ORIGINAL ARTICLE

Bali Medical Journal (*Bali MedJ*) 2023, Volume 12, Number 2: 1227-1230
P-ISSN.2089-1180, E-ISSN: 2302-2914

The effectiveness of CRP and leukocyte examinations as a detection of risk factors for pre-eclampsia in pregnant women

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Received: 2023-02-04
Accepted: 2023-03-28
Published: 2023-04-17

ABSTRACT

Introduction: Preeclampsia is an important problem in obstetrics because it is a pregnancy complication often found and results in high morbidity and mortality in both mother and baby. Preeclampsia is one of the complications of pregnancy that needs to be detected or monitored for symptoms, because in addition to being risky for the mother, it will also have an impact on the occurrence of preterm birth and even further impact, namely fetal death in the womb. This study aimed to determine the effectiveness of CRP and leukocyte examination to detect preeclampsia.
Method: This research was conducted at the Jagir Health Center Surabaya in March-July 2022. The research used case control with 30 pregnant women as samples divided into 15 as a control group of normal pregnant women and 15 pregnant women with preeclampsia.
Result: The results showed that of the 15 respondents who had preeclampsia more than half (60%) had high leukocyte and CRP levels, the remaining less than half (40%) had normal CRP and leukocyte levels. While in the control group more than half (67%) had normal CRP and leukocyte levels and less than half (33%) had normal CRP and leukocyte levels. The results of data analysis showed p value 0.001 (<0.005), which means there is a relationship between the CRP and leukocytes on the incidence of preeclampsia.
Conclusion: Examination of CRP levels and leukocyte count proved effective for detecting the incidence of preeclampsia in pregnant women. It is expected that pregnant women carry out routine pregnancy checks and health workers are expected to routinely carry out early detection to prevent pregnancy complications such as preeclampsia.

Keywords: leukocytes, CRP, preeclampsia, pregnant, detection.
Cite This Article: Masruroh, N., Rizki, L.K., Laili, U., Alifah, D.N. 2023. The effectiveness of CRP and leukocyte examinations as a detection of risk factors for pre-eclampsia in pregnant women. *Bali Medical Journal* 12(2): 1227-1230. DOI: 10.15562/bmj.v12i2.4304

INTRODUCTION

Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 25 of 2014 concerning Child Health Efforts, it is stated that every child has the right to survive, grow, and develop and has the right to protection from violence and discrimination so that it is necessary to carry out child health efforts in an integrated, comprehensive and sustainable manner. Child health efforts are carried out from the fetus in the womb until the child is 18 years old. One of the goals of child health efforts is to ensure children's survival through efforts to reduce the mortality rate of newborns, infants and toddlers. The results of the Indonesian Demographic and Health Survey (IDHS) in 2017 showed an IMR of 24 per 1,000 live births.[1]

Preeclampsia ranks in the top three causes of maternal death and it is estimated that there are more than 40,000 cases of death in developing countries each year. Severe preeclampsia also contributed to maternal complications (27%) and neonatal complications (34%). According to the 2020 survey, preeclampsia, eclampsia and bleeding contribute 50% of maternal deaths in Indonesia.[2]

The exact cause of preeclampsia is not known with certainty. Experts have put forward many theories, but no one is considered true. The inflammatory theory is one of the most frequently used theories to explain the pathophysiology of preeclampsia. In normal pregnancy there is an inflammatory reaction with low levels. This process is not part of a disease but a physiological condition. Preeclampsia occurs when the inflammatory reaction increases to the point of decompensating maternal organ systems. This extreme inflammatory reaction is a combination of the inflammatory reaction in normal pregnancy and impaired maternal circulation resulting from endothelial cell dysfunction which also triggers the inflammatory reaction.[3] On the other hand, the inflammatory reaction that occurs will trigger the activation of leukocytes in the blood circulation which further triggers endothelial damage. A more sensitive CRP measurement is high-sensitivity CRP (hs-CRP). With hs-CRP we can determine the lower limit of CRP levels more accurately. So that nowadays measurements with hs-CRP are more often carried out. The leukocyte count is a routine examination to assess the condition of the immune system and levels of inflammation in the body. Increased leukocytes are usually

associated with infection, inflammation, and tissue necrosis. The involvement of the inflammatory process in the pathophysiology of preeclampsia has been widely discussed in various studies. The inflammatory response involves activation and an increase in the number of leukocytes in response to inflammatory signals, so an increase in leukocyte levels can also be used as a predictive factor for preeclampsia.[4]

This study aims to determine the effectiveness of CRP and leukocyte examinations for early detection of preeclampsia, if proven effective, it is hoped that it can be used as a tool for early detection of preeclampsia in pregnant women to prevent complications of preeclampsia in pregnant women.

MATERIALS AND METHODS

Materials

The instrument used in this study was a questionnaire containing the characteristics of respondent data, patient medical records, and venous blood for examination of CRP and leukocyte levels.

Data collection procedures

After the respondent signs the informed consent, the respondent will be given a questionnaire to fill out, then his venous blood is taken by the officer then CRP and leukocyte levels are checked by the ELISA method.

