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Relationship of Severe Pre-Eclamsia with Neonatal Complications

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ABSTRACT

Pregnancy and childbirth are natural conditions that every mother looks forward to. Although childbirth is one of the physiological conditions, in every process there is still a risk of experiencing complications. These complications can worsen the condition of the mother and baby. The causes of maternal death in Indonesia are dominated by three main causes, one of them was hypertension in pregnancy. Hypertension in pregnancy is one of the signs and symptoms of preeclampsia. The purpose of this study was to determine the relationship between severe preeclampsia and neonatal complications in regional hospital dr. Soebandi Jember. This study design used retrospective correlation. The sampling technique used was simple random sampling with a total of 130 respondents. Data management used the SPSS application with the multivariate analysis of variance (MANOVA) test. The results of the study showed that the majority (64.6%) were respondents with mild preeclampsia. 61.5% of respondents experienced neonatal asphyxia, 66.9% of respondents did not experienced neonatal sepsis, 50.0% of respondents gave birth at a non-preterm gestational age and 46.2% of respondents gave birth to babies with low birth weight. The results of the Multivariate Analysis of Variance (MANOVA) analysis test showed results (p-value = 0.006). As conclusion, there was a significant relationship between severe preeclampsia and neonatal complications simultaneously. It was expected that pregnant women will actively carry out routine antenatal care checked and carry out early detection of preeclampsia.

Keywords: pre-eclampsia; neonatal; complications

INTRODUCTION

Pregnancy and childbirth are natural events that every mother looks forward to. Although childbirth is one of the physiological events, in every process there is still a risk of experiencing complications. These complications can worsen the condition of the mother and the baby, so that it can cause death to the mother or death to the baby.(1) The causes of maternal death in Indonesia are dominated by three main causes, one of which is hypertension in pregnancy. Hypertension in pregnancy is one of the signs and symptoms of preeclampsia.(2) The high incidence of preeclampsia in Indonesia does not only affect the condition of the mother, but also the condition of the fetus and neonatal.(3) Preeclampsia in the mother can cause complications such as placental abruption, hemolysis, pulmonary edema, liver necrosis, and kidney disorders. In the fetus and neonatal, it will cause neonatal asphyxia, neonatal sepsis, low birth weight (LBW), preterm birth and fetal death.(4)

Indonesia Health Profile data in 2020 there were 4,627 deaths, this number shows an increase in 2021 of 7,389 deaths, with cases of hypertension in pregnancy 1,077 cases.(5) The Maternal Mortality Rate (MMR) in East Java Province in 2021 reaches 234.7 per 100,000 live births with cases of hypertension in pregnancy of 9.62% or as many as 123 cases, and Jember Regency is the district with the highest number of maternal deaths in East Java, with a total of 115 deaths.(6) Data from the Directorate of Nutrition and Maternal and Child Health shows that the number of under-five deaths in Indonesia in 2021 is 27,566. Of all under-five deaths, 73.1% of them occurred in the neonatal period (20,154 deaths). The most common causes of neonatal death were cases of low birth weight

(LBW) (34.5%), neonatal asphyxia (27.8%), and congenital abnormalities, one of which was neonatal sepsis (12.8%).[5] The Infant Mortality Rate (IMR) in East Java Province in 2021 in total there are 3,598 toddlers died and most of them occurred in neonatal (0-28 days), namely 73.87%.[6]

The results of a preliminary study conducted at the RSD. dr. Soebandi Jember obtained data that during the period from January to December 2021, there were 184 babies being treated for neonatal asphyxia, 31 babies being treated for neonatal sepsis, 474 babies being treated for low birth weight (LBW) and 7 babies being treated for preterm birth. Patients with severe preeclampsia treated at RSD. dr. Soebandi Jember during 2020 there were 310 patients, there was a decrease in 2021 by 178 patients, and there was an increase again in 2022 by 223 patients.

