risk Factors:** The risk increases after the age of 55. The age most affected by stroke is the age of 65 years and over. From 2065 acute stroke patients who were treated at 28 hospitals in Indonesia, 35.8% were over 65 years old and 12.9% less than 45 years old, stroke attacks more men (19%) than women (12%)<sup>31</sup>. Stroke attacks and causes more death in black race, Asians, and Pacific Islanders, and Hispanics than Whites. In black race, stroke occurs presumably due to the high incidence of hypertension and a high-salt diet. The genetic risk of stroke increases if a parent or sibling has had a stroke or transient acute ischemia<sup>32</sup>.

**Etiology Cerebral thrombosis,** intracranial or intracerebral hemorrhage, including bleeding into the subarachnoid space or into the brain tissue itself. This bleeding can occur due to atherosclerosis and hypertension, general hypoxia, local hypoxia,<sup>32</sup>.

**Pathophysiology.** Non-hemorrhagic stroke is caused by a decrease in blood flow or even a complete stop in certain areas of the brain, which can cause neurons to stop functioning. Impaired blood flow to the brain can cause disruption of the supply of oxygen and glucose and if it occurs beyond the tolerance limit of cells, it can result in cell death. On the other hand, if the blood flow can be repaired immediately, the damage can be minimized.

### Therapy

Therapy for ischemic stroke is divided into acute and post-acute phases, acute phase

(days 0-14 after disease onset). The purpose of this therapy in this acute phase is to save neurons from dying and the accompanying pathological processes to do not harm brain function. Actions and drugs given must ensure adequate blood perfusion to the brain.

The airway must be clean and loose, the heart must be functioning properly, if necessary monitor with the ECG blood pressure: maintained at optimal levels and monitored blood sugar. High sugar levels in the acute phase should not be drastically reduced, especially if the patient has chronic diabetes mellitus, fluid, electrolyte, and blood acid-base balance should be monitored.

For pharmacological therapy, here are the options; Fibrinolytics/ Thrombolytics, anticoagulants can be given within 48 hours after symptom onset. If used for prevention, then thromboembolism in stroke patients who have limited mobility and avoid their use within 24 hours after fibrinolytic therapy<sup>34</sup>, Antiplatelet<sup>34</sup>.

Neuroprotective drugs, used to delay the occurrence of infarction in ischemic parts of the brain, especially the penumbra and not for the purpose of repairing reperfusion to tissues<sup>12</sup> such as citicoline, flunarizine, statins, or pentoxifylline<sup>35</sup>.

### RESEARCH METHODS

This type of research uses a descriptive method with a retrospective approach. Using secondary data from the medical records of the UKI General Hospital period of 1 January - 31 March 2019.

The obtained type of data is from medical records. Medical records and tables from Microsoft excel are used as a tool to collect and record the data

The location of data collection was carried out at the medical records section in the UKI General Hospital. Time of the study, time of execution, collection, and implementation of the study was carried out during the months

of March 20-April 2021. The population of this study were hypertensive patients with non-hemorrhagic stroke at the UKI General Hospital from the period January 1 - March 31, 2019. The sample data were 30 respondents

The sample is part of the population that has met the Inclusion Criteria, namely hypertensive patients who experienced non-hemorrhagic stroke at the UKI General Hospital period of 1 January-31 March 2019.

**Inclusion Criteria.**

- Hypertensive patients at UKI General Hospital Period 1 January-31 March 2019 with indications of non-hemorrhagic stroke counted from the first time they came to UKI hospital.
- Non-hemorrhagic stroke patients with hypertension who are inpatient or outpatient at the UKI General Hospital from the period of 1 January-31 March 2019.

**Exclusion Criteria.**

- Hypertensive patients without stroke,
- unreadable medical records.
- hypertensive patients with hemorrhagic stroke.
- non hemorrhagic stroke patients without hypertension

**Research Result**

**Characteristics of Research Subjects**

In this study, 30 research samples were obtained that met the inclusion criteria at the UKI general hospital period of 1 January 2019-31 March 2019. This data is secondary data from medical records.

