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The Effect of Antihypertensive Drugs on Blood Pressure in Preeclamptic Women at RSIA Ananda Makassar in 2020-2022

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Abstract

Background: The maternal mortality rate (MMR) in Indonesia is still very high, especially maternal mortality where in 2015 the maternal mortality rate (MMR) in Indonesia reached 305 per 100,000 live births caused by bleeding, infection and preeclampsia. This study aims to determine the effect of administering antihypertensive drugs on the blood pressure of preeclamptic mothers at RSIA Ananda Makassar in 2020-2022. Method: Quantitative research with a cross-sectional research design using a total sampling technique, where the number of samples is the same as the population. The samples in this study were mothers diagnosed with preeclampsia at the Ananda Mother and Child Hospital in Makassar, taking into account the inclusion and exclusion criteria. The number of samples in this study was 80 people. Result: Data analysis was carried out univariate and bivariate. Bivariate analysis of the effect of administering antihypertensive drugs on initial and discharge systolic blood pressure using the Wilcoxon test obtained a P-value <0.01 and for initial and discharge diastolic blood pressure a P-value <0.01 was obtained. Changes in decreasing systolic blood pressure using the Mann Whitney test obtained a P-value of <0.01 and diastolic blood pressure obtained a P-value of 0.027 Conclusion: There is an effect of administering antihypertensive drugs on the blood pressure of preeclamptic mothers at RSIA Ananda Makassar in 2020-2022.

Keywords**: **Preeclampsia, Antihypertensive Drug, Blood Pressure

INTRODUCTION

One of the leading causes of maternal mortality is preeclampsia, which is the main cause of death, illness in mothers, premature birth, perinatal death, and intrauterine growth restriction in pregnancy cases worldwide. In 2019, the number of maternal deaths due to preeclampsia reached 4,221, with most of these deaths caused by hypertension in pregnancy, which reached 1,066 deaths.[1]

Preeclampsia is a specific syndrome in pregnancy characterized by reduced organ perfusion, leading to vasospasm and endothelial dysfunction, marked by blood pressure ≥ 140/90 mmHg and proteinuria ≥ 300 mg/24 hours or a urine dipstick result of ≥ 1+. Preeclampsia can occur at 20 weeks of gestation or after delivery, characterized by elevated blood pressure. Preeclampsia commonly occurs in first pregnancies, pregnancies in adolescents, and pregnancies over the age of 40. Pregnancies with trophoblast cell invasion preeclampsia only occur in some spiral arteries in the myometrium, causing placental dysfunction, so that the placenta does not meet the blood supply needs for oxygen nutrition to the fetus. ([2])

Preeclampsia is a specific hypertensive disorder that occurs during pregnancy, developing in the second or third trimester as a complication in 2%–7% of pregnancies. Preeclampsia can be characterized by hypertension, edema, and proteinuria. Preeclampsia is a potentially dangerous pregnancy complication involving high blood pressure. High blood pressure during pregnancy is one of the greatest threats to both the mother and the fetus.[3]

Blood pressure is the force required for blood to flow through blood vessels and circulate throughout the human body. An increase or decrease in blood pressure will affect homeostasis in the arteries, arterioles, capillaries, and venous system. Blood pressure is never constant; it can change drastically in a matter of seconds. Blood pressure is divided into two types: systolic

and diastolic. Systolic blood pressure is the pressure when the heart contracts to pump blood throughout the body, while diastolic blood pressure is the pressure when the heart relaxes before pumping blood again. Hypertension occurs when systolic pressure is >120 mmHg and diastolic pressure is >80 mmHg. Both systolic and diastolic blood pressure increase with age. ([4] The management of preeclampsia in pregnant women is an interesting topic to discuss, as is the appropriate management of pregnant women with high blood pressure in order to reduce maternal mortality due to hypertension in pregnancy.