Preeclampsia is defined as high blood pressure that develops during pregnancy. This serious health problem usually occurs after the 20th week of pregnancy. A pregnant woman is said to have preeclampsia if she has a systolic blood pressure of 140 mmHg or higher, or a diastolic blood pressure of 90 mmHg or higher, with two examinations spaced at least 4 hours apart.[4]

The cause of preeclampsia is still not known with certainty. However, these health problems can be associated with several risk factors including, namely, a history of preeclampsia in a previous pregnancy, chronic hypertension, primigravida, maternal age over 40 years, multiple pregnancies or more, pregnancies that are too long apart (> 10 years), and maternal co-morbidities.[7] Abnormalities that occur in pregnant women with preeclampsia can of course affect the fetus they contain. Therefore, this health problem must be addressed immediately.[8]

Preeclampsia causes infiltration of trophoblast cells into several spiral arteries in the myometrium area, resulting in placental insufficiency. As a result, the placenta is unable to meet its blood needs to deliver nutrients and oxygen to the fetus. Placental insufficiency causes delayed fetal development. This causes oxidative stress of the placenta, increased uterine tone, and stimulation sensitivity, which affects fetal development and causes various complications, such as neonatal asphyxia, neonatal sepsis, preterm birth and low birth weight (LBW).[9]

Based on research conducted by Sirenden, et al[10], there were significant differences between pregnant women without preeclampsia and pregnant women with preeclampsia in gestational age at delivery, birth weight, APGAR score assessment, and neonatal complications ($p \leq 0.05$). This was also reinforced by a study conducted by Harrison & Palatnik[11], of 181,968 women, 8,634 (4.7%) pregnant women were diagnosed with preeclampsia, and the number of cases of neonatal sepsis was found to be higher in babies born to mothers with severe preeclampsia ($p<0.001$).

Delivery in pregnant women with preeclampsia is determined based on the condition of the mother, if the mother has had vaginal delivery before and the patient's preeclampsia is not complicated by Hemolysis, Elevated Liver Enzymes, Low Platelet Count (HELLP) Syndrome or HELLP syndrome, then in general doctors will suggest induction and try to do vaginal delivery as long as fetal testing is convincing. However, if the mother's blood pressure is unstable or has HELLP syndrome, and the mother's cervix is in bad condition, the doctor will recommend giving birth by sectio caesarean (SC) to avoid possible risks. In developing countries, sectio caesarean (SC) is the last resort to save the mother and fetus during critical pregnancy or delivery.[12]

Research related to neonatal complications born to pregnant women with severe preeclampsia, although there have been researchers who have conducted research on similar matters, the majority of previous researchers focused on the relationship between severe preeclampsia with only one variable. Meanwhile, in this study, researchers were interested in examining the relationship between severe preeclampsia and neonatal complications consisting of four variables, namely neonatal asphyxia, neonatal sepsis, preterm birth and low birth weight (LBW).

METHODS

The research design used in this study was correlation, using a retrospective approach which is defined as a research approach conducted with the main objective of making an objective picture or description of a situation by looking back.[13] The research location was dr. Soebandi Hospital of Jember. The research was conducted on April 13 - May 13, 2023. The population in this study were mothers who gave birth at dr. Soebandi Hospital of Jember. Samples were mothers giving birth with preeclampsia at dr. Soebandi Hospital of Jember for the period January 2020 - December 2022 with a total of 865 patients. According to Arikunto[14] says that if the subject is less than 100, then the entire population becomes the research sample, but if the subject is more than 100 then 10-15% or 15-25% can be taken. Based on the definition above, the results of the sum of the samples in this study were 865 x 15% = 129.75 so that they were rounded up to 130 samples. The sampling technique used was simple random sampling.

The data collection technique used a questionnaire containing general data on the characteristics of the respondents and specific data regarding the independent variable (severe preeclampsia) and the dependent variable (neonatal complications). Special data entry is adjusted to interpretation which includes the independent variables of severe preeclampsia and the dependent variables of neonatal asphyxia, neonatal sepsis, preterm birth, and low birth weight. Data analysis uses multivariate analysis, namely Multivariate Analysis Varians (MANOVA), because this analysis aims to determine whether there are differences in the effect of more than one dependent

variable, where in this study there are 4 dependent variables. Furthermore, the results of the research are presented in the form of tables to interpret data and explanations in the form of descriptive sentences used to explain and to complete the results of data classified and tabulated.