The obtained samples were grouped and then processed to determine the prevalence of hypertension in patients with non-hemorrhagic stroke and also processed based on their characteristics, namely age, gender, BMI, history of non-hemorrhagic stroke, history of hypertension and morbidity which is divided into type 2 diabetes mellitus, CKD, CVD. , CHD, hyperlipidemia or dyslipidemia

and hyperusemia from previous medical history or comorbidities.

The obtained data is not clearly stated regarding the first history of experiencing hypertension which is recorded in the medical record even though the authors only found 2 samples, so it was difficult to calculate the prevalence.

**Analysis of Research Results**

1. Prevalence of History of Hypertension in Non-Hemorrhagic Stroke Patients at UKI General Hospital for the Period 1 January 2019-31 March 2019.

Table 2 Prevalence of history of hypertension in non-hemorrhagic stroke patients at UKI Hospital

Non Hemorrhagic Stroke	Number of Patients	Percentage
Hypertension	30	100%
Non Hypertension	0	0%
TOTAL	30	100%

The table above shows that 100% of non-hemorrhagic stroke patients at UKI Hospital have a history of hypertension, which means that all non-hemorrhagic stroke patients in the period 1 January-31 March 2019 suffer from hypertension.

- 2 Characteristics of Hypertension in Non-Hemorrhagic Stroke Patients at UKI General Hospital Period of 1 January 2019-31 March 2019 Based on Age.

Table 3 Characteristics of Hypertensive Patients With Non-Hemorrhagic Stroke By Age

Age (year)	Number of Patients	Percentage
36-45	3	10%
46-55	6	20%
56-65	14	47%
>65	7	23%
TOTAL	30	100%

From the calculations written in the table above, it was found that the age group of 56-65 years<sup>24</sup> namely the late elderly, was the most hypertensive patients with non-hemorrhagic stroke and was not found in early adulthood at UKI General Hospital for the period 1 January 2019-31 March 2019.

3. Characteristics of Hypertension in Non-Hemorrhagic Stroke Patients at UKI Hospital Period 1 January 2019-31 March 2019 Based on Body Mass Index (BMI)

Table 4. Characteristics of Hypertensive Patients with Non-Hemorrhagic Stroke By BMI

IMT	Number of Patients	Percentage
Thin body	0	0
Normal	2	7%
Pre obese	2	7%
Obesity I	9	30%
Obesity II	2	7%
Not Classified	15	50%
TOTAL	30	100%

<sup>47</sup> From the table above, it is found that the number of patients with obesity I is the largest population of hypertensive patients with non-hemorrhagic stroke at UKI General Hospital for the period 1 January 2019-31 March 2019 with a percentage of 30% of the population that can be calculated. In the data above there are 15 samples that cannot be classified because the height data is not recorded in the medical record so that it cannot measure BMI for calculation.

Characteristics of Hypertension in Non-Hemorrhagic Stroke Patients at UKI General Hospital for the Period 1 January 2019-31 March 2019 Based on Gender.

Table 5 Characteristics of Hypertensive Patients with Non-Hemorrhagic Stroke By Gender.<sup>29</sup>

Gender	Number of Patients	Percentage
Male	18	60%
Female	12	40%
TOTAL	30	100%

From the table above, it is found that the male population is 60% more than the female population, which is only 40% of the total population at the UKI General Hospital for the period 1 January 2019-31 March 2019.

Characteristics of Hypertension in Non-Hemorrhagic Stroke Patients at UKI Hospital for the Period 1 January 2019-31 March 2019 Based on the Degree of Hypertension.