RESEARCH METHODS

The type of research conducted in this study was quantitative research with a *cross-sectional* design, which involved collecting data on independent and dependent variables simultaneously. The research was conducted in the working area of the Ananda Makassar Mother and Child Hospital for two months, namely in November-December 2023, with a sample size equal to the population size, namely mothers with a diagnosis of preeclampsia, taking into account the inclusion and exclusion criteria. The sample size in this study was 60 people. The data obtained was then analyzed using the *Statistical Package for the Social Sciences (*SPSS) application. The univariate analysis discussed the distribution and presentation of the variables. The bivariate analysis used the Wilcoxon test and the Mann-Whitney test to determine the effect of antihypertensive medication on the blood pressure of mothers with preeclampsia.

RESULTS AND DISCUSSION

Univariate Analysis

Table 1 Frequency Distribution Based on Maternal Age, Gestational Age, Parity, Diagnosis, and Antihypertensive Medication

Characteristics Sociodemographic	Number	Percentage
	n	%
Mother's age		
18-20 years	2	2.50
21-40 years	73	91.25
>41 years old	5	6.25
Gestational age		
Second trimester	29	36.25
Third trimester	51	63.75
Parity		
Nulliparous Primigravida	7 23	8.75 48.75
Primipara	32	40
Multipara	16	20
Grande-Multipara	2	2.5
Diagnosis		
Preeclampsia Mild	23	28.75
Preeclampsia Severe	57	71.25

Medication **Antihypertensive** Nifedipine Nifedipine+$MgSO_4$	24 56	30 70
Total	80	100

Source: Secondary Data

Table 1 shows the distribution of maternal characteristics based on age, gestational age, parity, diagnosis, and antihypertensive medication. The majority of mothers were in the 21-40 age group, with 73 individuals (91.25%). The majority of gestational ages were in the third trimester, with 51 individuals (63.75%). Parity is mostly comprised of primiparous mothers, with 39 women (48.75%). Diagnosis is mostly severe preeclampsia, with 32 women (40%). Antihypertensive medication use is mostly nifedipine + $MgSO_4$, with 56 women (70%).

Bivariate Analysis Normality Test

The Kolmogorov-Smirnov normality test was conducted to determine whether the data obtained was normally distributed. The Kolmogorov-Smirnov normality test was used in this study because the sample size was more than 50. Based on the results of the Kolmogorov-Smirnov normality test, the data obtained was not normally distributed, with a sig. value of < 0.01. Therefore, the Wilcoxon test will be performed to see whether there is a difference in the effect of the independent variable on the dependent variable.

Table 2 Effect of Antihypertensive Drug Administration on Initial and Discharge Systolic Blood Pressure

	TDSA	TDSP	
Medicine Antihypertensive			*P-value*[*]
	Median (min-max)	Median (min-max)	
Nifedipine	140 (140-160)	115 (110-140)	<0.01
Nifedipine + MgSO4	170 (150-210)	120 (110-130)	<0.01

[*] Wilcoxon test

SBP: Initial Systolic Blood Pressure DBP: Discharge Systolic Blood Pressure

The results of the Wilcoxon test for antihypertensive drugs showed a *P-value* <0.01, indicating that the administration of antihypertensive drugs had an effect on the systolic blood pressure of preeclamptic mothers in both antihypertensive drug groups.

Table 3 Effect of Antihypertensive Drug Administration on Initial and Discharge Diastolic Blood Pressure

Antihypertensive Medication	TDDA	TDDP	*P-value*[*]
	Median (min-max)	Median (min-max)	
Nifedipine	100 (90-100)	80 (70-90)	<0.01
Nifedipine + MgSO4	100 (80-140)	80 (70-100)	<0.01

[*] Wilcoxon test

TDDA: Initial Diastolic Blood Pressure TDDP: Discharge Diastolic Blood Pressure

The results of the Wilcoxon test for antihypertensive drugs showed a *P-value* of <0.01, indicating that antihypertensive drugs had an effect on the diastolic blood pressure of preeclamptic mothers in both antihypertensive drug groups.