RESULTS

The research was conducted at the Regional Hospital dr. Soebandi Jember with a sample size of 130. Table 1 shows that the majority of respondents aged 20-35 years were 76 (58.5%), the type of delivery was mostly normal, namely 59 (45.4%), most types of pregnancy were multigravida, 84 (64.6%), most respondents gave birth at gestational age > 37 weeks, 71 (54.6%), most of the history of the last family planning used by respondents was not using family planning, 55 (42.3%), and most respondents did not have a history of hypertension before pregnancy, 97 (74.6%).

Table 1. Distribution of respondent characteristics

Characteristics	Frequency	Percentage
Age		
<20 year	12	9.2
20-35 year	76	58.5
>35 year	42	32.3
Type of childbirth		
Normal birth	59	45.4
Assisted birth device	15	11.5
Birth by surgery	56	43.1
Pregnancy		
Primigravida	38	29.2
Multigravida	84	64.6
Grand multigravida	8	6.2
Gestational age		
28-<33 week	16	12.3
33-<35 week	15	11.5
35-<37 week	28	21.5
>37 week	71	54.6
Past contraceptive history		
Not contraceptive	55	42.3
Pill	30	23.1
Inject	30	23.1
Implants	6	4.6
IUDs	6	4.6
Condom	3	2.3
History of hypertension		
No history of hypertension	97	74.6
Have a history of hypertension	33	25.4

From table 2, the results obtained based on the number of preeclampsia incidents, the majority of respondents with mild preeclampsia were 84 people (64.6%). The incidence of asphyxia neonatorum, most of the respondents experienced mild asphyxia as many as 80 people (61.5%). The incidence of neonatal sepsis, most of the respondents did not experience sepsis as many as 87 people (66.9%). Half of the respondents gave birth at non-preterm gestational age as many as 65 people (50.0%). The incidence of infant weight, mostly LBW as many as 60 people (46.2%).

Table 3 shows a relationship between severe preeclampsia and neonatal asphyxia, neonatal sepsis, preterm birth, and low birth weight simultaneously. The results of the multivariate test showed (p-value 0.006 <0.05) which means that there is a relationship between severe preeclampsia and neonatal complications.

Based on table 4, the results of tests of between-subject6ys effects between severe preeclampsia and neonatal asphyxia show (p-value 0.050 <0.05), which means that there is a relationship between the occurrence of severe preeclampsia and neonatal asphyxia. The results of tests of between-subjects effects between severe preeclampsia and neonatal sepsis showed (p-value 0.207 > 0.05), which means that there was no relationship between the incidence of severe preeclampsia and neonatal sepsis. The results of tests of between-subjects effects

between severe preeclampsia and preterm birth showed (p-value 0.036 <0.05) which means that there is a relationship between the incidence of severe preeclampsia and the incidence of preterm birth. The results of tests of between-subjects effects between severe preeclampsia and low birth weight showed (p-value 0.001 <0.05), which means that there is a relationship between the incidence of severe preeclampsia and the incidence of low birth weight.

Table 2. Distribution of specific data

Variables	Frequency	Percentage
Pre-eclampsia		
Mild	84	64.6
Severe	46	35.4
Neonatal asphyxia	n	%
Mild	80	61.5
Moderate	38	29.2
Severe	12	9.2
Neonatal sepsis	n	%
No sepsis	87	66.9
Early onset sepsis	31	23.8
Late onset sepsis	12	9.2
Nosocomial sepsis	0	0
Preterm birth	n	%
No preterm	65	50.0
Very preterm	16	12.3
Moderately preterm	15	11.5
Late preterm	34	26.2
Baby's weight	n	%
No LBW	59	45.4
LBW	60	46.2
Very LBW	9	6.9
Extremely LBW	2	1.5
Total	130	100

Table 3. Results of multivariate analysis

Effect	Multivariate Tests					p-value
	Value	F	Hypothesis df	Error df	Partial Eta Squared	
Severe pre-eclampsia	0.891	3.804	4.000	125.000	0.109	0.006

Table 4. Results of multivariat analysis varians (MANOVA)

