UNDERGRADUATE THESIS

EVALUATION OF USING ORAL ANTIHYPERTENSION FOR HOSPITALIZED GERIATRIC PATIENTS IN X HOSPITAL IN 2018

UNIDA
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Submitted to Undergraduate Program University of Darussalam Gontor in Partticial Fulfillment of The Requirments for Health Science

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EVALUASI PENGGUNAAN ANTIHIPERTENSI ORAL PADA PASIEN RAWAT INAP GERIATRI DI RUMAH SAKIT X TAHUN 2018

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ABSTRAK

Penelitian ini telah dilakukan pada evaluasi penggunaan antihipertensi oral pada pasien rawat inap geriatri rumah sakit X pada tahun 2018. Tujuan dari penelitian ini adalah untuk menentukan ketepatan indikasi, obat, dan dosis dalam pengobatan antihipertensi pada pasien rawat inap geriatri di rumah sakit X pada periode Juli-Desember 2018. Desain penelitian menggunakan metode deskriptif observasional, dimana data dikumpulkan secara retrospektif. Data diambil dari rekam medik hipertensi geriatri yang dirawat inap pasien rumah sakit X pada periode Juli-Desember 2018 sebanyak 69 pasien dengan inklusi 40 pasien. Data yang diambil dianalisis menggunakan standar *Eighth Joint National Committee* (JNC VIII) 2014 untuk ketepatan indikasi, obat, dan dosis. Hasil terapi pengobatan antihipertensi pada pasien rawat inap geriatri memperoleh tepat indikasi 100%, tepat obat 100%, dan tepat dosis 88%. Adanya perbedaan dalam perawatan dapat disebabkan oleh kondisi pasien geriatri yang sangat rentan. Pencapaian manfaat klinis yang optimal diperlukan untuk mengurangi tekanan darah dengan terapi yang tepat dan rasional.

Kata kunci: *geriatri obat antihipertensi, rumah sakit X*

EVALUATION OF USING ORAL ANTIHYPERTENSION FOR HOSPITALIZED GERIATRIC PATIENTS IN X HOSPITAL IN 2018

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ABSTRACT

The study aims at explaining the evaluation of using oral antihypertension for hospitalized geriatric patients in X hospital in 2018. The purpose of the study was to determine the accuracy of indications, the accuracy of drugs, and the accuracy of doses in antihypertensive treatment in geriatrics hospitalized patients of X hospital in the period July to December 2018. The design of research used a non-experimental observational descriptive method, in when data were collected retrospectively. The data were taken from the medical record of hypertensive geriatrics hospitalized patients of hospital X in the period July-December 2018 as many as 69 patients with the inclusion of 40 patients. The data taken were analyzed using the Eighth Joint National Committee (JNC VIII) 2014 standard for the accuracy of the drug, accuracy of the indications and accuracy of the dosage. The results in the therapy of antihypertensive treatment in geriatrics obtained the right indication of 100%, the right drug of 100%, and the right dosage of 88%. The existence of difference in treatment was caused by the condition of geriatric patients which was very vulnerable. The optimally clinical benefits are necessary to reduce blood pressure with appropriate and rational therapy.

Keywords: *antihypertensive drugs, geriatric, hospital X*

STATEMENT OF ELIGIBILITY

FOR UNDERGRADUATE THESIS EXAMINATION

EVALUATION OF USING ORAL ANTIHYPERTENSION FOR HOSPITALIZED GERIATRIC PATIENTS IN X HOSPITAL IN 2018

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I hereby that this thesis was originally belonged to my own and did not belong to other researchers for different levels. Furthermore, this thesis was previously published, except for a few parts with their original references.

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ACKNOWLEDGEMENTS

Assalamu'alaikum Wr. Wb.

Thanks to Allah SWT for His mercy and blessings which are always bestowed upon the author so the thesis can be completed properly. Prayers and greetings may be poured out on the Prophet Muhammad SAW who showed his people to the right path. This thesis is entitled "Evaluation of Using Oral Antihypertension for Hospitalized Geriatric Patients in X Hospital in 2018" as a condition for completing a Bachelor degree in Pharmacy Department at the University of Darussalam Gontor.

The preparation of the thesis faced many obstacles, but in the end, the author could solve it correctly and well for the guidance and assistance of several parties both morally and spiritually. Then with all humility, the author would like to express her great gratitude to:

1. Mr. Abdul Rochim and Mrs. Ainur Rohmah, both parents who gave affection, moral and material support, motivation and endlessly devote prayer, so I was able to complete this research.
2. Al-Ustadz Prof. Dr. Amal Fathullah Zarkasyi, M.A as a Rector, the University of Darussalam Gontor.
3. Al-Ustadzah drg. Ruskiah Oktavia, M.M as Dean of the Health, University of Darussalam Gontor.
4. Al-Ustadz Amal Fadholah, S.Si, M.Si, Apt as Head of Pharmacy Department, University of Darussalam Gontor.
5. Al-Ustadzah Yulia Dwi Andarini M.P.H, Apt and Al-Ustadzah Nadia Mira Kusumaningtyas, S.Si, M.Sc as supervisor, for their willingness to provide guidance, criticism, suggestions, support, and motivation in the process of completing this thesis for undergraduate.
6. All Pharmacy Lecturers who had provided insight and additional into science and experience as guidelines and provisions for authors.

7. Medical record section of hospital X, who helped and guided me in the research process.
8. UNIDA for Girls family, especially the 2015 classmates who could not be mentioned one by one. Thanks for the togetherness, struggle, and support that always be remembered.
9. Mr Sahwi Ari Riyanto and Mrs Ida Lailawati for kindness to help the research in Madiun.
10. Thanks to Sintia Ayu, Fergiawan Alfianto, Diah Masrifah, Puteri Arune, and Rilo Pambudi for togetherness and support each other and may Allah bless to meet in Jannah.

I hope all the assistance given had received a replay from Allah SWT. The author realizes that there are still many shortcomings in writing. Therefore criticism and suggestions are highly expected for the improvement of this thesis. Hopefully, the thesis could be useful for the development of science. *Amin Ya Rabbal Alamin.*

Wassalamu'alaikum Wr. Wb.

Ngawi, April 30th, 2019

Zuhria Annur Laili

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CHAPTER I

INTRODUCTION

1.1. Background of the Research

Hypertension is a state of someone is blood pressure (BP) which is above the normal range or optimal, i.e. 140 mmHg for systolic and 90 mmHg for diastolic for recurring inspections (Indonesian Cardiovascular Specialist Association, 2015). The disease is categorized as the silent killer because its sufferers do not know that they were suffering from hypertension before they promptly got medical check. Hypertension occurs in a prolonged period and continuously triggers a stroke, heart attack, heart failure, and the leading cause of chronic kidney disease, so to achieve optimal clinical benefits, they have to reduce the blood pressure with the right therapy (AHA, 2014).

According to data from the World Health Organization (WHO) (2013), the data show 972 million people or 26.4% of people suffer from hypertension, the number of patients increases 29.2% in 2025. Most diseases in the elderly based on the Basic Health Research 2018 are hypertension, with a prevalence of 55.2% at the age of 55-64 years, 63.2% at the age of 65-74 years, and 69.5% at the age of ≥75 years (Ministry of Health 2018). According to the Basic Health Research data in East Java Province, the prevalence of hypertension reached 36%, and the prevalence of hypertension in the city of Madiun reached 11.71% (Ministry of Health, 2016).

Hospital X is the Islamic hospital to provide optimal health services because the hospital become a primary choice of community in Madiun and surrounding areas by providing health services focus on Islamic service and patient safety and quality. One of the diseases with the highest prevalence suffered by elderly patients in hospital X was the hypertension prevalence in 2017 which was 8.97%. In 2018, the prevalence of hypertension was 186 patients in the inpatient and outpatients was 78 patient so the elderly patients needed special treatment to get useful and safe therapy.

Hypertension in elderly has some specificity, usually accompanied by more severe risk factors because the pathological condition is weakened. It is often followed by another disease which affects the handling of hypertension such as drug dosages, drug selection, side effects or complication. Elderly treatment of advanced hypertension is not treated to the maximum (reaching a target of less than 150/90 mmHg) because of the fear that the treatment side effects will outweigh the benefits. Besides, some factors influence the response of elderly patients to antihypertensive therapies such as atherosclerosis, cardiovascular changes due to degenerative processes, and decreased baroreflex responses (Suhardjono, 2014).

:Allah said in surah As-Syu'ara ayat 80

وَ إِذَا مَرِضْتُ فَهُوَ يَشْفِيْنِ

Which means: *"And when I get sick, He heals me."*

We as Muslims should trust that healing comes from Allah while the presence of medical personnel is healing as an intermediary because Allah created everything. If Allah will not heal, the recovery will not happen. We always have to pray and strive to seek health because Allah created diseases unless He also created an antidote.

Treatment of hypertension generally uses groups of drugs such as diuretics, β-blocker, Angiotensin Converting Enzyme Inhibitors (ACEI), Angiotensin Receptor Inhibitors (ARBs), and Calcium Channel Blocker (CCB). There is an alternative agent used to increase the effect of blood pressure reduction in patients who receive first-line therapy to reduce the risk of cardiovascular complications (JNC VIII, 2014).

The study was conducted to find out antihypertensive treatment therapy in geriatric patients because they have a weak physiological condition and susceptible disease that can cause multypathology. Moreover, the use of the drug must be considered as it can cause undesirable effects in long run.

1.2. Formulation of the Problem

Based on the background, there are formulations of the problem as follows:

1. How is the accuracy of indication of oral antihypertensive drugs for hospitalized geriatric patients in the period of July to December 2018 according to the Eight Joint National Committee (JNC VIII) 2014?
2. How is drugs accuracy of oral antihypertensive drugs for hospitalized geriatric patients in the period of July to December 2018 according to the Eight Joint National Committee (JNC VIII) 2014?
3. How is the dose accuracy of oral antihypertensive drugs for hospitalized geriatric patients in the period of July to December 2018 according to the Eight Joint National Committee (JNC VIII) 2014?

1.3. Objective of the Research

The research objectives are as follows:

1. To know the accuracy of indication of oral antihypertensive drugs for hospitalized geriatric patients in the period of July to December 2018 according to the Eight Joint National Committee (JNC VIII) 2014.
2. To know drugs accuracy of oral antihypertensive drugs for hospitalized geriatric patients in the period of July to December 2018 according to the Eight Joint National Committee (JNC VIII) 2014.
3. To know dose accuracy of oral antihypertensive drugs for hospitalized geriatric patients in the period of July to December 2018 according to the Eight Joint National Committee (JNC VIII) 2014.

1.4. Benefits of the Research

1.4.1. Theoretical Benefits

The study was conducted to determine the therapeutic evaluation of using oral antihypertensive drugs in geriatric hospitalized patients of hospital X in the period July-December 2018, which were reviewed from the right indication, right drug, and the right dose.

1.4.2. Practical Benefits

The research was expected to be useful as a reference source for further research related to improving pharmaceutical care for geriatric hypertensive patients, so they get the right health services and improve the pharmacist's image in choosing the most effective drugs for patients, from the right indication, medication, and dosage.

CHAPTER II

LITERATURE REVIEW

2.1. Review of Related Literature

The research carried out by Supraptia (2014) was about the problems related to antihypertensive drugs in elder patients in the geriatric poly of the RSUD Dr Soetomo, Surabaya. The results of the study still remained Drug-Related Problems (DRP) which could be prevented, namely actual DRP 3.2%. The existence of physiological changes, pharmacokinetics, and pharmacodynamics along with the aging process and the comorbidities let older patients get polypharmacy therapy. Judged from the achievement of blood pressure targets, 66.9% of patients had not reached the target.

The research conducted by Yosida (2016) was about the effectiveness of the use of antihypertensive drugs in the inpatient installation of the Bakung Ward in Panembahan Senopati Bantul Hospital in August 2015. In this study, 12 patients used antihypertensive drugs. The most cases were in female (53.8%) and geriatric group (75%). The single antihypertensive drugs used were more than 83.8%. The proportion of antihypertensive drug used gave patients sufficient because the patient achieved the therapeutic outcome on the patient's final day of treatment.

The research which conducted by Andriyana (2018) talked about evaluating the therapy of the use of antihypertensive drugs in geriatric patients at the inpatient installation of Dr Moewardi Surakarta. The results from 61 geriatric patients with hypertension who were given antihypertensive drugs at the inpatient installation of Dr Moewardi Hospital in 2016 found an 100% right indications, 100% right patients, 95.08% right drugs and 96.55% right dosages. Viewed from the single antihypertensive drug most widely used, amlodipine was 32.78%. Meanwhile, the most widely used of combination antihypertensive drugs in patients was amlodipine with candesartan at 19.67%.