Table 6 Characteristics of Hypertensive Patients with Non-Hemorrhagic Stroke Based on the Degree of Hypertension

Hypertension Degree	Number of Patients	Percentage
Normal	3	10%
Pre-Hypertension	7	23,3%
Hypertension I	14	46,7%
Hypertension II	6	20%
TOTAL	30	100%

From the table above, it is found that patients with hypertension I are the highest with a total percentage of 46.7% and followed by pre-hypertension as much as 23.3% of the total population at the UKI General Hospital for the period 1 January 2019-31 March 2019. In this period there were patients with systolic and normal diastole, but according to his medical record there is a history of hypertension, which is 10%.

Characteristics of Hypertension in Non-Hemorrhagic Stroke Patients at UKI Hospital Period 1 January 2019-31 March 2019 Based on History of Non-Hemorrhagic Stroke



Table 7 Characteristics of Hypertensive Patients with Non-Hemorrhagic Stroke Based on History of Non-Hemorrhagic Stroke

Suffering Time	Number of Patients	Percentage
<5 years	15	50%
≥5 years	1	3,3%
Never	14	46,7%
TOTAL	30	100%

From the table above, it was found that 50% of patients had never experienced a non-hemorrhagic stroke before, while 47% of patients had been diagnosed with a non-hemorrhagic stroke with a duration of less than 5 years, while only 1 or 3% of the sample had experienced it more than 5 years ago and it recurred. in the period 1 January 2019-31 March 2019 at UKI General Hospital.

Characteristics of Hypertension in Non-Hemorrhagic Stroke Patients at UKI Hospital Period 1 January 2019-31 March 2019 Based on Comorbid Risk Factors

Table 8 Characteristics of Hypertensive Patients with Non-Hemorrhagic Stroke Based on Comorbidities

Comorbidity	Number of Patients	Percentage
DM tipe 2	11	36,7%
Hyperlipidemia	4	13,3%
CKD	3	10%
PJK	5	16,7%
CVD	8	26,7%
Hyperuricemia	4	13,3%
No Comorbidity	7	23,3%

From the table above, it is found that the most comorbid disease is type 2 DM, which is 36.7% followed by CVD, which is 26.7% and the smallest value is CKD, which is 10% in the total population at UKI General Hospital for the period 1 January 2019-31 March 2019.

From the data obtained, there are 7 or 23.3% of the population who do not have

comorbid diseases, but concomitant diseases or previous medical history that are not classified. There are 3 out of 7 populations that have neither comorbid nor RPD recorded.

Table 9 Characteristics of Hypertensive Patients with Non-Hemorrhagic Stroke Based on More Than 1 Comorbid

Amount	Number of Patients	Percentage
1 Comorbid	12	40%
≥2 Comorbid	11	36,7%
None / No Classified	7	23,3%
TOTAL	30	100%

From the table, it is found that there are 37% of the total population who have more than 2 comorbidities and 23% are not classified because they do not have comorbid data found in the medical records of the UKI General Hospital for the period 1 January 2019-31 March 2019.

## DISCUSSION

From the results of research from medical records at UKI General Hospital period of January 1 to March 31, 2021, it showed that 30 patients who suffered from non-hemorrhagic stroke had a history of hypertension. This shows that hypertension is quite high and is one of the main risk factors for non-hemorrhagic stroke patients at UKI General Hospital.

In research conducted at Dr. RSUP. Wahidin Sudirohusodo Makassar 2012 which was carried out with a case control design, it was found that people with a history of hypertension had 2 times greater risk of having a stroke than people without a history of hypertension. Hypertension is the main factor that causes stroke<sup>36,37</sup>.