Table 4 Changes in Blood Pressure Reduction Based on Antihypertensive Drugs

Blood Pressure	Change in Blood Pressure Reduction		P-Value
	Nifedipine	Nifedipine + $MgSO_4$	
ΔTDS (mmHg) Median (min-max)	30 (20-40)	50 (20-90)	<0.01
ΔTDD (mmHg) Median (min-max)	21 (13-25)	20 (0-40)	0.027

The Mann-Whitney test results showed that combination therapy with nifedipine + $MgSO_4$ reduced blood pressure more than nifedipine therapy alone. The more antihypertensive drugs used in combination, the greater the difference in blood pressure between admission and discharge. The reduction in systolic blood pressure with nifedipine + $MgSO_4$ therapy was 50 mmHg, while the reduction in systolic blood pressure with nifedipine therapy was 30 mmHg, with a *P-value* <0.01. Meanwhile, nifedipine therapy reduced diastolic blood pressure more than nifedipine + $MgSO_4$ combination therapy, with nifedipine therapy reducing diastolic blood pressure by 21 mmHg and nifedipine + $MgSO_4$ combination therapy reducing diastolic blood pressure by 20 mmHg with a *P-value of 0*.027.

DISCUSSION

The results of the sample obtained were grouped into Table 1 to obtain an overview of patients according to the age of the pregnant mother and the age of the pregnancy. The group of pregnant women with preeclampsia in the 21–40 age category accounted for 91.25%. This occurred because age is an important part of reproductive status. Age is related to the rise and fall of bodily functions, which affects a person's health status, especially pregnant women. This study is in line with research conducted on the decline in reproductive health. At this age, other diseases are more likely to be found in pregnant women, one of which is hypertension. The process of reproductive organ degeneration will have a direct impact on the condition of the mother during pregnancy and childbirth, including , and preeclampsia. However, this study is in contrast to the research conducted by (Mustofa et al, 2021), which found that mothers under the age of 20 have reproductive organs that are still developing, resulting in a decline in organ function and possibly causing preeclampsia. This is because in younger women, the development of reproductive organs is not yet complete and estrogen hormone production is not yet optimal, while in older women, there is a possibility of narrowing of the arteries in the kidneys and uterus, which can cause hypertension during pregnancy.[5,10]

Table 1 shows that multiple pregnancies occurred in 32 primiparous patients (40%). Preeclampsia can occur in primiparous pregnant women because some of them have a history of hypertension before pregnancy, which can increase the risk of preeclampsia sevenfold, and older age can also influence primiparity. This study is in line with research conducted by (Hermawati Dewi 2020), which found that preeclampsia can occur in primiparous and multiparous pregnant women, especially if there are other predisposing factors such as older age. Older multiparous women are at risk for cardiovascular disease and a decline in bodily functions, which can lead to faster development of preeclampsia. This study contrasts with research conducted by (Mariati Piska, 2022), which found that preeclampsia is more common in primigravida or women who have never given birth and is a risk factor for preeclampsia

because in the first pregnancyfirst there is an incomplete formation of blocking antibodies against placental antigens, leading to an unfavorable immune response. Primigravida is associated with a lack of maternal knowledge about pregnancy care. Maternal knowledge about pregnancy care.[6]

