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Hematological Analysis of Preeclampsia Patients at Regional Public Hospital RadenMattaher Jambi - Indonesia

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Abstract

The cause of maternal death may vary from bleeding, preeclampsia, abortion complication, obstructed labor or labor dystocia, and sepsis. Preeclampsia is considered as the main cause of maternal and fetal mortality and morbidity which is defined as a syndrome characterized by hypertension and proteinuria after 20 weeks of pregnancy. Hematology factors such as hemoglobin level, hematocrit level, and platelets count influenced the preeclampsia incidence. Therefore, this research aimed to analyze level of hemoglobin, hematocrit, and platelets count on the preeclampsia incidence. Case-control was applied as a method with 110 sample numbers consisted of 55 expectant mothers as case samples and 55 expectant mothers as control samples with a ratio of 1:1. Chi-square test was applied in this research with 95% level of certainty. The research results indicated that most expectant mothers with preeclampsia (55%) had hemoglobin at risk level, 64.3% had abnormal hematocrit level, and 55.5% had platelets count at risk level as well. Chi-square statistical analysis concluded that hemoglobin level, hematocrit level, and platelets count influenced the preeclampsia incidence with p-value of 0.002 and OR value of 3.656 (CI: 1.654-8084); p-value of 0.31 and OR value 2.571; and p-value 0.002 and OR value 3.656 (CI: 1.654-8.084), respectively.

Keywords: Hemoglobin; Hematocrit; Platelets; Preeclampsia.

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1. Introduction

Preeclampsia is a disease during pregnancy that can cause severe maternal morbidity and mortality of fetus. Preeclampsia occurs specifically to pregnant women and it happens worldwide that can result prematurity and long-term cardiovascular disease for pregnant mother. Hematology factors such as hemoglobin level, hematocrit level, and platelets count influenced the preeclampsia incidence [1-2].

The World Health Organization (WHO) states that preeclampsia / eclampsia is a cause of maternal morbidity and mortality after postpartum hemorrhage. Preeclampsia is the number 2 cause, namely as much as 13% of maternal deaths [3]. Preeclampsia is defined as the onset of hypertension accompanied by proteinuria at gestational age more than 20 weeks. Preeclampsia is a multisystem disorder in pregnancy characterized by endothelial dysfunction, increased blood pressure due to vasoconstriction, proteinuria due to glomerular failure, and edema due to increased vascular permeability [4].

Anemic pregnant women have higher risk to morbidity and mortality for both mother and fetal. As the required-blood volume increase during pregnancy, the necessity of Fe and iron increase as well. However, when the Fe and iron requirements are unfulfilled, it will cause a serious problem to both mother and fetus. Hemoglobin level is one of the problem factors that influences preeclampsia. This condition causes the fetus lack of oxygen and food nutrition that result growth disorder and low body mass of fetus [5]. Low hemoglobin level is called anemia. Anemia provokes growth disorder both in brain and body cells, leads to fetal mortality and leads to unintentional *abortus*[6].

Most of the preeclampsia cases, platelet deficiency is caused due to damage to the vascular endothelium, so that the secretion of vasodilator prostacyclin by endothelial cells is reduced. Changes in thromboxane activity play a crucial role in the imbalance between prostacyclin and thromboxane. This results in a 50% reduction in placental perfusion, hypertension, and a decrease in plasma volume. If the state of preeclampsia is still not resolved, the decrease in platelets will continue to occur and cause thrombocytopenia. Gestational thrombocytopenia results from the progressive expansion of blood volume that typically occurs during pregnancy, leading to hemodilution.

2. Method

This study was descriptive-analytic using a case-control approach. Populations used were 110 expectant mothers at Regional Public Hospital RadenMattaher Jambi Province in 2019. Case samples included were 55 expectant mothers (total sampling) who experienced preeclampsia, meanwhile, 55 expectant mothers who have not experienced preeclampsia used as control samples. Random sampling was used as sampling techniques. Case and control samples ratio was 1:1 for total samples of 110 expectant mothers and the criteria for inclusion were expectant mothers with 20 weeks of pregnancy. The data were taken from Medical Record (MR) of Regional Public Hospital RadenMattaher Jambi Province. For the data analysis, chi-square test was applied with 95% level of certainty.