2.2. Theoretical Basis

2.2.1. Geriatric

a. The Native of Geriatric

Aging is a process of disappearing the ability of a tissue to repair or replace itself and maintain its typical structure and function. The diseases suffered by geriatric patients are generally endogenic, multiple, chronic, atypical symptoms, without causing immunity, but they become more susceptible to other diseases or complications. The effect of drugs on the body of the geriatric raises a series of biochemical reactions in cells ranging from receptors to effectors. The cell biochemical process occurs and produces a cellular response in geriatric patients. The decrease is very significant in the mechanism of the homeostatic response which takes place physiologically (Darmojo, 2009).

b. Age Limit

There are the age restrictions that cover the age limit of the elderly according to WHO (2013), as shown below:

1. Elderly : 60-74 years
2. Old : 75-90 years
3. Very old : >90 years

c. Pathophysiology of Aging of the Cardiovascular System

The renin-angiotensin-aldosterone system (RAAS) may contribute to the age-associated to increase in nitric oxide (NO) inactivation. With aging, RAAS activity, the concentration of angiotensin II, and a principal RAAS effector cause the production increase of reactive oxygen species (ROS) by activating NADPH oxidase. Age-related to ROS production may promote vascular inflammation. Thus, aging associates with a concerted impairment in endothelial function disrupts arterial homeostasis, favouring chronic activation of pro-oxidant and proinflammatory pathways, and a shift toward a vasoconstrictor profile, predisposing to CVD and adverse events (Janic *et al*., 2014).

The increase of stiffness in central arteries particularly of the thoracic aorta also characterizes human vascular aging. Endothelial dysfunction and arterial stiffness are closely interconnected mediators of age-dependent vascular dysfunction. The stiffer the artery, the greater the exposure of the endothelium to hemodynamic load, promoting endothelial activation, inflammation, and damage. Age-related reductions in NO bioavailability may contribute to impaired arterial distensibility via changes in smooth muscle tone (Dikalov *et al*., 2013).

d. Pharmacological Changes Caused by Aging

1. Pharmacokinetics changes

   There are four components of pharmacokinetic changes, namely absorption, distribution, metabolism, and elimination. The parameters are important to ensure the proper design of the patient treatment regimen and the rationality of the drug and to prevent toxicity. The clinical implications for each parameter are used to consider the characteristic of the drug when predicts the extent to affected by the drug (Da Costa, 2019).

2. Pharmacodynamic changes

   Pharmacodynamic changes refer to changes in the drug response to time. The changes occur along with aging which is characterized by changes in organ systems, homeostatic function or receptors and cellular. In the cardiovascular system, the increase in demand for cardiac output required by moderate activity is successfully fulfilled until at least 75 years of age (in individuals without heart disease), but the increase is mainly due to an increase in stroke and not for tachycardia, as in young adults (Da Costa, 2019).

2.2.2. Hypertension

a. Definition and Classification

Hypertension is defined as the value of systolic blood pressure above 140 mmHg and diastolic blood pressure above 90 mmHg after a repeat examination at least two times which shows that blood pressure remains high at least one year. High blood pressure cannot be cured but it can be overcome in several ways like lifestyle changes and if necessary it can use drugs. Hypertension usually does not cause symptoms, so it is often called the "silent killer" (AHA, 2014). The classification of blood pressure for ages 18 years or older based on the American Heart Association (AHA) 2014 can be seen at Table 2.1.

Table 2.1. Classification of Hypertension

Category	Systolic	Diastolic
Optimal	<120 mmHg	<80 mmHg
Pre-Hypertension	120-139 mmHg	80-89 mmHg
Hypertension stage 1	140-159 mmHg	90-99 mmHg
Hypertension stage 2	≥160 mmHg	≥100 mmHg

American Heart Association, 2014

The blood pressure target for ages 18 years or older based on the Eighth Joint National Committee (JNC VIII), 2014 can be seen in Table 2.2.

Table 2.2. Blood Pressure Target

Population	Blood Pressure Target
<60 years	<140/90 mmHg
>60 years	<150/90 mmHg
Chronic kidney disease	<140/90 mmHg
Diabetes	<140/90 mmHg

Eighth Joint National Committee, 2014

There are two categories of hypertension according to their causes, namely primary (essential) and secondary (non-essential) hypertension:

1. Primary Hypertension

   95% of hypertension sufferers including primary hypertension as well as cause cannot be identified. The cause is a complex interaction between genetic factors and various environmental factors. The example is hyperactivity of the adrenergic nervous system, growth abnormalities in the cardiovascular and kidney systems, disorders of the renin-angiotensin-aldosterone (RAA), natriuresis disorders, and other factors including obesity, high salt, low potassium, excessive alcohol consumption, smoking, increased blood viscosity, use of non-steroidal anti-inflammatory drugs (NSAIDs) and metabolic syndrome (Kabo, 2011).

2. Secondary Hypertension

   Hypertensive sufferers (5-8%) are secondary hypertension, and the number is increasing due to more advanced examination techniques so the causes of hypertension are more common, including genetic factors, kidney, heart disease, pregnancy, renovascular hypertension, primary hyperaldosteronism. Therapy for secondary hypertension aims at improving the condition or eliminating the cause so if the cause is gone, hypertension will disappear (Kabo, 2011).

b. Epidemiology

   Figure 2.1 shows that the prevalence of non-communicable diseases in Indonesia especially hypertension increases significantly from 25.8% in 2013 to 34.1% in 2018. There were differences between diagnoses by health workers in 2013 reaching 25.8% while diagnosis by doctors obtained 34.1% in 2018. It can occur because the blood pressure meter used is sophisticated and able to diagnose well (Basic Health Research, 2018).

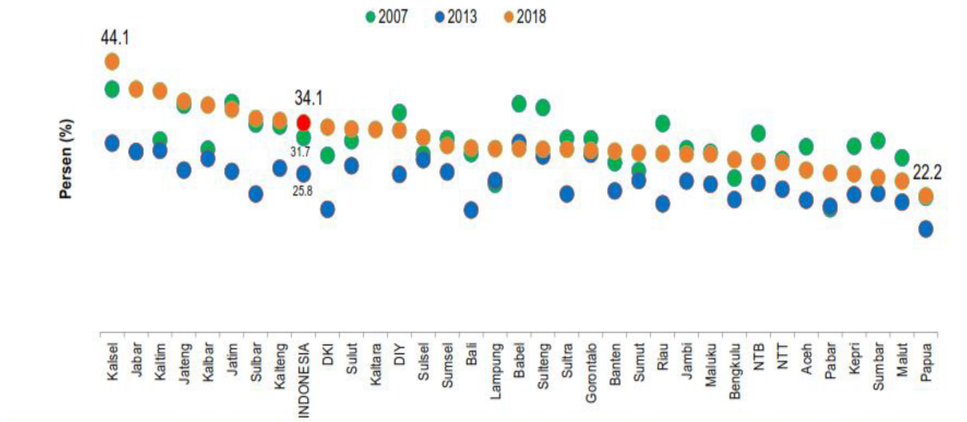


Figure 2.1. Prevalence of Hypertension is Based on the Results of Measurements on Residents Aged ≥18 Years According to the Province, 2007-2018

Figure 2.2 shows the prevalence of hypertension in residents aged ≥18 years. According to gender characteristics, women was higher than men. Men reached by 31.3% and women rose by 36.9%. The highest age is over 75 years because the increasing age also increases blood pressure (Basic Health Research, 2018).

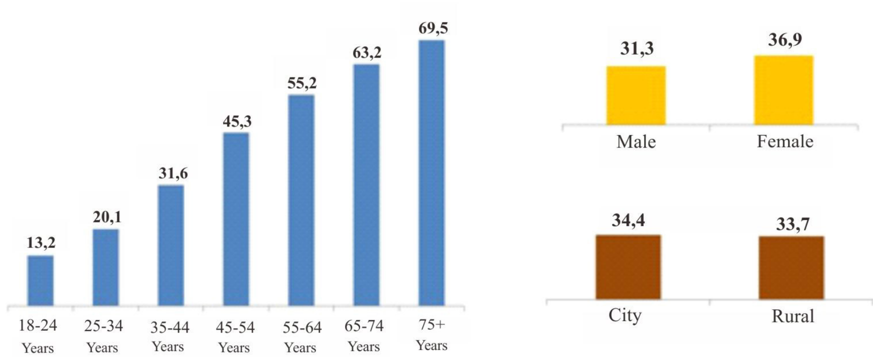


Figure 2.2. Prevalence of Hypertension (Doctor's Diagnosis) in Residents Aged ≥18 Years According to Characteristics, 2018

c. Pathophysiology

Blood pressure is determined by two main factors, namely cardiac output, and peripheral vascular resistance. Cardiac output is the product of a heart rate with a stroke volume, while a stroke is determined by venous return and the strength of myocardial contractions. Peripheral resistance is determined by vascular smooth muscle tone, vascular wall elasticity, and blood viscosity. The parameters are influenced by several factors including the sympathetic and parasympathetic nervous system, the renin-angiotensin-aldosterone system (RAAS) and local factors in the form of vasoactive materials produced by vascular endothelial cells (Dipiro *et al*., 2008).

The renin-angiotensin-aldosterone system (RAAS) is one of the most important hormonal mechanisms in controlling hemodynamic stability by regulating blood pressure, fluid volume, and sodium-potassium balance. Renin-angiotensin-aldosterone (RAA) is activated by renin secretion, which is a catalyst for the formation of angiotensin I from hydrolysis of angiotensinogen. Angiotensin I is hydrolyzed by angiotensin converting enzyme (ACE) to angiotensin II. Angiotensin II can cause vasoconstriction of blood vessels, aldosterone synthesis, sodium absorption, peripheral resistance, and cardiac output causing hypertension. The adrenal cortex is the part of the kidney that produces mineralocorticoid and glucocorticoid hormones, namely aldosterone, and cortisol. Excess aldosterone will increase water and sodium reabsorption, while excess cortisol will rise the synthesis of epinephrine and norepinephrine which act as vascular vasoconstrictors. Indirectly it will affect the increase in blood volume, cardiac output and cause an increase in total peripheral resistance (Dipiro *et al*., 2008).

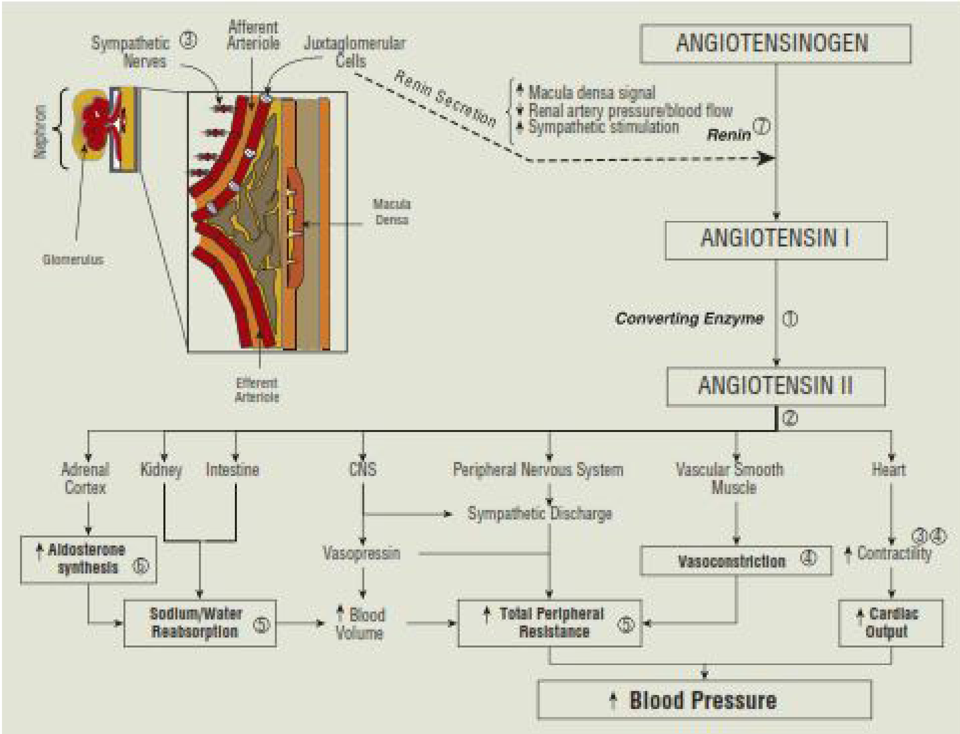


Figure 2.3. Renin-Angiotensin-Aldosterone System

d. Risk Factors

Hypertension has several risk factors. It can increase blood pressure, so the number of blood pressure becomes high. There are two types of risk factors for hypertension, namely:

1. Risk factors unmodifiable

a) Genetic

Genetic factors in families will have a risk of developing hypertension two times higher than families without a history of hypertension. Patients who have the genetic nature of primary hypertension (essential) naturally without therapeutic intervention, will get hypertension and they obtain the symptoms in 30-50 years old (Anggraini *et al*., 2009).

b) Age

The age factor is influential on hypertension because the aging increases the risk of hypertension. After the age of 45 years, the arterial wall will be thickened because of the accumulation of collagen in the smooth muscle layer of blood vessels, and then the blood vessels will gradually narrow and become stiff causing systolic blood pressure. Increased age will cause several physiological changes, such as increased peripheral resistance and sympathetic activity. Regulating blood pressure namely baroreceptor reflexes in the elderly will decrease in sensitivity, and kidney function has been reduced which causes renal blood flow and glomerular filtration rate to decrease (Anggraini *et al*., 2009).

c) Race

High blood pressure is more common in black people than white people, it develops at a younger. Black people found lower renin levels and higher sensitivity to vasopressin. Complications occuring in black people are the stroke, heart attack, and kidney failure (Mayo Clinic Staff, 2015).

d) Gender

Each gender has a different organ structure and hormones, so the risk of cardiovascular exposure in men is earlier than women. Men have a higher risk of cardiovascular morbidity and mortality. Meanwhile, women are usually more susceptible to hypertension when they are over 45 years old because premenopausal women still have the estrogen hormone which plays a role in increasing High-Density Lipoprotein (HDL). High of HDL levels can prevent atherosclerosis in women. Postmenopausal women estrogen hormones are no longer produced, so the risk of cardiovascular disease becomes higher (Anggraini *et al*., 2009).