The results showed that from 30 patients hyperuricemia with hypertension, there were 3 patients (10%) aged 36-45 years, while 6

patients (20%) were early elderly (46-55 years), 14 patients (47%) were late elderly (56-65 years), and 7 patients (23%) were seniors (>65 years).<sup>10</sup>

This shows that the highest number of hypertensive patients with non-hemorrhagic stroke is in the late elderly (56-65 years),<sup>28</sup> the lowest is in late adulthood (36-45 years). This study showed that the incidence of hypertension with non-hemorrhagic stroke increased by age category, except for the elderly (>65 years) which decreased.<sup>6</sup>

The results of this study are in line with the theory based on its etiology which states that the age of 50-60 years is the age at which the incidence of hypertension which is one of the degenerative diseases due to aging can change the body's physiology and especially blood vessels which is the etiology of non-hemorrhagic stroke, namely the presence of due to decreased blood flow or even a complete stop in certain areas of the brain, which can cause neurons to stop functioning<sup>33</sup>.

<sup>25</sup> From the results of the characteristic study of Body Mass Index (BMI) the incidence of hypertension with non-hemorrhagic stroke was highest in the obese BMI group I, namely 9 patients (30%) and the lowest was in the normal and pre-obese BMI group, namely a patient (7%). As for the obese group II as many as 2 patients (7%). However, of the 30 patients, there were 15 patients (50%) who did not have BMI data in their medical records, thus disturbing the validation of BMI data in this study.

Hypertension that occurs in individuals with obesity has a mechanism that involves many factors. These factors broadly cause hypertension through six primary<sup>35</sup> mechanisms, namely: 1) sodium retention, 2) increased activity of the sympathetic nervous system, 3) increased renin-angiotensin by adipose tissue, 5) endothelial function disorders, and 6) vascular mechanisms associated with hypertension. insulin

resistance and altered ion transport. excess fat tissue is closely related to all of the above mechanisms, especially in central obesity with visceral fat tissue compared to peripheral/subcutaneous fat tissue. To differentiate between the two, a CT scan or MRI is needed<sup>39</sup>. Therefore, central obesity may occur in individuals with a BMI <27.8/m<sup>2</sup>.<sup>18</sup>

The results showed that the number of hypertensive patients with non-hemorrhagic stroke among men and women was quite significant, namely 18 patients (60%) male and 12 female (40%).

In line with Calvin's theory and research (2020) that men often experience signs of hypertension in their late thirties, while women often experience hypertension after menopause. Women's blood pressure, especially systolic, increases more sharply with age.<sup>55</sup> After 55 years, women do have a higher risk of developing hypertension. One of the causes is the difference in the hormones of the two sexes. Estrogen production decreases during menopause<sup>40</sup>.

Some menopausal hormones have additive effects on increasing blood pressure during<sup>58</sup> menopausal transition their effects such as relative increase in androgen levels, Activation<sup>16</sup> of the Renin Angiotensin System, high renin levels, Increased plasma endothelin levels, High salt sensitivity, Increased insulin resistance, High sympathetic activity, Weight gain.<sup>5</sup>

A decrease in the estrogen/androgen ratio dilutes the vasorelaxant effect of estrogen on the walls and increases the production of vasoconstrictive factors such as endothelin. Male and female sex steroids have a regulating effect on the Renin-Angiotensin System (RAS) and affect angiotensinogen production and sodium metabolism. Decreased<sup>16</sup> estrogen levels at menopause lead to upregulation of the RAS with increased plasma renin activity. This has the potential to reduce RAS<sup>41</sup> activity.

These results are also in line with Palm's study which found that there was a statistically significant relationship between male and female sex and tended to be higher in men than women. However, this is still controversial regarding gender differences with the incidence of stroke until now<sup>42</sup>. As in Daugherty's research, according to statistical data, there is no significant difference between men and women<sup>43</sup>.

The results showed that hypertension with non-hemorrhagic stroke increased along with the increase in blood pressure. This is indicated by the highest in the hypertension group I and the lowest in normal blood pressure. Of the 30 hypertensive patients with non-hemorrhagic stroke, there were 3 patients (10%) with normal blood pressure, 7 patients (23.3%) with prehypertension, 14 patients (46.7%) with grade I hypertension and 6 patients (20%) with hypertension. Grade II hypertension.