3. Result

The study's results of hemoglobin level, hematocrit level, and platelets count overview in expectant mothers at Regional Public Hospital RadenMattahercan be seen in Table 4.1 below.

Table1: Frequency Distribution of Hemoglobin Level, Hematocrit Level, and Platelets Count

Variable	Risk		No Risk	
	Total	%	Total	%
Hemoglobin level	62	56,4	48	43,6
Hematocrit level	42	38.2	68	61.8
Platelets Count	61	55,5	49	44,5

Table 4.1 illustrated that most of the respondents have hematology (hemoglobin level, hematocrit level, and platelets/thrombocyte count) which were included as a risk group toward preeclampsia.

The analysis results of hematology in expectant mothers at Regional Public Hospital RadenMattaher Jambi Province using chi-square analysis can be seen in Table 4.2 below:

Table2: Frequency Distribution of Expectant Mothers' Hemoglobin Level, Hematocrit Level, and Platelets Count toward Preeclampsia

Variable	Group	Preeclampsia				Total		OR 95% CI	P-Value
		Experienced		Did not Experience					
		f	%	f	%	f	%		
Hemoglobin	Risk	39	35,5	22	20,0	62	56,4	3,656 (1,654-8.084)	0,002
	No Risk	16	14,5	33	30,0	48	43,6		
Hematocrit	Risk	15	35.7	27	64.3	42	38.2	2.571 (1.162-5.693)	0.031
	No Risk	40	58.8%	28	41,2	68	61.8		
Platelets	Risk	39	35,5	22	20,0	61	44,5	3,656 (1,654-8.084)	0,002
	No Risk	16	14,5	33	30,0	49	55,5		

Chi-square statistics test results obtained p-value of 0.002, hence it can be concluded hemoglobin level of

expectant mothers influenced the incidence of preeclampsia. The largest OR value amounted to 3.656 (1.656-8.084) indicated that the respondents with hemoglobin levels at risk had 3.656 times chance of experiencing preeclampsia compared to respondents with normal hemoglobin levels. Likewise with the results of the chi-square statistical test on the hematocrit value, obtained p-value of 0.031 with OR value of 2.571 indicated that abnormal hematocrit values having 2.5 times risk of experiencing preeclampsia compared to patients with normal hematocrit values. The analysis results in expectant mothers' platelets count obtained p-value of 0.002, thus it can be concluded that platelets count of expectant mothers influenced the incidence of preeclampsia. The largest OR values of 3.656 (1.656-8.084) indicated that respondents with platelets levels at risk having 3.6 times the chance to experience preeclampsia compared to respondents with normal platelets count.

4. Discussion

Preeclampsia is a multisystem disorder in pregnancy characterized by endothelial dysfunction, high blood pressure due to vasoconstriction, proteinuria due to glomerulus failure, and edema due to increased vascular permeability [7]. Invasion of trophoblasts cells in the muscle layers of the spiral arteries and surrounding tissues do not occur while hypertension in pregnancy, therefore vasoconstriction and a failure of remodeling spiral arteries happened. In this case, uteroplacental blood flow decreases which lead to hypoxia and ischemia [8].

Trophoblasts invasion occurred in preeclampsia especially in the part of spiral arteries which is causing most of the spiral arteries' part in the endometrium to remain in constriction condition, thus it is unable to fulfill the fetus's nutrition and needs. The inadequacy occurs due to the decrease of erythrocyte production and or hemoglobin level decrease [9]. This condition will cause anemia in expectant mothers which define as a condition that the hemoglobin level less than 11 g/dl in the first and third trimesters or less than 10.5 g/dl in the second trimester [10]. Based on Sumarni's research obtained the hemoglobin level of expectant mothers who were experienced preeclampsia and eclampsia were amounted to 11.95gr/dl on average and the highest hemoglobin level was 17.5 gr/dl while the lowest was 7 gr/dl [11].