2. Modifiable risk factors

a) Stress

Stress and hypertension can increase through sympathetic nerve activity and blood pressure intermittently. Stress will increase peripheral vascular resistance and cardiac output to stimulate sympathetic nerve activity that which trigger the work of the heart and cause an increase in blood pressure (Anggraini *et al*., 2009).

b) Smoking

Smoking can cause an increase of blood pressure. Nicotine in cigarettes could affect a person's blood pressure through atherosclerotic plaque formation, the direct effect of nicotine on the release of epinephrine and norepinephrine, carbon dioxide on erythrocytes (Setyanda *et al*., 2015).

c) Salt consumption

Salt affects hypertension through the increase plasma volume, cardiac output, and blood pressure. Sodium causes the body to retain water by exceeding the reasonable threshold of the body, so it can increase blood volume and pressure. The high sodium intake can cause adipocyte cell hypertrophy due to lipogenic processes in white fat tissue, so it will cause narrowing of blood vessel channels by fat and increase blood pressure (Susanti, 2017).

d) Obesity

Obesity is one of the factors that cause a variety of serious diseases including hypertension. Epidemiological studies mention a relationship between weight and blood pressure in both hypertensive and normotensive patients. Blood pressure was strongly influenced by obesity in the upper body with an increase in the amount of fat in the abdomen or centralized obesity (Susilo, 2010).

e).Clinical Manifestations

The clinical manifestation is evident from the patient's health or a risky condition for cardiovascular disease, namely: Age (over 55 years for men and over 65 years for women), diabetes mellitus, dyslipidemia, microalbuminuria, family history of cardiovascular disease too early, obesity (BMI ≥30 kg/m^2), physical activity, and smoking (Dipiro *et al*., 2008).

The symptoms in hypertension patients are asymptomatic. Hypertension causes symptoms such as headaches, shortness of breath, dizziness, chest pain, palpitations and epistaxis. However, with these symptoms, it does not guarantee that someone is diagnosed with hypertension (WHO, 2013).

f). Diagnosis

Diagnosis of hypertension requires several stages of examination that must be followed before determining the therapy. The diagnosis of hypertension can be divided into two classifications depending on the average blood pressure. Hypertension stage 1 occurs if the systolic blood pressure is 140-160 mmHg and the diastolic blood pressure is 90-100 mmHg. Hypertension stage 2 happens if the systolic blood pressure is ≥160 mmHg and the diastolic blood pressure is ≥100 mmHg. Identification of hypertension needs to be done to determine the underlying causes of hypertension such as conducting laboratory tests to know the secondary causes of hypertension (Dufton, 2011).

g). Complication

High blood pressure prolonged will damage the arterial endothelium and accelerate atherosclerosis. The complications from hypertension damage body organs such as the heart, eyes, kidneys, brain, and large blood vessels. The main risk factors of hypertension are a cerebrovascular disease (stroke, transient ischemic attack), coronary artery disease (myocardial infarction, angina), kidney failure, dementia, and atrial fibrillation (Dipiro *et al*., 2008).

h). Therapy

1. Non-Pharmacological Therapy

   The healthy lifestyle has been shown to reduce blood pressure and generally beneficial in reducing the risk of cardiovascular problems. In patients suffering grade 1 hypertension without other cardiovascular risk factors. A healthy lifestyle strategy is the initial management stage which must be applied for at least 4-6 months. If there is no reduction in the average blood pressure or other cardiovascular risk factors, it is highly recommended to start pharmacological therapy (Indonesian Cardiovascular Specialist Association, 2015).

2. Pharmacological Therapy

   According to JNC VIII (2014), the target of reducing blood in hypertensive patients varies depends on the complications and the rate of hypertensive patients. Hypertensive complications can affect various target organs, such as the heart (ischemic heart disease, left ventricular hypertrophy, heart failure), brain (stroke), kidney (kidney failure), eyes (retinopathy), and peripheral arteries (intermittent claudication). The organ damage depends on the high blood pressure of the patient and how long the high blood pressure is uncontrolled and untreated. The hypertension therapy algorithm is shown in Figure 2.3:

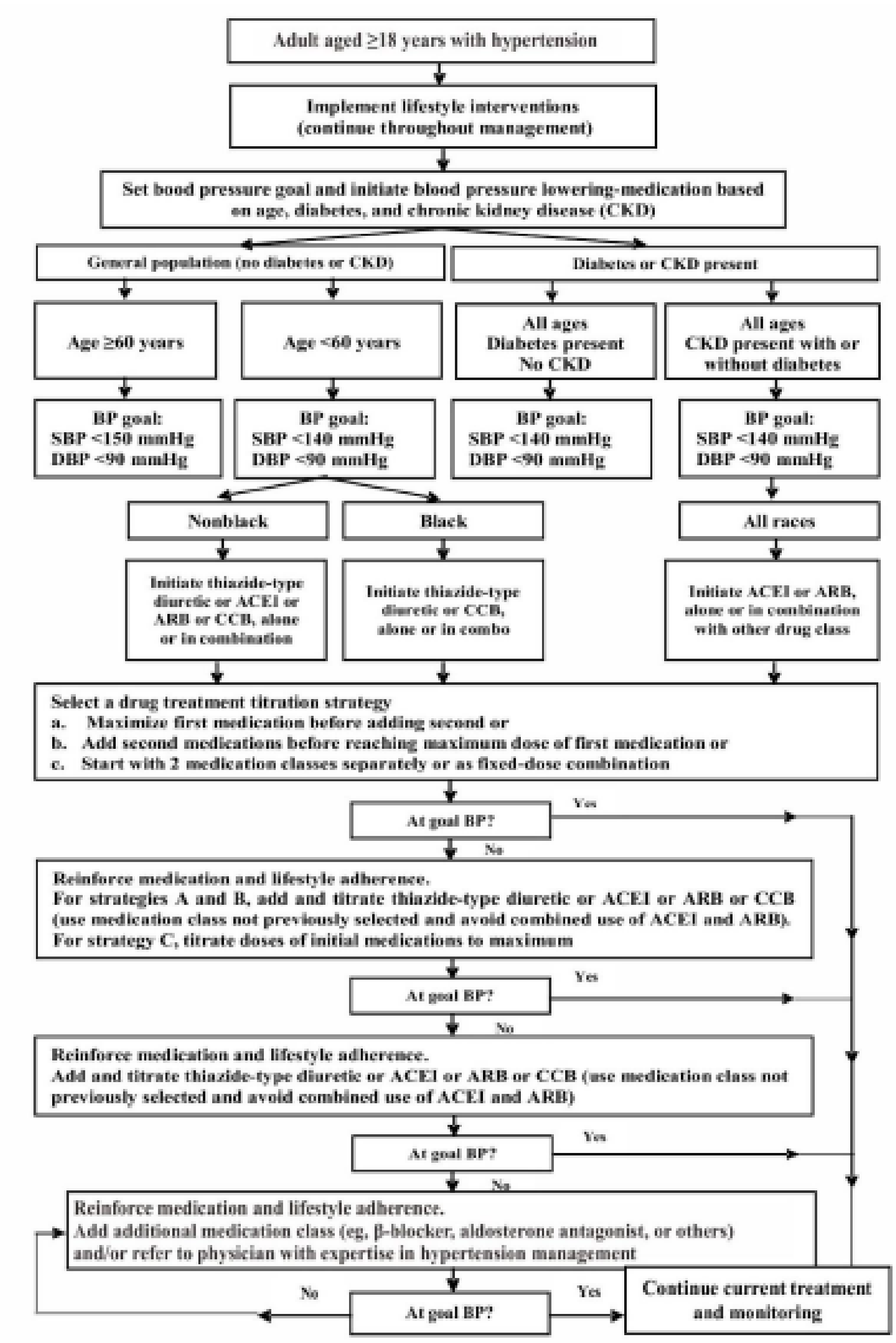


Figure 2.4. Hypertension Therapy Algorithm (JNC VIII, 2014).

Systolic blood pressure is obtained during cardiac contraction, and diastolic blood pressure is derived after contraction when the heart chamber is filled. Systolic blood pressure is associated with cardiovascular risk compared to diastolic blood pressure, so systolic blood pressure should be used as the primary clinical sign for controlling disease in hypertension. Most patients with hypertension need two or more antihypertensive drugs to reach the desired blood pressure target. The addition of the second drug from a different class begins when the use of a single drug with a standard dose fails to reach the blood pressure target (Ministry of Health, 2006).

According to the European Society of Hypertension (2013), the possible combination of classes of antihypertensive drugs can be seen in Figure 2.4 where continuous green lines: preferred combinations; green dashed line: useful combination (with some limitations); black dashed lines: possible but less well-tested combinations; continuous red line: not recommended combination. Although verapamil and diltiazem are sometimes used with a beta-blocker to improve ventricular rate control in permanent atrial fibrillation, only dihydropyridine calcium antagonists should normally be combined with beta-blockers.

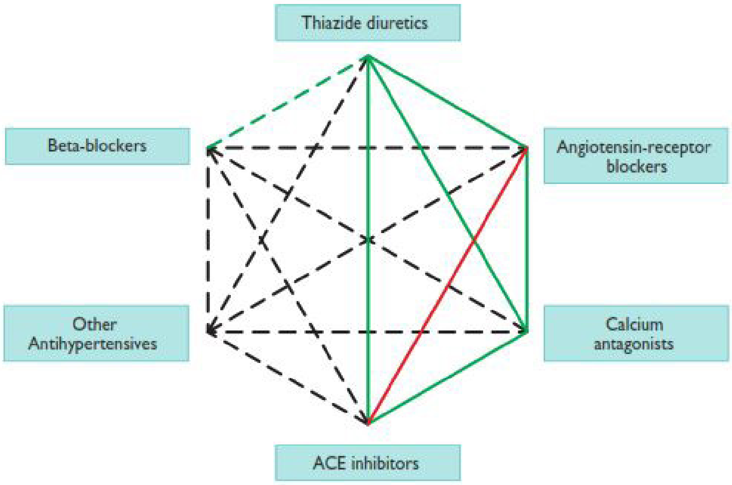


Figure 2.5. Antihypertensive Drug Combination (ESH, 2013).

According to the Eighth Joint National Committee (JNC VIII) 2014 the doses used in the treatment of hypertension therapy were shown in table 2.3.

Table 2.3. Standard of Oral Antihypertensive Doses

Class	Drugs	Usual dose range (mg/(day	Frequency/day
Diuretic	Hydrochlorothiazide	12,5-50	1
	Furosemide	20-80	2
	Spironolactone	25-50	2
ACEI	Captopril	12,5-150	2/3
	Lisinopril	10-40	1
	Imidapril	2,5-20	1
ARBs	Candesartan	8-32	1
	Valsartan	80-320	1
CCB	Amlodipine	5-10	1
	Nifedipine	30-90	1
β-blocker	Bisoprolol	2,5-10	1

Eighth Joint National Committee 2014

**ACEI: Angiotensin Converting Enzyme Inhibitor * ARBs: Angiotensin Receptor Blockers * CCB: Calcium Channel Blocker*

2.2.3. Antihypertensive Drugs

Medications commonly used to treat high blood pressure are as follows:

1. Diuretics

Diuretics consist of various types, such as thiazide diuretics, loop diuretics, and potassium-sparing diuretics. The effect of a diuretic drug is depletion of sodium, water, chloride in the body which mostly leads to a decrease of blood pressure. Thiazide diuretics are generally used as first-line antihypertensive drugs, while the other types of diuretics are given if there are any certain conditions. The mechanism of diuretics drugs in our body takes place in the kidneys, and they are adequately proven to be able to decrease the blood pressure.

Prescription of diuretics medications are grouped into three main types:

a. Thiazide Diuretics

The drug effects in the distal tubule of a kidney by inhibiting the normal reabsorption of sodium back to the blood vessel and therefore can increase its amount of excretion through urination. The effects of thiazide diuretics occur within 1-2 hours after the administration and maintaining this effect gradually up to 12-24 hours. Hence, the drug is sufficient to consume once a day. The antihypertensive effect at low doses and increasing the doses will not avail anything through it can increase only the diuretics effect. The effects of thiazide diuretics in the renal tubule depend on their level of secretion (Dipiro *et al*., 2008).