Tables 2 and 3 present data on the administration of nifedipine therapy at an initial systolic blood pressure and initial diastolic blood pressure of 140/115 mmHg and a decrease in blood pressure upon discharge to 100/80 mmHg (normal). Blood pressure upon discharge was measured when the patient was about to leave, so the results of the hypertension therapy could be seen. In this study, the Wilcoxon test yielded a P-value <0.01, meaning that the administration of nifedipine had an effect on the blood pressure of mothers with preeclampsia. The mechanism of action of nifedipine is to relax the heart and smooth muscles by inhibiting calcium influx across the cell membrane, thereby inhibiting the entry of calcium from the extracellular space into the cell. The inhibition of calcium influx causes a decrease in blood vessel muscle contraction, resulting in vasodilation and a decrease in blood pressure. Similarly, other therapies also showed a decrease in patient blood pressure. This study is in line with research conducted by (Kundarto & Faizah, 2021), which states that the antihypertensive drug nifedipine is more effective than methyldopa because nifedipine is a calcium channel blocker. Calcium channel inhibition will result in a decrease in heart rate and ultimately reduce blood pressure. Nifedipine is an ideal drug for treating preeclampsia because it has a rapid onset, can be administered orally, and is effective in lowering blood pressure without causing harmful side effects. This study contrasts with research conducted by Saputri Gusti Ayu Rai (2020), which found no effect of nifedipine use on the blood pressure of mothers with preeclampsia. The administration of nifedipine was not at the correct dosage, so the reduction in blood pressure was less effective. The use of a drug is considered rational if the patient receives the drug according to their clinical needs, i.e., the correct indication, the correct dosage, the correct method of administration, and the correct patient with preeclampsia.[7]

Tables 2 and 3 present data on the administration of combination therapy with nifedipine + MgSO4 on initial systolic and diastolic blood pressure of 170/100 mmHg, which decreased to 120/80 mmHg (normal). In this study, the Wilcoxon test yielded a P-value <0.01, indicating that the administration of nifedipine had an effect on the blood pressure of mothers with preeclampsia. The combination of these two drugs works by inhibiting calcium influx and smooth muscle contraction in the heart, thereby causing arterial relaxation and lowering blood pressure. This study is in line with the research conducted by (Putri D, 2022), which states that the use of combination therapy, namely nifedipine and $MgSO_4$, is the right choice for treating hypertension in preeclamptic mothers compared to the use of single therapy because combination therapy reaches the target more quickly with a lower dose and blood pressure decreases rapidly. This study contrasts with research conducted by (Azizah Sitti, 2019), which found no effect of combination therapy with nifedipine and $MgSO_4$ due to an increase in maternal heart rate (tachycardia), resulting in more mothers experiencing complications, as well as a decrease in blood pressure that was too low, affecting the condition of the mother and fetus.[3,5,8,15]

Table 4 shows that the use of antihypertensive drugs, namely combination therapy with nifedipine + $MgSO_4$, is more effective in mothers with severe preeclampsia and can lower systolic blood pressure by 50 mmHg compared to single therapy, which can lower blood pressure by 30 mmHg. Some mothers with preeclampsia require one, two, or three additional antihypertensive drugs to adequately manage blood pressure, with monotherapy blood pressure targets that work through a single mechanism being less effective and the administration of drugs in combination therapy depending on accompanying factors such as the presence of comorbidities, namely diabetes mellitus and kidney disorders. Hypertension

in pregnant women must be closely monitored to reduce maternal and fetal morbidity and mortality by avoiding risks that can trigger high blood pressure, preventing transmission of viruses, preventing seizures, and considering pregnancy termination if the mother or fetus are in danger. Administration of antihypertensive drugs to mothers with preeclampsia should begin when systolic blood pressure is ≥ 130 or diastolic blood pressure ≥ 80 mmHg.[9]

Based on research data, data analysis, and discussion, it was found that the administration of antihypertensive drugs had an effect on the blood pressure of preeclamptic mothers at RSIA Ananda from 2020 to 2022. The combination of nifedipine + $MgSO_4$ was more effective in lowering blood pressure by 50 mmHg in preeclamptic mothers, and the blood pressure of patients discharged from the hospital generally decreased toward normal levels. The study has limitations, as the researchers did not examine risk factors for preeclampsia and focused more on antihypertensive drug therapy without discussing other medications used in patients.

CONCLUSION

Based on the research data, analysis of the research data, and discussion, there is an effect of antihypertensive drug administration on the blood pressure of mothers with preeclampsia at RSIA Ananda Makassar from 2020 to 2022. The combination of nifedipine + $MgSO_4$ is more effective in lowering blood pressure by 50 mmHg in mothers with preeclampsia.

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