Dependent variable	Tests of between-subjects effects						Information
	Type III sum of squares	df	Mean square	F	Partial eta squared	p-value	
Neonatal asphyxia	1.678	1	1.678	3.922	0.030	0.050	Significant
Neonatal sepsis	0.693	1	0.693	1.612	0.012	0.207	Not significant
Preterm birth	7.202	1	7.202	4.468	0.034	0.036	Significant
Birth weight	5.071	1	5.071	11.876	0.085	0.001	Significant

DISCUSSION

Incidence of Severe Preeclampsia in Pregnant Women

In this study all respondents were pregnant women with preeclampsia. The results showed that most pregnant women had mild preeclampsia. Most of the respondents were aged 20-35 years and most types of pregnancies were multigravida.

Preeclampsia can be influenced by several factors including the age of the mother, history of hypertension before pregnancy and gravida.[15] The results of research conducted by Muzalfah, et al[16] showed that there was a significant relationship between maternal age and the incidence of preeclampsia (p-value = 0.016). Research

conducted by Antareztha, et al[17] shows that there is a significant relationship between chronic hypertension (high blood pressure that has occurred before pregnancy) and the incidence of preeclampsia (p-value = 0.007). Supported by research conducted by Pratiwi & Wantonoro[18] showed a significant relationship between parity (<2 or ≥ 4) and the incidence of preeclampsia in pregnant women at Wonosari Hospital (p-value = 0.004).

According to researchers, preeclampsia experienced by pregnant women is caused by other risk factors that lead to severe preeclampsia, such as a history of severe preeclampsia in a previous pregnancy and there are other comorbid diagnoses in the mother such as anemia, hydatidiform mole, hyperemesis gravidarum, polyhydramnios, oligohydramnios, HBSAG+, incomplete abortion, gestational diabetes mellitus, and premature rupture of membranes.

Incidence of Neonatal Asphyxia in Newborns

The results showed that most babies born to preeclamptic mothers experienced mild asphyxia. Most of the respondents gave birth at >37 weeks of gestation. Research of Dhamayanti[19] showed that there was a significant relationship between preeclampsia and the incidence of neonatal asphyxia in newborns (p-value = 0.007). Supported by research conducted by Rachmawati[20] showed a significant relationship between preeclampsia and the incidence of neonatal asphyxia at Panembahan Senopati Bantul Hospital, Yogyakarta (p-value = 0.000). The results of this study are in accordance with Cunningham[21] which states that preeclampsia causes reduced blood flow to the uterus which causes reduced oxygen flow to the placenta and fetus. Vasoconstriction of blood vessels results in reduced blood supply to the placenta resulting in fetal hypoxia. A further consequence of fetal hypoxia is impaired gas exchange between oxygen and carbon dioxide resulting in neonatal asphyxia.

According to researchers, mothers who experience severe preeclampsia experience vasoconstriction of blood vessels which can cause reduced oxygen flow in the blood to the placenta and fetus, if this occurs continuously the result is that the fetus experiences hypoxia because it is unable to exchange gases between oxygen and carbon dioxide so it experiences neonatal asphyxia. Because the mother's gestational age is above 37 weeks, meaning that it is close to term, so the baby has mild asphyxia.

Neonatal Sepsis in Newborns

The results showed that most babies born to preeclamptic mothers did not experience neonatal sepsis. Most of the respondents gave birth at >37 weeks of gestation.

Research by Suwarna, et al[22] showed that risk factors such as premature rupture of membranes more than 18 hours, gestational age less than 37 weeks, delivery by cesarean section, and birth weight <2500 grams, have a significant relationship with the incidence of early onset neonatal sepsis. Supported by research conducted by Sulistijono, et al[23] showed that maternal factors in the form of premature rupture of membranes and fetal factors (low birth weight, preterm, and Apgar score <7) are risk factors that increase the proven early onset of sepsis in newborns.

According to the researchers, there is no relationship between severe preeclampsia and neonatal sepsis because severe preeclampsia does not purely affect the presence of neonatal infection, both early onset and late onset sepsis. The main factor in the occurrence of neonatal sepsis is infection which can originate from maternal factors (premature rupture of membranes) or from fetal factors (LBW and prematurity).