In consequence, this medication is less preferred to be prescribed for patients with impaired renal function. An example of thiazides is hydrochlorothiazide (HCT). HCT often uses in combination of other antihypertensive agents because it can boost the effectiveness of other drugs with a different mechanism, so the doses can be reduced. It also prevent fluid retention by the other agents, yet the effect of those drugs can still be maintained. The primary effect of thiazides is diuretics which increase urination and cause hyponatremia, hypokalemia, and hyperuricemia; therefore, it is not recomended to consume if there are contraindications (James *et al.*, 2014).

b. Loop Diuretics

The drug mainly affects the ascending part of the loop of Henle. Since this part has a large capacity to reabsorb NaCl, the capability of the diuretic effect from this drug is powerful too. Hence, loop diuretic scarcely uses an antihypertensive unless under certain conditions, such as pulmonary oedema, impaired renal function, and heart failure. An example of loop diuretics is furosemide which has side effects, such as hyponatremia, hypokalemia, hypomagnesemia causing arrhythmia, hyperuricemia, hyperglycemia, and increase level of Low-Density Lipoprotein (LDL) and triglyceride (Weber *et al.*, 2013).

c. Potassium-Sparing Diuretics

The drug affects the final distal tubules of the kidney and ductal colonies by inhibiting the mineralocorticoid receptor (spironolactone) and an influx of sodium through ion channels in the lumen membrane. The type of diuretic is considered as a weak diuretic and can cause hyperkalemia. The type of drugs is spironolactone which has an antagonist effect against aldosterone. The drug will bind to the aldosterone receptor and thereby reducing NaCl reabsorption. The aldosterone antagonist works depend on the kidney prostaglandins. When it is consumed together with NSAIDs (nonsteroidal anti-inflammatory drugs), the NSAIDs will inhibit potassium-sparing diuretics. The side effects of this drug include impotence, gynecomastia, and irregular menstruation (James *et al*., 2014).

2. *Calcium Channel Blocker* (CCB)

CCBs work by inhibiting the influx of calcium across the cell membrane. In smooth muscle, when the calcium canal is blocked, it causes a decrease in transmembrane calcium influx which causes weakening of tone and relaxation of vascular smooth muscle. This relaxation is a form of vasodilation. Arterioles are more sensitive than veins, so arterioles dilate faster and reduce peripheral resistance. In the heart muscle, it can interfere with the excitation-contraction process and also affect the conduction of the authoritarian cell of the heart. The effect of toxicity works if the drug works by inhibiting calcium channels in cardiac depression including heart failure, brachycardia, and AV blockade (Dipiro *et al*., 2008).

There are three classes of CCB namely dihydropyridine (nifedipine and amlodipine), phenylalanine (verapamil), and benzodiazepines (diltiazem). Dihydropyridine has peripheral vasodilator properties which are antihypertensive work whereas verapamil and diltiazem have cardiac effects and they are used to reduce heart rate and prevent angina. All CCBs are metabolized in the liver. The CCB group does not hurt lipid, glucose or uric acid profiles. The side effects of CCB include urinary retention and constipation due to the smooth muscles of the gastrointestinal tract and also experiencing relaxation, peripheral edema which usually occurs in the dihydropyridine group. Because arteriolar dilatation exceeds the vein, hydrostatic pressure increases and fluid leads to interstitial, bradyarrhythmia, conduction disturbances and gum hyperplasia (Weber *et al*., 2013).

3. *Beta Blocker (*β-blocker)

β-blockers have cardiac effects that reduce cardiac output and explain some of the antihypertensive effects. However, cardiac output falls equally in patients treated with β-blockers regardless of BP lowering. β-adrenoceptors are located on the surface membranes of juxtaglomerular cells, and β-blockers inhibit these receptors and thus the release of renin. However, there is a weak association with plasma renin and antihypertensive efficacy of β-blocker therapy. Some patients with low plasma renin concentrations do respond to β-blockers. Therefore, additional mechanisms must also account for the antihypertensive effect of β-blockers. However, the ability of β-blockers reduces plasma renin and thus angiotensin II concentrations may play a major role in their ability to decrease CV risk. Types of drugs β1 include atenolol, metoprolol, bisoprolol, and acebutolol (Dipiro *et al*., 2008).

4. *Angiotensin Receptor Blocker* (ARB)

The ARB drugs work by inhibiting the angiotensin I (AT1) receptor. AT1 receptors are in vascular smooth muscle, heart muscle, and some in the kidneys, brain, and adrenal glands. Whereas the AT2 receptor is present in the adrenal medulla and possibly in the central nervous system. The effects caused by AT1 receptor inhibition include vasodilation, decreased sodium retention, and increased blood potassium. ARB type drugs include valsartan, candesartan, irbesartan, telmisartan, and losartan. ARBs are not like ACEIs that inhibit angiotensin-converting enzymes, so there is no inhibition of the degradation of bradykinin and bradykinin to remain inactive metabolites. The causes of ARB does not cause the side effects of dry cough and angioedema (James *et al*., 2014).

5. *Angiotensin Converting Enzyme Inhibitor* (ACEI)

ACE inhibitors block the ACE (also termed bradykinase), thus inhibiting the conversion of angiotensin I to angiotensin II.

Angiotensin II is a potent vasoconstrictor that also stimulates aldosterone secretion, causes an increase in sodium, and waters reabsorption with accompanying potassium loss. By blocking the ACE, vasodilation and a decrease in aldosterone occur. ACE inhibitors also block the degradation of bradykinin and stimulate the synthesis of other vasodilating substances (prostaglandin E and prostacyclin). Increased bradykinin in BP-lowering effects of ACE inhibitors, also responsible for the side effect of dry cough. ACE inhibitors effectively prevent of left ventricular hypertrophy by reducing the direct stimulation by angiotensin II on myocardial cells (Dipiro *et al*., 2008). The example from ACEI is captopril that rapidly absorbed, but it has a short duration of work. Thus it is useful to determine whether a patient will respond well to ACEI. The first dose should be given at night because a sudden drop in blood pressure may occur. The effect will increase if patients have low sodium levels (Weber *et al*., 2013).

2.2.4. Evaluation of Drug Use

Evaluation of drug use is an activity whether to evaluate the use of drugs in a structured and sustainable manner to ensure the drugs effective, safe and affordable (rational). The evaluation of drug use aims at getting an overview of the pattern of drug use in some instances and conducting regular evaluations for the use of certain drugs (Health Ministry Regulations, 2016).

2.2.5. Conceptual Framework

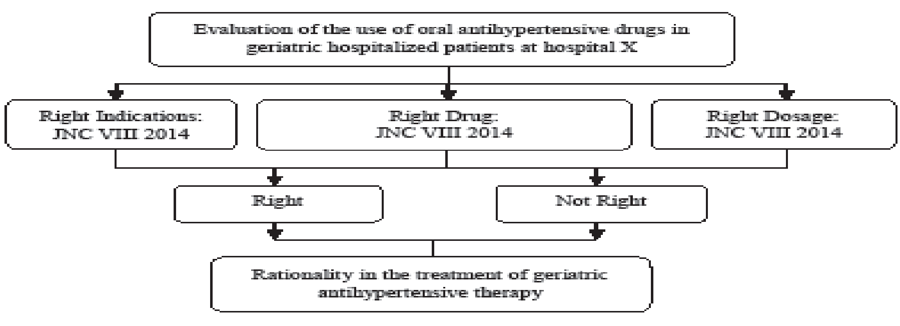


Figure 2.1. Conceptual Framework

CHAPTER III

RESEARCH METHODOLOGY

3.1. Research Design

The research was conducted using a descriptive non-experimental observational design, where the data was collected retrospectively. Data was taken from medical records of geriatric hypertensive hospitalized patients of hospital X in period July-December in 2018.

3.2. Time and Place of Implementation

The research was carried out at the hospital X by taking medical record data for geriatric hypertension hospitalized patients from December of 2018 to January of 2019.

3.3. Operational Definition

1. Descriptive research is research describing the phenomenon found as it neither analyzes how and why the phenomenon can occur nor requires a hypothesis.
2. An appropriate indication is the administration of drugs tailored to the symptoms and diagnosis of patients because the drug has a specific therapeutic spectrum.
3. Appropriate medicine is the accuracy to select drugs which are suitable for the drug choice which must be safe to conseme for patients.
4. Appropriate dosage is the accuracy administering doses of antihypertensive drugs which are suitable for geriatric patients.
5. Hypertension is a patient diagnosed with a systolic blood pressure of more than 140 mmHg and diastolic blood pressure of more than 90 mmHg.
6. Systolic blood pressure is the highest pressure when the heart

contracts and pumps blood through the arteries.

7. Diastolic blood pressure is the pressure when it falls to the lowest point in the artery.
8. Antihypertensive drugs are drugs used to treat hypertension in geriatric patients.
9. Geriatric patients are elderly patients (over 60 years of age) with multiple diseases or disorder due the decrease of organ function, psychology, social, economic and environmental.
10. Subjective data are data obtained through patients' perceptions, feelings, and ideas about their health problems.
11. Objective data are data obtained through observation and measurement or physical examination.

3.4. Population and Samples

1. Population Research

The population is a set of units which is usually in the form of people, objects, transactions or events in which researchers are interested in studying it further. The target population of this study was hypertensive patients in geriatrics who received antihypertensive therapy and registered at hospital X.

2. Research Samples

The sample used in the research were all patients diagnosed with geriatric hypertension and received antihypertensive treatment at Hospital X in 2018, with the following criteria as follows:

a. The inclusion criteria are the criteria where the research subject represents the research sample fulfiling the requirements as a sample. The inclusion criteria for the sample in this research are as follows:
   1) A patient diagnosed with hypertension
   2) Hypertensive patients with age above 60 years
   3) The hypertensive patient who had complications and without

complications

4) Patients who got antihypertensive drug therapy
5) Patients hospitalized from July to December 2018 at hospital X

b. The exclusion criteria is a criterion where the conditions cause subjects to fulfil the inclusion criteria which cannot be included. The exclusion criteria for the sample in this research are as follows:
    1) Unreadable patient medical record data
    2) Hypertensive patients who have already die

The sample used in the research was the medical record data of patients who had met the inclusion and exclusion criteria of:

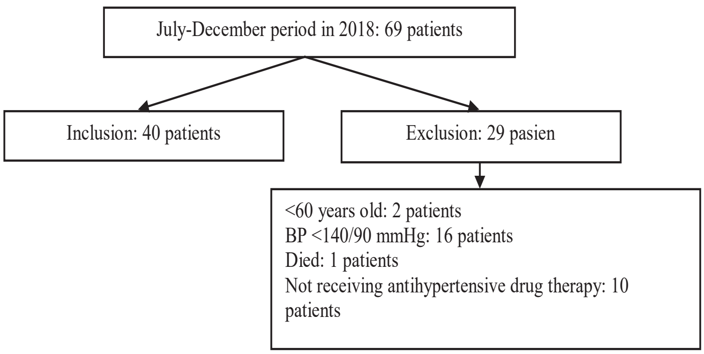


Figure 3.1. Chart of Research Data Acquisition

The formula for determining the sample was based on Slovin Formula (Sevilla *et al*., 2007):

$$n = \frac{\mathrm{N}}{1 + \mathrm{N}\, e^2}$$

$$n = \frac{69}{1 + 69\ 0{,}1^2}$$

$$n = 40$$

Information:

n = Total sample

N = Total population

E = Error tolerance limit

3.5. Research Procedure

1. Research Licensing

The research was conducted by submitting a research permit from the Department of Pharmacy, University of Darussalam Gontor to the director of the hospital X accompanied by a research proposal.

2. Observation

After obtaining a research approve at hospital X, observations were made by recording the patient's medical record to find out the number of patients diagnosed with hypertension in geriatrics and hospitalized.

3. Data Collection

The data were obtained from the collection of medical record data in geriatric patients hospitalized and treated antihypertensive therapy in period July to December in 2018. It was evaluated its rationality in antihypertensive treatment of geriatrics seen from the specific aspects of the drug, the right indications, and the right dose;. Then, the data were analyzed descriptively.

3.6. Data Analysis

The evaluation of data used antihypertensive drugs including patient accuracy, drug accuracy, and dose accuracy. An evaluation was carried out by comparing data on antihypertensive treatment in geriatrics with the research standards used. The data obtained were processed into a percentage form and presented in table form.

Data analysis in this study was descriptive non-experimental. Data obtained included medical record numbers, patient names, age, gender, blood pressure, primary and concomitant diagnoses, physical examination, drug administration data (drug name, dose, and frequency of administration). Then. it was grouped according to each distribution, into a percentage form and presented in table form.