Hypertension is often found in patients with acute stroke, even those who were previously normotensive in the acute phase may experience an increase in blood pressure. In the first 24 hours of the acute phase of stroke, more than 60% of patients presented with a systolic blood pressure  $\geq 160$  mmHg and more than 28% had a diastolic blood pressure  $> 90$  mmHg. Hypertension in non-hemorrhagic stroke is a brain response with the aim of increasing brain perfusion pressure so that blood flow will increase so that damage to the penumbra area does not get worse. However, resulting in a fall in blood pressure that is too rapid in acute non-hemorrhagic stroke can expand the infarct and adversely affect the neurologic status. Normal cerebral blood flow (CBF) is about 50-55 ml/100 g brain/minute and the limit for transmission failure at the synapse is about 18 ml/100 g brain/minute which results in nerve cells unable to function normally but there is still potential for recovery. Nerve cells will die if the CBF is reduced to close to 8

ml/100g brain/min. If the brain area with CBF levels between 8-18 ml/100 g brain/min, the brain cell area can recover or continue to neuronal death<sup>44</sup>.

Non-hemorrhagic stroke based on a history of non-hemorrhagic stroke showed the highest data was in the group before 5 years which amounted to 15 people (50%) with the most data occurring recurrent stroke in 1 year and the lowest was only one person who had recurrent stroke more than 5 years (3,3%).

The results of our study are close to that of Amila's study in 2020 with the result that a third of all stroke patients who recover from a stroke will have a re-attack in 5 years, 5-14% of them will have a re-stroke in the first year<sup>45</sup>. According to the National Stroke Association, 3-10% of stroke recurrences occur within 30 days, 5-14% of stroke patients will have a re-stroke within 1 year, and 25-40% within 5 years<sup>46</sup>. The most comorbid comorbidities were 11 patients (36.7%) with Type 2 DM, 4 patients (13.3%) with hyperlipidemia, 3 patients (10%) with CKD, 5 patients (16.7%) with CHD, 8 patients (26.7%) had CVD, 4 patients (13.3%) had Genu OA or hyperuricemia and 7 patients (23.3%) had no comorbidities.

From the results of this study, it was found that the most comorbid diseases in hypertensive patients with non-hemorrhagic stroke were Type 2 DM, namely 11 patients (36.7%). While the lowest is CKD or chronic kidney disease with a percentage of 3 patients (10%). These results are in line with the conclusion of Rong Chen's study that diabetes is a major risk factor for stroke. It can cause pathological changes in the blood vessels in various locations and can lead to stroke if the cerebral vessels are directly affected. In addition, mortality is higher and post-stroke outcome is poorer in patients with stroke with uncontrolled glucose levels.

There are several possible mechanisms by which diabetes causes stroke, namely vascular

endothelial dysfunction, increased arterial stiffness at an early age, systemic inflammation and thickening of the capillary basement membrane. Abnormalities of early left ventricular diastolic filling are usually seen in type II diabetes. The function of the vascular endothelium is very important for maintaining the structural and functional integrity of the blood vessel walls as well as vasomotor control and in type II diabetic patients have arteries that are stiffer and less elastic than those with normal glucose levels.

## CONCLUSION

From the results of research conducted on hypertensive patients with non-hemorrhagic stroke, it can be concluded that the prevalence is 30 people. The incidence of non-hemorrhagic stroke is more common in male patients (60%) than women (40%). The highest incidence of hypertension with non-hemorrhagic stroke is in the late elderly (47%). hypertension with non-hemorrhagic stroke was highest in obese BMI I (30%) and the lowest was in normal and pre-obese BMI (7%).

Hypertension with non-hemorrhagic stroke was highest in the comorbid type 2 DM group (36.7%) and the lowest was CKD (10%). The incidence of hypertension with non-hemorrhagic stroke was 36.7% having more than one comorbid. Hypertension with non-hemorrhagic stroke had a history of suffering from hypertension for less than 5 years with a percentage of 50%.

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