The Incidence of Preterm Birth in Newborns

The results showed that most of the babies born were not preterm. Most of the respondents gave birth at >37 weeks of gestation. Nurhayati's research[24] showed that there was a relationship between preeclampsia and the incidence of preterm labor at the Tangerang District General Hospital (p-value = 0.001). Supported by research conducted by Umi, et al[25] showed that there was a relationship between preeclampsia and the incidence of preterm labor at the Muhammadiyah Sumberejo Hospital, Bojonegoro Regency (p-value = 0.035). In preeclampsia, vascular endothelial dysfunction occurs and pathophysiological changes occur, namely spasm of blood vessels and increased blood pressure. Changes that occur in the cardiovascular system in the form of arteriolar spasm can disrupt uteroplacental blood flow. The placenta is abundantly supplied with blood from the uteroplacental arteries and is fully developed in the first and second trimesters of pregnancy. Reduced blood flow to the placenta results in impaired placental function. Sudden arteriolar spasm can cause severe asphyxia. If the spasm lasts a long time it will interfere with fetal growth. If there is an increase in uterine tone and sensitivity to stimulation it can cause preterm parturition.[26]

According to researchers, mothers who experience severe preeclampsia experience blood vessel spasms resulting in impaired function of the placenta. Arterial spasm that lasts a long time will interfere with fetal growth and increase uterine tone thereby stimulating premature parturition in pregnant women <37 weeks with preeclampsia.

The Incidence of Low Birth Weight (LBW) in Newborns

The results showed that most of the babies were born with LBW. Most of the respondents gave birth at >37 weeks of gestation. Faadhilah & Helda's research[27] shows that there is a relationship between preeclampsia and the incidence of low birth weight (LBW) at the Tangerang District General Hospital (p-value = 0.001). Supported by research conducted by Khader, et al[28] showed that there was a relationship between preeclampsia and the incidence of low birth weight (LBW) (p-value = 0.001). Exposure to an abnormal intrauterine environment affects anthropometric, metabolic, and mental development, leading to an increased risk of disease later in life, pathological examination of the placenta from preeclamptic pregnancies commonly reveals placental infarction and sclerotic narrowing of arteries and arterioles, with characteristics of reduced endovascular invasion by cytotrophoblasts and inadequate remodeling of the uterine spiral arteries.[29]

According to researchers, mothers who experience severe preeclampsia experience vasoconstriction of blood vessels resulting in impaired function of the placenta. Impaired uteroplacental circulation causes a decrease in the supply of nutrients to the fetus, resulting in the fetus not being able to grow optimally and experiencing low birth weight (LBW).

Relationship between the Incidence of Severe Preeclampsia and Neonatal Complications

Based on the results of the Multivariate Analysis of Variance (MANOVA) test, it is known that simultaneously there is a significant relationship between severe preeclampsia and neonatal complications. Noni's research[30] showed that there was a significant relationship between severe preeclampsia and neonatal complications (p-value = 0.004). Supported by research conducted by Maryana[31] showing that there is a relationship between preeclampsia and neonatal complications (LBW and neonatal asphyxia). Preeclampsia can be caused by the theory of placental vascularization abnormalities, the theory of immunological tolerance between mother and fetus.[26] Complications in preeclampsia cause intrauterine growth restriction (IUGR), placental hypoperfusion, seizures, prematurity, and fetal and maternal death.[32]

According to researchers, severe preeclampsia can cause complications that can worsen the condition of the mother and baby. Mothers with severe preeclampsia experience vasoconstriction of blood vessels which can affect the lack of oxygen supply, lack of nutritional intake, impaired fetal growth, and impaired uteroplacental circulation which causes various complications for the fetus and neonatal conditions they contain, such as neonatal asphyxia, premature parturition and low birth weight (LBW).

CONCLUSION

Most of the respondents had mild preeclampsia, had mild neonatal asphyxia, did not experience neonatal sepsis, gave birth at a non-preterm gestational age, and gave birth to low birth weight babies (LBW). The results of the Multivariate Analysis of Variance (MANOVA) analysis test showed results (p-value = 0.006) which means there is a relationship between severe preeclampsia and neonatal complications.

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