3.7. Research Flow Chart

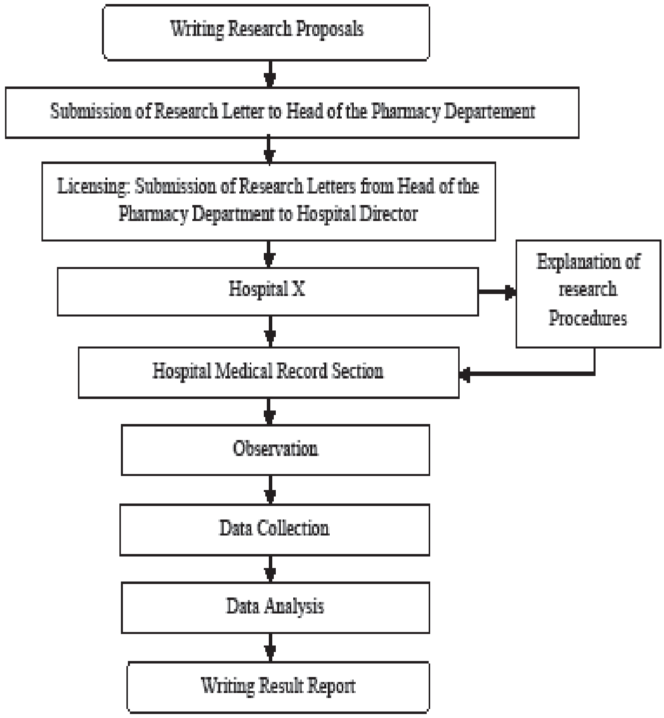


Figure 3.2. Research Flow Chart

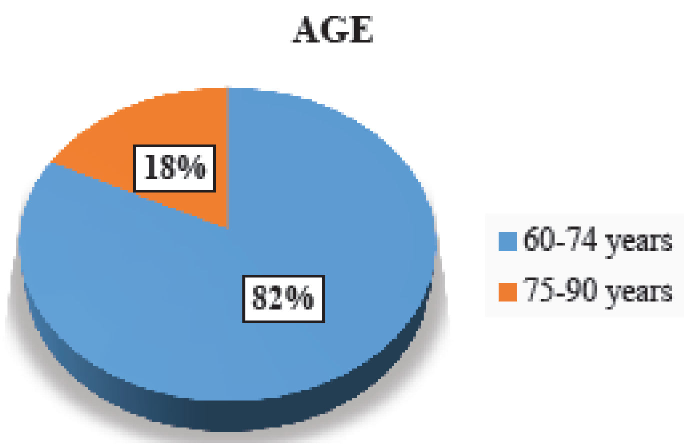
CHAPTER IV

RESEARCH FINDING AND DISCUSSION

4.1. Characteristics of Patients

4.1.1. Age

The demographics of patients based on geriatric age were divided into three groups: elderly (60-74 years), old (75-90 years) and very old (>90 years). The distribution of geriatric hypertension hospitalized patients at X hospital in the period July-December 2018 based on age can be seen in Figure 4.1. The incidence of hypertension was most prevalent in the elderly group, which reached 33 patients (82%). Furthermore, it occurred in the old group as many as seven patients (18%).



Hypertension is growing with increasing age more than 60 years old and above. The pathophysiology of geriatric hypertension begins with atherosclerosis, a peripheral vascular disorder that continues with blood vessel stiffness. The stiffness of blood vessels accompanied by narrowing and enlargement of plaques can inhibit peripheral circulatory disorders. The increasing age could increase in calcification or a shift in peripheral blood vessels, so its elasticity reduced followed by the increasing of peripheral vascular resistance and the increasing of blood pressure (Sarasaty, 2011).

Hypertension commonly occurred in a young adult man, but it occurred in a woman after the age of 45 years and associated with changes in the hormone estrogen after menopause. The role of the hormone estrogen was to increase HDL (High-Density Lipoprotein) levels which were a protective factor in preventing the occurrence of the atherosclerosis process. The protective effect of the hormone estrogen was considered as the presence of female immunity at premenopausal age. Premenopause women began to lose the hormone estrogen and caused damage (Anggraeni *et al*., 2009)

Geriatric hypertension was caused by lack of physical activity. Physical activity greatly influences the stability of blood pressure. Regular exercise had the effect of lowering blood pressure by around 6-15 mmHg in hypertensive patients. Isotonic and regular exercise could reduce peripheral resistance was into lower blood pressure. People who were not active to do physical activities tended to have a higher heart rate frequency. The results in the heart muscle pumping blood pressure higher on the arterial wall, and increasing peripheral resistance caused an increase in blood pressure. Lack of physical activity in geriatrics could cause stress (Afiah *et al*., 2018).

The stress increased peripheral vascular resistance and stimulated sympathetic nervous system activity which ended in hypertension. If stress occured, the epinephrine or adrenaline hormone would be released. Epinephrine hormone activity increased blood pressure regularly, and if stress occurs in long run, it will cause an increase in permanent blood pressure (Afiah *et al*., 2018).

Geriatric organs were very susceptible to disease due to a decrease in physiological systems. If hypertension occured for an extended period, it would cause damage to some organs and complications. These complications could attack several organs such as the eyes, brain, heart, arteries, and kidneys (Nuraini, 2015).

4.1.2. Gender

The patient's demographics by gender show that women are more than men. The distribution of hospitalized geriatric patients at hospital X in the period July-December 2018 based on gender can be seen in Figure 4.2 that geriatric hypertension patients in women are higher than men, women are 27 patients (68%) and men are 13 patients (32%).

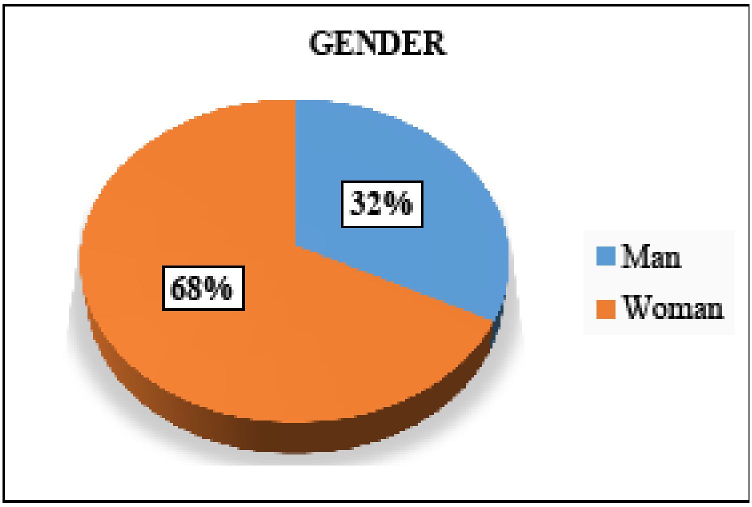


Figure 4.1. Gender Distribution

Every human had a different organ structure and hormones, so the risk of cardiovascular exposure in man was earlier than a woman. Man had a higher risk of cardiovascular morbidity and mortality because of a lifestyle like smoking and alcohol intake. Nicotine in cigarettes affected a person's blood pressure, through atherosclerotic plaque formation, the direct effect of nicotine on the release of the hormone epinephrine and norepinephrine, or through the effects of carbon monoxide in increasing erythrocytes. Carbon monoxide gas in cigarettes increased haemoglobin levels, so the supply of oxygen for tissues throughout the body including the heart muscle decreased. These gases interfere with the release of oxygen and accelerate the occurrence of atherosclerosis, so it would the cause increase of blood pressure (Setyanda *et al*., 2015)

Another lifestyle which affected hypertension was lack of physical. People who lack activity tended to have heart rate frequency higher, so the muscle of the heart worked harder on each contraction. The harder and the more frequent heart muscle pumped, the bigger pressure was imposed on the arteries. Regular exercise mades the heart healthy and it could avoid hypertension because hypertension was increased by blood pressure that gave symptoms to continue for a target organs, such as stroke for the brain, disease coronary heart for blood vessels heart and heart muscle. Epidemiological evidence showed that various cardiovascular risk factors could be suppressed by doing activities physical (Andria, 2013).

The prevalence of hypertension in men was similar to women. However, women were protected from cardiovascular disease before menopause. Thus, the high prevalence of hypertension in women often occured after menopause due to the cessation of the production of the hormone estrogen which resulted in the body being unable to maintain vasodilation. It could control blood pressure caused by the presence of psychological factors that women were more vulnerable to stress than men. The stress increased the hormone adrenaline and noradrenaline so blood vessels would narrow and cause blood pressure to increase. More women suffered from cardiovascular disease after menopause. The reduction of the hormone estrogen occurd after menopause. The hormone estrogen function was to protect women from cardiovascular diseases such as hypertension because it caused vasodilation of the heart arteries (Barton *et al*., 2009).

4.1.3. Diagnosis

Demographics of geriatric hypertension patients based on diagnostic classification consist of two types, hypertension stage I with systolic/diastolic blood pressure 140-159/90-99 mmHg and hypertension stage II ≥160/≥100 mmHg. The distribution of geriatric hypertension hospitalized patients at hospital X in the period July-December 2018 based on diagnosis can be seen in Figure 4.3 that hypertension stage II was higher than in hypertension stage I. Hypertension stage I was 6 patients (15%), and hypertension stage II was 34 patients (85%).

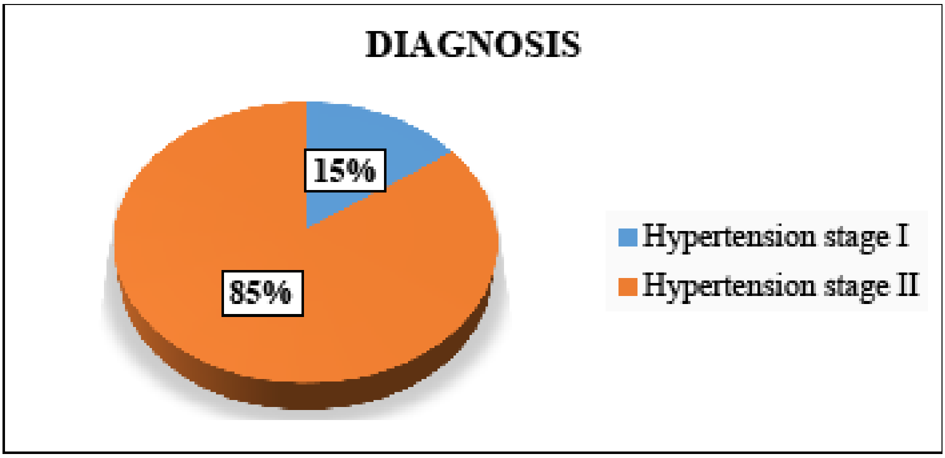


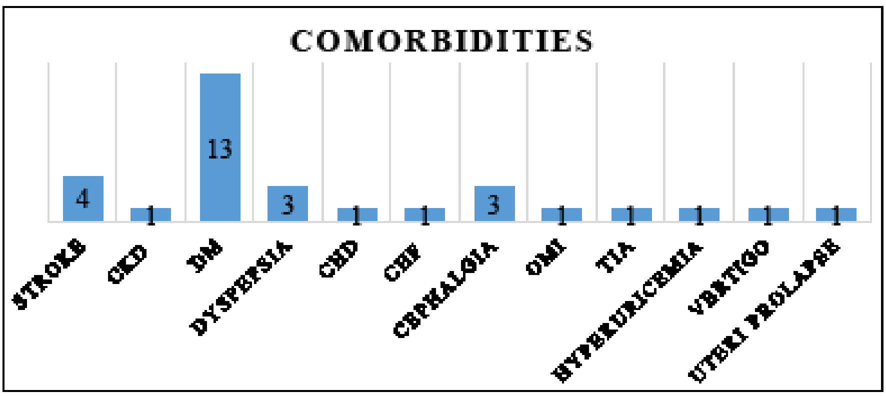
Figure 4.1. Diagnosis Distribution

The high incidence of geriatric hypertension could be caused by several factors such as hormonal changes, age, obesity, gender, family history, lack of physical activity, and stress (Wahyuningsih, 2013). Diagnosis of geriatric hypertension based on correct blood pressure measurements was carried out at least 3 different measurements of blood pressure and blood pressure performed on more than 2 visits. Diagnosis of hypertension needs to be done correctly and adequately to evaluate the treatment. Blood pressure measurement in geriatrics was often disrupted due to the physiology of the aging process (degenerative). In geriatric hypertension patients with blood pressure above 160 mmHg could be started by administering 1 type of antihypertensive drug and if needed can be added to other antihypertensive groups (Indonesian Cardiovascular Specialist Association, 2015). The patient hypertension stage 2 with blood pressure ≥160/90 mmHg, antihypertensive drug therapy must immediately begin with two combinations of drugs without waiting to see the effects of lifestyle changes (Weber *et al*., 2014).

Systolic blood pressure (SBP) should be the primary target for diagnosis and management of antihypertensive therapy in geriatric patients. The increase in SBP is responsible for increasing both the incidence and prevalence of hypertension, uncontrolled SBP would lead to an increase in cardiovascular disease and kidney disease so SBP patients should be considered in the provision of antihypertensive therapy to get the right treatment. Uncontrolled blood pressure would cause high blood pressure, causing complications such as coronary artery disease, stroke, congestive heart disease, chronic renal insufficiency, and dementia (Lionakis *et al*., 2012).