The results of this study indicated that there was a relation between hemoglobin level and preeclampsia experienced by expectant mothers with p-value of 0.002. In line with the conducted research, most severe preeclampsia has a hemoglobin level of <11 gr/dl compared to expectant mothers with normal conditions with a hemoglobin level of ≥13.2 gr/dl. The mean difference in the amount of hemoglobin level of expectant mothers with preeclampsia obtained significant relationship with p-value of 0.001. The same research's results has been conducted by Sumarni that the average of expectant mothers' hemoglobin level who were experienced preeclampsia/eclampsia was in the normal level criteria, however having maximum value exceed normal with a relationship between hemoglobin level of expectant mothers and preeclampsia [11].

In addition to hemoglobin level, hematocrit and platelets count also influence the occurrence of hemoconcentrationas a result of hematology change in preeclampsia. Hematocrit considers an important determinant in the blood viscosity since it is comparable with blood viscosity. Sumarni's research has obtained results that the average hematocrit level of expectant mothers with preeclampsia/eclampsia was 35.55 mg/dl, with the highest hematocrit was 50 mg/dl and the lowest was 25 gr/dl. Hematocrit level increase in

preeclampsia/eclampsia occurs due to hemoconcentration causes by the decrease of plasma volume by vasospasm. Yuliana mentioned that hematocrit level in expectant mothers with preeclampsia was higher compared to the hematocrit level of expectant mothers with normal condition. Hematocrit increases to 60%-70% will impact on the occurrence of polycythemia, higher oxygen transport capacity, blood viscosity which is 10 times greater than water, and thrombosis as well as emboli [12-13]. As stated by Wibowo, hematocrit and severity of preeclampsia are interrelated [14]. The results showed that p-value of 0.031 indicated a relation between hematocrit and patients with preeclampsia. Moreover, a research conducted by Yuliana obtained p-value of 0.004 and $p<0.05$ indicated that there was significant relation statistically between the mean level of hematocrit in preeclampsia, normal pregnancy, and higher hematocrit level on patients with preeclampsia than non-preeclampsia [12].

Hemoconcentration which continuously increases will cause decreased tissue perfusion in all organs and will lead to worsening preeclampsia. Vasospasm induced platelets aggregation and endothelial damage that will add more contribution for sustaining platelets dysfunction. Utami and his colleagues mentioned that 50% of preeclampsia cases were related to thrombocytopenia [15]. The results of this study have shown that there was a relation between platelets count and preeclampsia with p-value = 0.002. It is related to Yulianingsih, which mentioned that there was a significant relation between platelets count towards preeclampsia degree [16]. Moreover, some changes of hematology profile can occur such as decreased of thrombocyte on preeclampsia. The results of this research have found that preeclampsia has platelets counts <150.000/µl which indicated there was mean significant differentiation in the number of platelets of preeclampsia patients with p-value of 0.001. Another research conducted by Suwoto mentioned that platelets count of <150.000/µl has a significant relationship as a predictor of mothers' morbidity and mortality on HELLP syndrome [17]. Laboratory examination results also showed that thrombocytes are a prognostic factor that affects the occurrence of preeclampsia [18].

The use of secondary data considered as the weakness of this study, hence it does not provide a whole overview of the cause of preeclampsia in expectant mothers. Furthermore, the use of retrospective as research design has made limitation to find out other factors which influenced preeclampsia on respondents.

5. Conclusion

Most of the respondents have hemoglobin level, hematocrit level, and platelets count at risk of preeclampsia. Furthermore, hemoglobin, hematocrit, and platelets have significant relation with preeclampsia on expectant mothers at Regional Public Hospital RadenMattaher Jambi Province.

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