4.1.4. Comorbidities

The data on the distribution of comorbidities in geriatric hypertensive patients were shown in Figure 4.4. The results obtained from the research had the most complications with hypertension, namely in patients with diabetes mellitus as many as 13 patients (33%), followed by a stroke as many as 4 patients (10%). The other comorbidities were dyspepsia, cephalgia, CKD (Chronic Kidney Disease), CHD (Congestive Heart Disease), CHF (Chronic Heart Failure), OMI (Old Miokard Infark), TIA (Transient Ischemic Attack), hyperuricemia, vertigo, and uteri prolapse.



*CKD: Chronic Kidney Disease * DM: Diabetes Mellitus *CHD: Congestive Heart Disease

* CHF: Chronic Heart Failure *OMI: Old Miokard Infark *TIA: Transient Ischemic Attack

Figure 4.1. Comorbidities Distribution

Geriatric patients suffer from one or more chronic diseases which make the selection of appropriate antihypertensive therapy. Physiological changes occur in the geriatric cause the concentration of the drug to be more significant, the time for drug elimination to be longer, a decrease in function and response of organs, the presence of various other comorbidities, the treatment of comorbidities must be taken into account in the administration of antihypertensive drugs while biological changes in the geriatric will affect the interaction process of drug molecules that affect the benefits of clinical and pharmacotherapy.

The factors of occurring in complications of hypertension with diabetes mellitus, namely changes in blood sugar levels, high blood sugar would stick to the walls of blood vessels. Then an oxidation process occurs where blood sugar reacted with proteins from the walls of blood vessels that cause AGEs. AGEs (Advanced Glycosylated Endproducts) were substances formed from excess levels of sugar and protein that were mutually binding. It condition damaged the inner walls of blood vessels and also attracted saturated fat or cholesterol that attaches to the walls of blood vessels so an inflammatory reaction will occur. Leukocytes and platelets and other materials would unite and form plaques will make the walls of blood vessels stiff and hard, causing blockages resulting in changes in blood pressure (Tandra, 2009). The research conducted by Andriyana in 2018 also stated that the most results of complications with hypertension were diabetes mellitus and stroke. The hypertensive complications with diabetes mellitus were macrovascular and microvascular diseases compared to ordinary patients who did not suffer from diabetes mellitus (Berraho *et al*., 2012).

Another factor affecting hypertension was a stroke. Stroke was a disorder of acute neurological dysfunction caused by circulatory disorders and occurs suddenly with symptoms that did not match the disturbed focal area of the brain. In hypertension, several physiological disorders leaded to complications in the form of strokes. Disorders occured were changes in the structure of cerebral blood vessels, changes in cerebral blood flow, oxidative stress, inflammation, and arterial baroreflex dysfunction (Health Ministry Regulations, 2014).

4.2. Evaluation of the Use of Antihypertensive

4.2.1. Right Indications

The right indication is the administration of drugs tailored to the symptoms and diagnosis of patients because the drug has a specific therapeutic spectrum. Based on Table 4.1, it can be seen that the therapy in geriatric hypertension hospitalized patients at hospital X in the period July-December 2018 of 100% fulfil the accuracy of indications.

Table 4.1. Parameters of Right Indication

Case number	Subjective data	Objective data	BP	Diagnosis	Accuracy	
					R	NR
1	Decreased awareness, difficulty speaking, weak limbs	Cholesterol total ↑ Sodium ↓ ↓ Potassium	140/90	HT St 1	√	
2-15	Weak limbs, headache, decreased appetite, unable to speak, nausea, vomiting	Triglycerides ↑ Creatinine ↑↓ Cholesterol total ↑ ↑↓ LDL ↑ Gout ↓ Sodium ↓ Potassium	160/90-220/112	HT St 2	√	
16	Weak limbs, impaired speech	↑ Creatinine ↓ Sodium	140/90	HT St 1+ DM	√	

Case number	Subjective data	Objective data	BP	Diagnosis	Accuracy	
					R	NR
17-27	Spin dizziness, weak limbs, speech disorders, nausea, vomiting, abdominal pain, decreased consciousness	Triglycerides ↑ Creatinine ↑ Cholesterol total ↑ ↑↓ LDL ↑ Gout ↓↑ Sodium ↓ Potassium ↑ BUN ↑ GDP ↑ G2PP	160/90-210/100	HT St 2+ DM	√	
28	Neck pain	Creatinine ↑ ↑ BUN ↓ Sodium	150/100	HT St 2+ CKD+DM	√	
29-30	Weak limbs	↑ Sodium ↓↑ Creatinine	140-150/90	HT St 1+ Stroke	√	
31-32	Weak limbs, dizziness, nausea, vomiting, unconsciousness	Cholesterol total ↓↑ Triglyceride ↑↓GDP ↑ LDL ↑ Sodium ↓ ↑ Creatinine	160/90-190/110	HT St 2+ Stroke	√	
33	Spin dizziness, vomiting, tightness	↑ LDL	150/90	HT St 1+ Dyspepsia	√	
34	Vomiting, weakness, no appetite, dizziness, heartburn, bloating	LDL ↑ BUN ↑ ↑ Creatinine	170/100	HT St 2+ Dyspepsia +PJK+CHF	√	
35	Heartburn, nausea	↓ Potassium ↑ pH	160/90	HT St 2+ Dyspepsia+Cephalgia+OMI	√	

Case number	Subjective data	Objective data	BP	Diagnosis	Accuracy	
					R	NR
36-37	Headache	Triglycerides ↑ Creatinine ↑ ↓ Potassium Total cholesterol ↑ ↑ LDL ↑ Gout	160/100	HT St 2+ Cephalgia	√	
38	Feet feel stiff	Total cholesterol ↑ ↑ LDL ↑ Triglycerides ↑ GDP ↓ Potassium	170/100	HT St 2+ Hyperuricemia	√	
39	Spin dizziness, nausea, vomiting	BUN ↑ ↑ Creatinine	210/100	HT St 2+ Vertigo	√	
40	Weak limbs, unable to speak	↑ Gout	180/100	HT St 2+ uterine prolapse	√	
PERCENTAGE					**100%**	**0%**

The diagnosis of hypertension was established by looking at the condition of an increase in systolic blood pressure of more than ≥140 mmHg and diastolic ≥90 mmHg, history results and laboratory results. History results which were subjective data can be seen from the patient's complaints ranging from no symptoms to arousal, symptoms that usually occur namely pain or headache, anxiety, heart palpitations, dizziness, stiff neck, visual disturbances, nausea, vomiting, and pain in the chest. While the laboratory results or objective data should be monitored in patients with hypertension are hemoglobin, hematocrit, blood sugar and fasting blood sugar, total cholesterol, LDL (Low-Density Lipoprotein), HDL (High-Density Lipoprotein), triglycerides, potassium and sodium, urine, creatinine, and liver function (ESC, 2018).

The causes of hypertension increase in total cholesterol, LDL and triglyceride levels were characterized by dyslipidemia. Dyslipidemia was a risk factor for atherosclerosis in blood vessels due to the formation of plaques on the walls of blood vessels that cause blockages when pumping blood. However, HDL levels affected the occurrence of hypertension in geriatric women; this is due to hormonal changes, namely estrogen (Feryadi *et al*., 2012).

Associated with the body's electrolyte sodium levels in patients with hypertension were generally high so it will stimulate the brain to drink until the excess fluid in the body and would make the heart pump work also increase. The condition of hyperuricemia could also increase renin production. It happened because endothelial dysfunction occured causes arterial pressure to increase and low blood flow to the kidneys so the renin is secreted and activated SRAA (Mustafiza, 2010). As kidney function decreases, potassium might build up to high levels in the blood. It could be dangerous for the heart. Some of the best medicines for treating high blood pressure and preventing further loss of kidney function could also make the potassium go higher (National Kidney Foundation, 2010). Creatinine examination in the blood was done to assess kidney function because the concentration in plasma and its excretion in urine in 24 hours was relatively constant if the levels of urea and creatinine in high blood would cause complications (Setyaningsih, 2013).

4.2.2. Right Drug

Antihypertensive drugs were evaluated by looking at the suitability of drug therapy with the standard book of the Joint National Committee of Eighth Report in 2014. Evaluation of the accuracy of the drug was seen based on the right parameters of the drug evaluated according to the patients who received the drug by meeting the right indications. 40 cases met the criteria of the right indication so that all cases would be analyzed for the accuracy of drug use. The results of the accuracy analysis in the research were 40 drugs (100%).

Table 4.2. Parameters of Right Drug with the Diabetes Mellitus and Chronic Kidney Disease Comorbidities

Diagnosis	Drug	Group	Standard (JNC VIII, 2014)	Accuracy	
				R	NR
HT stage 1	Captopril	ACEI	Tunggal/kombinasi: Diuretik tiazid, ACEI, ARB, CCB	√	
HT stage 2	Amlodipine	CCB		√	
	Nifedipine			√	
	Valsartan	ARB		√	
	Candesartan			√	
	Captopril	ACEI		√	
	Lisinopril			√	
	Nifedipine+Candesartan	CCB+ARB	Tunggal/Kombinasi: Diuretik tiazid, ACEI, ARB, CCB	√	
	Amlodipine+Candesartan			√	
	Bisoprolol+HCT	BB+Diuretik	Betablocker, antagonis aldosteron/yang lainnya, titrasi obat diatas hingga maksimal	√	
	Lisinopril+Bisoprolol	ACEI+BB		√	
HT stage 2+DM	Captopril	ACEI	Tunggal/Kombinasi: Diuretik tiazid, ACEI, ARB, CCB	√	
	Amlodipine	CCB		√	
	Nifedipine			√	
	Candesartan	ARB		√	
	Captopril+Amlodipine	ACEI+CCB		√	
	Lisinopril+Amlodipine	ACEI+CCB		√	
	Amlodipine+Candesartan	CCB+ARB		√	
	Bisoprolol+HCT	BB+Diuretik	betablocker, antagonis aldosteron/yang lainnya, titrasi obat diatas hingga maksimal	√	
HT stage 2+ CKD+DM	Amlodipine	CCB	Tunggal/kombinasi ACEI/ARB dengan golongan lain)	√	
	Valsartan	ARB		√	
	Furosemide	Diuretik		√	

According to JNC VIII 2014, the comorbidities listed were Diabetes Mellitus (DM) and Chronic Kidney Disease (CKD). High blood pressure (BP) was the main cause of CKD. BP which could damage blood vessels so that it reduced the blood supply to important organs such as the kidneys. High BP also breaks down small filtration units in the kidneys so the kidneys could stop removing waste and extra fluid from the blood. Extra fluid on the blood vessel accumulated and increased blood even more. Kidneys that were sick. CKD disease makes blood pressure higher and could cause heart failure. Following a treatment plan and preventing blood pressure from being controlled could help prevent kidney disease from increasing and preventing heart disease (National Kidney Foundation, 2010).

Increased aldosterone production and augmented signalling through the mineralocorticoid receptor (MR) are also key events in the pathogenesis of hypertension. Corticosteroids might also contribute to CVD in DM patients via actions mediated in part through activation of the MR (Sowers, 2013). Adipose tissue was known to produce a lipid-soluble factor that stimulates aldosterone production from the adrenal zona glomerulosa. Aldosterone activation of the MR in the distal renal tubule and collecting duct increased sodium retention leading to an expansion of plasma volume and increased BP. In addition, aldosterone exerts non-genomic actions also likely through MR activation, which contributed to hypertension by altering cellular redox state, signalling and endothelial-mediated vascular relaxation. Thus, adipose tissue contributed to systemic elevations in BP, in part, through local production of components of the RAAS (Whaley *et al.*, 2010).

Table 4.3. Parameters of Right Drug with Other Comorbidities

Diagnosis	Drug	Group	Standard (JNC VIII, (2014	Accuracy	
				R	NR
HT stage 1+ Stroke	Captopril+ Nifedipine	ACEI+CCB	Single/combination: Thiazide diuretics, ACEI, ARB, CCB	√	
	Valsartan	ARB		√	
HT stage 2+ Stroke	Candesartan	ARB	Single/combination: Thiazide diuretics, ACEI, ARB, CCB	√	
	Amlodipine	CCB		√	
	Bisoprolol	BB	Beta-blocker, aldosterone antagonists, or other titrate the drug up to the maximum	√	
HT stage 1+ Dyspepsia	Bisoprolol	BB	Beta-blocker, aldosterone antagonists, or other titrate the drug up to the maximum	√	
	Valsartan	ARB	Single/combination: Thiazide diuretics, ACEI, ARB, CCB	√	
HT stage 2 + Dyspepsia + PJK + CHF	Amlodipine+ Imidapril	CCB+ACEI	ACEI/ARB, BB, Diuretik, Spironolakton	√	
	Bisoprolol+ Spironolactone	BB+Diuretik		√	
HT stage 2+ Dyspepsia+ Cephalgia+ OMI	Amlodipine	CCB	Single/combination: Thiazide diuretics, ACEI, ARB, CCB	√	
HT stage 2+ Cephalgia	Captopril	ACEI	Single/combination: Thiazide diuretics, ACEI, ARB, CCB	√	
	Amlodipine	CCB		√	
	Valsartan	ARB		√	
	Lisinopril+ Bisoprolol	ACEI+BB	Beta-blocker, aldosterone antagonists, or other titrate the drug up to the maximum	√	
HT stage 2 + Hyperuricemia	Amlodipine	CCB	Single/combination: Thiazide diuretics, ACEI, ARB, CCB	√	
	Captopril	ACEI		√	
	Nifedipine	CCB		√	

<table>
<tr><th rowspan="2">Diagnosis</th><th rowspan="2">Drug</th><th rowspan="2">Group</th><th rowspan="2">Standard (JNC VIII, (2014</th><th colspan="2">Accuracy</th></tr>
<tr><th>R</th><th>NR</th></tr>
<tr><td rowspan="3">HT stage 2+ Vertigo</td><td>Amlodipine</td><td>CCB</td><td rowspan="2">Single/combination: Thiazide diuretics, ACEI, ARB, CCB</td><td>√</td><td></td></tr>
<tr><td>Candesartan+ Captopril</td><td>ARB+ACEI</td><td>√</td><td></td></tr>
<tr><td>Bisoprolol+HCT</td><td>BB+Diuretik</td><td>Beta-blocker, aldosterone antagonists, or other titrate the drug up to the maximum</td><td>√</td><td></td></tr>
<tr><td rowspan="2">HT stage 2+ Uterine prolapse</td><td>Bisoprolol</td><td>BB</td><td>Beta-blocker, aldosterone antagonists, or other titrate the drug up to the maximum</td><td>√</td><td></td></tr>
<tr><td>Amlodipine+ Candesartan</td><td>CCB+ARB</td><td>Single/combination: Thiazide diuretics, ACEI, ARB, CCB</td><td>√</td><td></td></tr>
<tr><td colspan="4">PERCENTAGE</td><td>100%</td><td>0%</td></tr>
</table>

ACEI was an antihypertensive group that could inhibit ACE (Angiotensin-Converting Enzymes) activity, so it could reduce the formation of angiotensin II. Mechanism of ACEI was slow down the renal prognosis due to diabetes and non-diabetes. ACEI had a direct cardiovascular protective effect through a decrease in angiotensin II work and an increase in bradykinin, in this connection ACEI had anti-atherosclerotic effects, reduces plaque formation, and improves endothelial function (Rasyid *et al*., 2014).

ARB worked by inhibiting the angiotensin I receptor. The effects of AT1 receptor inhibition were vasodilation, decreased sodium retention, and increased blood potassium. ARBs were not the same as ACEI which inhibit ACE, so there is no inhibition of the degradation of bradykinin and bradykinin to remain inactive metabolites. It does not cause the side effects of dry cough and angioedema (James *et al*., 2014).

One of the oral antihypertensive groups had clinical management of hypertension. Both monotherapy, and combination were the CCB group which was effective and safe in reducing blood pressure with good tolerance. CCB works by dilating arteries by reducing the flow of calcium into cells to reduce blood pressure effectively, especially when the class of drugs was combined with other drugs. The CCB could be used to reduce blood pressure in all groups of patients, regardless of gender, race, age, and intake of sodium in food (Elliott *et al*., 2011).

ARB combination with CCB shows effectiveness, could be well tolerated and safe to use for the treatment of uncontrolled hypertension (Miura, 2012). Clinical studies showed that in patients at high risk for cardiovascular disease and patients with renal failure, the use of ARB therapy with CCB was superior because it acted as renoprotective and reduced metabolic side effects in patients with metabolic disorders (Mallat, 2012). The combination of amlodipine with candesartan is the right combination because both works with different mechanisms to reduce blood pressure. Drugs with different working mechanisms can control blood pressure by minimizing the occurrence of toxicity. The combination of the two types of groups can help prevent diabetic nephropathy in patients with diabetes mellitus who are complicating hypertension. Side effects such as peripheral edema due to the administration of a single CCB are significantly decreased if combined with ARB (Mallat *et al*., 2013).

The combination of ACEI and CCB has a neutral metabolic effect. The combination of these two groups is often used in hypertensive patients with heart failure, left ventricular dysfunction, post-myocardial infarction, high risk of coronary heart disease, diabetes, chronic renal failure and stroke prevention (Rasyid *et al*., 2014).

Bisoprolol was a second generation beta blocker selectively which was a β-1 (cardioselective) antagonist receptor. Bisoprolol worked by slowing heart activity by stopping the message (neurotransmitter) sent by the sympathetic nerve to the heart. It is done by blocking the beta-adrenergic receptors. As a result, the heart beated more slowly so the blood pressure in the blood vessels decreased and the heart would be more relaxed to pump blood throughout the body. Bisoprolol was given to patients with stable conditions characterized by the absence of excess fluid (edema). Bisoprolol is usually given in addition to ACEI or diuretics, starting with a low dose of 1.25 mg/day and then increasing every few weeks until the target dose of blood pressure is reached at 10 mg/day (Rachman, 2014). Bisoprolol was often combined with HCT because bisoprolol has the effect of increasing serum potassium levels while HCT decreases serum potassium levels. If diuretics and beta blockers were combined, thus could increase the risk of hyperglycemia and hypertriglyceridemia in some patients, especially in patients with diabetes. Although these two antihypertensive groups were often combined in therapy, they had to monitor serum potassium levels, blood pressure, and blood glucose (Setyawati, 2017).

4.2.3. Right Dosage

Evaluation of the dose accuracy needs to be done to determine the amount of dose and frequency of administration, especially for drugs with a narrow therapeutic index based on the Eighth Joint National Committee (JNC VIII) 2014 guidelines. Based on Table 4.3 from the use of antihypertensive drugs there were 35 cases (88%) and no exact dose of 5 cases (12%).

Table 4.4. Parameters of Dosage

Drug	Dose	Frequency	Standard (JNC VIII 2014)	Case number	Accuracy	
					R	NR
HCT	25	1x1	25-50 1x	4,8,9,27,39	√	
Furosemide	80	1x1	20-80 2x	29	√	
Spironolactone	100	1x1	25-100 2x	34	√	
Captopril	25	3x1	12,5-150 2 or 3x	1,17,29	√	
		1x1		39	√	
	12,5	3x1		5,19,38	√	
		2x1		35	√	
Lisinopril	10	1x1	10-40 1x	8,9,13,16,37	√	
Imidapril	10	1x1	2,5-20 1x	34	√	
Candesartan	16	1x1	8-32 1x	4,5,11,24,28,39	√	
	8	1x1		40	√	
		2x1		31	√	
Valsartan	80	1x1	80-320 1x	3,7,28,30,32,37	√	
Amlodipine	10	1x1	2,5-10 1x	2,3,4,8,10,13,28,32,34, 35,38	√	
		2x1		27		√
	5	1x1		9,11,15,19,21,24	√	
		2x1		20	√	
Nifedipine	5	3x1	30-90 1x	5		√
		2x1		38		√
	10	3x1		2,12,29	√	
		2x1		6,23		√
Bisoprolol	2,5	1x1	2,5-10 1x	4,8,9,13,27,32,33,34,37 ,39,40	√	
PERCENTAGE					88 %	12 %

Patients with case number 27 were treated with amlodipine 10 mg 2x1, which was more than the dose of the Eighth Joint National Committee (JNC VIII) 2014 guidelines, the therapeutic dose is 2.5-10 mg/day. Excessive dose of amlodipine was not recommended for the treatment of hypertension with diabetes complications. The same case in the study of Untari *et al*. in 2015 was the excessive doses of amlodipine were 20 mg/day compared to the usual dose of 2.5-10 mg. High drug dosages could cause drug levels in the blood to exceed the range of therapies and cause toxicity. Giving drugs without the standards can have a broad impact on patients. If the drug dosage listed on the prescription was not up to standard, it might cause complications (Indonesian Cardiovascular Specialist Association, 2015).

According to the Eighth Joint National Committee (JNC VIII) 2014, the standard dose of nifedipine was the initial dose of 30-60 mg/day, and the maximum maintenance dose was 120 mg/day. In patients with case number 5 suffering from hypertension stage 2 and patient number 38 suffering from hypertension stage 2 with hyperuricemia getting nifedipine 5 mg with a frequency of 2x1 and 3x1, which was too low in the standard dose of 30-90 mg/day. Using low doses than the recommended dosage could cause unwanted effects. If the therapeutic effect was not achieved then the goal of treatment would also not be achieved. Moreover the drug became ineffective for the patient (Chasanah, 2012).

The low frequency of drug therapy was the frequency of drug administration which was lower than the recommended frequency in the standard. According to the Eighth Joint National Committee (JNC VIII) 2014, the standard dose of nifedipine was the initial dose of 30-90 mg/day, and the maximum maintenance dose was 120 mg/day. Cases with number 6 suffered from hypertension stage 2 and patient number 23 suffered from hypertension stage 2 with DM receiving a 10 mg dose of nifedipine with a frequency of 2x1. If the frequency of drug administration was lower than the recommended frequency in the standard, it could result in sub-doses (blood drug levels were below the minimum effect concentration) (Chasanah, 2012).

CHAPTER V

CONCLUSIONS AND SUGGESTIONS

5.1. Conclusions

The research evaluation of antihypertensive drugs use in geriatric hospitalized patients of hospital X in the period July-December 2018 give the results as follows:

1. 40 patients (100%) with the right indications obtain the drug according to the diagnosis.
2. 40 patients (100%) getting the right drug met JNC VIII 2014 standard.
3. 35 patients (88%) gaining the drug dosage accurately adjusted to JNC VIII 2014 standards.

5.2. Suggestions

Based on the research of evaluation the using of antihypertensive drugs in geriatric hospitalized patients of Hospital X in the period July-December 2018, there are some suggestions as follows:

1. To analyze laboratory results for calculate doses in geriatrics.
2. To monitor the development of blood pressure after therapy.
3. To monitor pathophysiological conditions from pharmacokinetics and pharmacodynamics aspects.
4. To conduct a propective study to monitor the treatment of patients from the beginning to the end of treatment.

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APPENDIX

Appendix 1. Medical Record Data of Geriatric Hypertension Hospitalized Patients of Hospital X, July-December Period 2018

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
1	5614	Marem	15-09-2018/ 24-9-2018	63	F	140/90	HT stage 1	-	Decreased awareness, difficulty speaking, weak left body	HB 11,6 L Platelets 443 H Eosinophil 6,7 H MPV 4,5 L Cholesterol total 220 H Sodium 133 L Potassium 2,7 L Chloride 92 L Calsium 0,98 L	Captopril	25	3x1
2	31217	Suyatno	3-12-2018/ 12-12-2018	60	M	160/100	HT stage 2	-	Dizzy spin, left leg weak	Leukocytes 10,7 Monocytes 9,2 MPV 4,9 L PDW 18,7 H Triglycerides 231 H Creatinine 0,76 L Potassium 3,1 L	Amlodipine Nifedipine	10 10	1x1 3x1
3	30842	Sikem	15-12-2018/ 20-12-2018	64	F	160/90	HT stage 2	-	Rheumatic pain, headache, decreased appetite	Potassium 3,3 L Leukocytes 10,6 H Lymphocytes 9,0 L MPV 3,9 L PDW 18,3 H	Amlodipine Valsartan	10 80	1x1 1x1

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
4	24847	Salikin	22-08-2018/ 02-09-2018	69	M	190/100	HT stage 2	-	Can't talk, stiff hands can't be moved	Platelets 415 H Eosinophil 8,0 H MPV 4,5 L LDL 130 H Creatinine 1,34 H Gout 8,5 H	Candesartan Amlodipine Bisoprolol HCT	16 10 2,5 25	1x1 1x1 1x1 1x1
5	23802	Rohmat	31-07-2018/ 08-08-2018	64	M	170/100	HT stage 2	-	Speech disorder, weak right foot	Triglyceride 172 H	Captopril Nifedipine Candesartan	12,5 5 16	3x1 3x1 1x1
6	31385	Marmi	25-12-2018/ 29-12-2018	78	F	210/100	HT stage 2	-	Weakness, pain in the legs, cannot be bent	HB 11,8 L Leukocytes 15,2 H Neutrophils 90,3 H Lymphocytes 4,7 L MPV 4,1 L PDW 18,4 H LDL 119 H Triglyceride 182 H Creatinine 0,51 L Potassium 3,1 L	Nifedipine	10	2x1
7	30154	Jahman	7-12-2018/ 11-12-2018	62	M	170/100	HT stage 2	-	Weak left body	Leukocytes 11,9 H LDL 117 H Triglyceride 174 H	Valsartan	80	1x1
8	29871	Tuminem	26-11-2018/ 30-11-2018	65	L	220/100	HT stage 2	-	Weak left body	Cholesterol 264 H LDL 180 H HB 10,7 L	Amplodipin Lisinopril Bisoprolol HCT	10 10 2,5 25	1x1 1x1 1x1 1x1

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
										Platelets 463 H			
										MCH 24,1 L			
										MCHC 29,0 L			
										PDW 18,1 H			
										Potassium 2,9 L			
										Chloride 90 L			
										Calsium 0,93 L			
9	28669	Siti Romelah	01-11-2018/ 06-11-2018	64	F	220/112	HT stage 2	-	Unable to speak, headache	Potassium 3,1 L	Amlodipine	5	1x1
										Calsium 1,01 L	Lisinopril	10	1x1
										Cholesterol total 140 L	Bisoprolol	2,5	1x1
											Hct	25	1x1
10	27514	Sumiati	13-10-2018/16-10-2018	74	F	170/100	HT stage 2	-	Dizziness, nausea, vomiting	PDW 18,4 H	Amlodipine	10	1x1
										Sodium 131 L			
										Calsium 0,96 L			
										LDL 121 H			
11	27473	Sukinem	12-10-2018/ 17-10-2018	69	F	170/100	HT stage 2	-	Dizziness, weak body right, nausea, vomiting, headache	Leukocytes 11,5 H	Amlodipine Cansedartan	5 16	1x1 1x1
										Neutrophils 86,4 H			
										Lymphocytes 7,9 L			
										MPV 4,8 L			
										Cholesterol total 206 H			
										LDL 143 H			
										Creatinine 2,16 H			
										Gout 6,2 H			
12	27450	Umi Kaltum	11-10-2018/ 18-10-2018	67	F	160/90	HT stage 2	-	Weak limbs	MPV 4,2 L	Nifedipine	10	3x1
										Cholesterol total			

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
										LDL 177 H Triglyceride 164 H Sodium 133 L Potassium 2,5 L			
13	25773	Karsini	16-09-2018/ 24-09-2018	65	F	204/100	HT stage 2	-	Weak left body	HB 10,9 L Leukocytes 9,2 H Hematocrit 34,9 L MCV 77,2 L MCH 24,1 L MCHC 31,2 L Potassium 3,3 L Calsium 1,05 L HDL 36 L LDL 112 H Triglyceride 148 H Gout 7,3 H	Amlodipine Lisinopril Bisoprolol	10 10 2,5	1x1 1x1 1x1
14	26001	Warji	17-09-2018/ 24-09-2018	63	M	200/120	HT stage 2	-	Unable to speak, tingling in both legs	HDL 33 L LDL 111H Triglyceride 192 H Gout 7,9 H MCHC 31,4 L PDW 19,2 H Creatinine 1,81 H Calsium 1,08 L	Amlodipine	5	1x1
15	22314	Sadikin	26-7-2018/ 4-8-2018	62	L	174/115	HT stage 2		Weak body left	Creatinine 1,52 H	Amlodipine Candesartan	10 16	1x1 1x1

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
16	27069	Suparno	5-10-2018/ 10-10-2018	67	M	140/90	HT stage 1	DM	Weak body left, speech disorder	Leukocytes 16,1 H	Lisinopril Amlodipine	10 5	1x1 1x1
										Neutrophils 89,0 H			
										Lymphocytes 4,7 L			
										MPV 4,8 L			
										Creatinine 1,77 H			
										Sodium 133 L			
17	061469	Sutinah	26-07-2018/ 30-07-2018	78	P	185/97	HT stage 2	DM	Decreased awareness	Leukocytes 9,5 H	Amlodipine	10	1x1
										Hematocrit 35,8 L			
										PDW 18,4 H			
										Calsium 0,89 L			
										GDP 125 H			
18	25251	Wahyuningsih	30-08-2018/ 01-09-2018	73	F	170/90	HT stage 2	DM	Vomiting, dizziness spinning	PDW 18,3 H	Captopril	25	3x1
										Sodium 132 L			
										Calsium 1,03 L			
										GDP 247 H			
19	174864	Jainem	17-08-2018/ 04-09-2018	73	F	190/100	HT stage 2	DM	Limp, unwilling to eat, nausea, abdominal pain	HB 11,1 L	Captopril Amlodipine	12,5 5	3x1 1x1
										Leukocytes 18,7 H			
										Hematocrit 34,3 L			
										Erythrocytes 3,40 L			
										PDW 18,4 H			
										Creatinine 1,46 H			
										BUN 24,00 H			
										Potassium 3,2 L			
20	29729	Suparmi		64	F	200/100		DM		MCHC 31,7 L	Amlodipine	5	2x1

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
			22-11-2018/ 28-11-2018				**HT stage 2**		**Weakness of 1/2 right body**	MPV 18,8 H Cholesterol total 149 L Calsium 0,98 L			
21	28938	Samadiyanto	07-11-2018/ 10-11-2018	85	M	210/100	HT stage 2	DM	Dizziness, nausea, vomiting	HB 9,5 L Hematocrit 30,1 L Erythrocytes 3,32 L MCHC 31,6 L PDW 18,1 H Creatinine 1,77 H Calsium 1,07 L	Amlodipine	5	1x1
22	28427	Ngaisah	04-11-2018/ 09-11-2018	61	F	173/96	HT stage 2	DM	Limp 1/2 right body	HB 11,9 L Erythrocytes 5,78 H MCV 65,9 L MCH 20,6 L MCHC 31,2 L Cholesterol total 141 L GDP 130 H G 2 hours PP 135 H Sodium 3,2 L Calsium 1,08 L	Amplodipin	10	1x1
23	29890	Sani	26-11-2018/ 28-11-2018	73	F	200/110	HT stage 2	DM	Dizziness, nausea, vomiting	HB 11,6 L Leukocytes 13,3 H MCHC 30,1 L Neutrophils 90,5 H	Nifedipine	10	2x1

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
										Lymphocytes 5,3 L MPV 4,7 L PDW 18,6 H Cholesterol 220 H LDL 135 H Calsium 1,02 L			
24	24299	Karni	10-11-2018/ 14-10-2018	60	F	180/90	HT stage 2	DM	Unconscious	GDP 143 H G 2 jam PP 194 H Lymphocytes 9,1 L Triglyceride 280 H Albumin 3,44 L BUN 3,8 L Gout 7,0 H Sodium 159 H Calsium 1,39 H	Amlodipine	5	1x1
25	23313	Siyem	19-7-2018/ 23-7-2018	69	F	160/90	HT stage 2	DM	Speech disorder	Monocytes 10,4 H Potassium 3,1 L	Candesartan	16	1x1
26	27462	Nasirotun	27-10-2018/ 2-11-2018	69	F	170/90	HT stage 2	DM	Stomach ache	HB 11,8 L Platelets 421 H Hematocrit 35,1 L Lymphocytes 9,5 L PDW 19,6 H Sodium 131 L Chloride 92 L Calsium 1,07 L	Amplodipin	10	1x1

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
27	23305	Marni	19-7-2018/ 28-07-2018	65	F	210/100	HT stage 2	DM	Decreased consciousness, weakness	Leukocytes 13,4 H Erythrocytes 2,68 L HB 8,2 L Hematocrit 24,8 L Neutrophils 90,6 H Lymphocytes 3,8 L PDW 18,1 H BUN 59,5 H Creatinine 4,13 H	Amlodipine Candesartan Bisoplrolol HCT	10 16 2,5 25	2x1 1x1 1x1 2x1
28	24533	Rebo	15-09-2018/ 28-09-2018	68	M	150/100	HT stage 2	CKD DM	Right neck pain	HB 9,8 L Hematocrit 28,5 L Erythrocytes 3,40 L MPV 4,9 L Creatinine 15,10 H BUN 78,5 H Sodium 130 L Calsium 0,90 L	Amlodipine Valsartan Furosemid	10 80	1x1 1x1 1x1
29	54869	Saman hudi	30-10-2018/ 11-11-2018	68	M	150/90	HT stage 1	Stroke	Left leg limp	HB 11,4 L Leukocytes 9,2 H Hematocrit 34,1 L MCV 76,8 L MCH 25,7 L Lymphocytes 8,0 L Creatinine 1,85 H	Captopril Nifedipine	25 10	3x1 3x1

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
										Sodium 162 H			
										Chlorida 81 L			
										Calsium 1,43 H			
30	27138	Sri Sunarsih	07-10-2018/ 12-10-2018	64	F	140/90	HT stage 1	Stroke	Weak limbs	Leukocytes 10,9 H	Valsartan	80	1x1
										MCHC 29,2 L			
										MPV 4,1 L			
										PDW 18,3 H			
										Sodium 132 L			
										Calsium 1,03 L			
										Cholesterol total 144 L			
										Gout 2,3 L			
31	25280	Winarko	4-10-2018/ 6-10-2018	80	M	160/90	HT stage 2	Stroke	Dizziness, right limb disorders	HB 9,8 L	Candesartan	8	2x1
										Leukocytes 11,2 H			
										Hematocrit 32,0 L			
										MCV 77,5 L			
										MCH 23,7 L			
										MCHC 30,6 L			
										Neutrophils 86,3 H			
										Lymphocytes 5,1 L			
										MPV 3,9 L			
										Cholesterol total 120 L			
										Triglyceride 39 L			
										GDP 140 H			
										Sodium 129 L			

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
										Calsium 0,95 L			
32	27553	Samiten	20-10-2018/ 31-10-2018	65	F	190/110	HT stage 2	Stroke	Unconscious, dizzy, vomiting	HB 11,9 L Cholesterol total 211 H LDL 131 H Triglyceride 204 H Creatinine 1,49 H Calsium 1,06 L	Amlodipine Bisoprolol Candesartan	10 2,5 16	1x1 1x1 1x1
33	10390	Sukijan	16-08-2018/ 21-08-2018	60	M	150/90	HT stage 1	Dyspepsia	Spinning dizziness, vomiting, abdominal pain in the middle, tightness	Leukocytes 10,7 H Lymphocytes 10,4 L PDW 19,6 H LDL 135 H Calsium 1,09 L	Bisoprolol Valsartan	2,5 80	1x1 1x1
34	7476	Matori	02-07-2018 /09-07-2018	72	M	170/100	HT stage 2	Dyspepsia CHD CHF	Vomiting, weakness, lack of appetite, dizziness, stomach pain in the pit of the stomach, bloating	Leukocytes 14,8 H MCHC 31,9 L Lymphocytes 31,9 L PDW 18,1 H HDL 30 L LDL 125 H BUN 23,8 H Creatinine 1,49 H Calsium 1,08 L	Amlodipine Imidapril Bisoprolol Spironolakton	10 10 5 100	1x1 1x1 1x1 1x1
35	30983	Karti Suyami	17-12-2018/ 21-12-2018	76	F	160/90	HT stage 2	Dyspepsia cephalgia OMI	Heartburn, nausea	HB 11,6 L Hematocrit 32,8 L Erythrocytes 3,74 L	Amlodipine	10	1x1

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
										Monocytes 14,2 H PDW 18,9 H SGPT 32,7 H Potassium 3,0 L pH 7,0 H			
36	28542	Kasih	31-10-2018/ 5-11-2018	80	F	160/100	HT stage 2	Cephalgia	Headache	HB 10,9 L Leukocytes 3,9 L Hematocrit 32,8 L Erythrocytes 3,40 L MCH 32,1 H Triglyceride 141 H Creatinine 1,25 H	Captopril	12,5	2x1
37	26438	Djuminah	25-9-2018/ 4-10-2018	67	F	230/100	HT stage 2	Cephalgia	Spinning dizziness, vomiting, weak body before left, tingling	HB 12,2 H Leukocytes 13,9 H MCHC 31,8 L PDW 18,3 H Potassium 3,2 L Cholesterol total 259 H LDL 170 H Triglyceride 148 H Gout 5,9 H	Amplodipin Valsartan Lisinopril Bisoprolol	10 80 10 2,5	1x1 1x1 1x1 1x1
38	27568	Soemarsini	15-10-2018/ 24-10-2018	63	F	170/100	HT stage 2	Hyperuricemia	Feet feel stiff	Leukocytes 10,0 H MCV 78,2 L MCH 25,3 L	Amlodipine Captopril Nifedipine	10 12,5 5	1x1 3x1 2x1

No	MR number	Name	Date of treatment	Age	Gender	BP	Main diagnose	Comorbidities	History	Laboratory results	Drug	Dose	Frequency
										Cholesterol total 216 H LDL 123 H Triglyceride 207 H GDP 133 H Potassium 3,2 L			
39	23613	Eko Yuliarini	26-7-2018/ 28-7-2018	60	F	200/100	HT stage 2	Vertigo	Dizziness, nausea, vomiting	HB 9,7 L Hematocrit 29,5 L Erythrocytes 3,10 L MPV 5,1 L PDW 19,5 H Neutrophils 83,1 H Lymphocytes 11,9 L BUN 56,6 H Creatinine 6,31 H Chloride 110 H Calsium 1,13 L	Amplodipin Candesartan Captopril Bisoprolol HCT	10 16 25 2,5 25	1x1 1x1 1x1 1x1 1x1
40	22951	Ropiyah	11-07-2018/ 16-07-2018	82	F	180/100	HT stage 2	Uteri prolapse	Weak body before right, can't talk	Leukocytes 9,3 H HB 11,7 L PDW 18,1 H Cholesterol 140 L HDL 36 L Gout 5,9 H	Bisoprolol Amplodipin Candesartan	2,5 10 8	1x1 1x1 1x1