Data analysis

Questionnaires that have been filled out by respondents and laboratory results obtained are then tabulated and analyzed using independent t test and chi square

RESULTS

It can be seen that more than half (53%) of respondents in the preeclampsia group were in parity 2-4, while in the normal pregnancy group almost half (40%) were in parity 1 or first pregnancy. With the results of the analysis of the significance of p value 0.003 which means that parity affects the incidence of preeclampsia. In the age variable, it can be seen that most respondents (86%) who experienced preeclampsia were in the age range of 19-34 years and only a small portion (14%) of respondents who experienced preeclampsia were at the age of >35 years, as well as in the normal pregnancy group. respondents (80%) were in the age range of 19-34 years and only (20%) respondents with normal pregnancies were >35 years old. The analysis results obtained a significant p value of 0.001, meaning that age affects the incidence of preeclampsia.

From the table above, it can be seen that of the 15 respondents who experienced preeclampsia, more than half (53%) of the results of the examination of CRP levels were at a high level, while in normal pregnant women the majority (80%) CRP levels were in the normal range. Only A small portion (20%) of respondents have high CRP levels. The analysis results obtained p value 0.001 which means CRP levels are associated with the incidence of preeclampsia.

From table 3 above, it can be seen that of the 15 respondents who had preeclampsia, most (83%) had high leukocyte levels and the remaining few (27%) had normal leukocyte levels. Meanwhile, more than half of pregnant women in the control group (67%) had normal leukocyte levels and less than half (33%) had high leukocyte levels. From the results of data analysis obtained p value 0.001 which means there is a relationship between leukocyte levels with preeclampsia

From the cross tabulation of the data above, it can be seen that of the 15 respondents who had preeclampsia more than half (60%) had high leukocyte and CRP levels, the remaining less than half (40%) had normal CRP and leukocyte levels. While in the control group more than half (67%) had normal CRP and

Table 1. Distribution of respondent characteristics by parity and age.

Variable	Preeclampsia		Normal		p value
	n	%	n	%	
Parity					0.003
1	4	26	6	40	
2-4	8	53	4	36	
>5	3	21	5	24	
Age					0.001
19-34	13	86	12	80	
>35	2	14	3	20	

Source : primer data 2022

Table 2. The relationship between CRP levels and the incidence of preeclampsia.

Variable	Preeclampsia		Normal		p value
	n	%	n	%	
CRP level					0.001
Normal	7	47	12	80	
High	8	53	3	20	

Source : primer data 2022

Table 3. The relationship between leukocyte levels and preeclampsia.

Variable	Preeclampsia		Normal		p value
	n	%	n	%	
Leukocyte					0.001
Normal		27	10	67	
High		83	5	33	

Source : primer data 2022

Table 4. The effectiveness of CRP and leukocyte levels against preeclampsia.

Variable	Preeclampsia		Normal		p value
	n	%	n	%	
Leucocyte and CRP					0.001
Normal	6	40	10	67	
High	9	60	5	33	

Source : primer data 2022

leukocyte levels and less than half (33%) had normal CRP and leukocyte levels. The results of data analysis obtained a p value of 0.001 (<0.005) which means that CRP and leukocyte examinations are effective for detecting the incidence of preeclampsia in pregnant women.

DISCUSSION

These results of characteristic respondent are in line with Masruroh's research in 2020 which states that age and parity determine the incidence of preeclampsia.[5] This is also in line with the research of Setyawati et al in 2018 which resulted that parity and age were closely related to the incidence of preeclampsia. The gestational age in the ideal and safe category is in the age range of 19-34 years because at that age the reproductive organs and mental health of women are ready to accept changes during the pregnancy process.[6]

Research from Angelina in 2019 aligns with this result about the relationship between CRP levels and the incidence of preeclampsia. They said the inflammatory response will produce pro-inflammatory cytokines in the mother's body, including tumor necrosis factor-alpha, interleukin-6, and CRP. These markers of inflammation will increase along with the endothelial damage that occurs. This means that if there is damage to the endothelium, there will be an increase in CRP levels.[7] A similar opinion was conveyed in Agustina's research in 2014: In preeclampsia, there is endothelial damage, which is one aspect of the systemic inflammatory response in the mother. This inflammatory response is also present in normal pregnancy, but is more severe. Preeclampsia occurs when a systemic inflammatory process causes the mother's decompensation of one or more systems. Because CRP is a substance that is a sensitive marker of systemic inflammation, research is being developed to determine the possible relationship between CRP and preeclampsia.[8]

Agreeing with this is according to Angelica in 2019 that another commonly found inflammatory response is increased levels of circulating leukocytes in the blood. Leukocytes will produce L-Selectin which plays a role in adhesion to the endothelium, and is strengthened by vascular cell adhesion molecule 1. In the presence of cytokines, neutrophils will be activated and produce chemoattractants, further aggravating the inflammatory response. Several studies have shown an increase in the number of leukocytes in women with preeclampsia. Mihu et al in 2010 proved that leukocytes and neutrophils can be used as markers of inflammation in preeclampsia. Other studies have also been carried out by Canzoneri in 2009 and Pughikimo in 2015. Both studies also concluded the same thing, that increased serum leukocyte levels in preeclampsia.[9]

According to Angelina (2019), the increase in hs-CRP corresponds to the degree of preeclampsia. This study divided the preeclampsia group into mild preeclampsia and severe preeclampsia. Hs-CRP was more elevated in the severe preeclampsia group compared to mild preeclampsia or normal pregnancy.[7] Damage to the placental vasculature will stimulate the release of proinflammatory cytokines that trigger the liver to release CRP. This increase in CRP levels is one indicator of placental ischemia which will then be measured as a marker of vascular damage which is a trigger for preeclampsia in pregnancy after 20 weeks of gestation. Vasospasm is the basic mechanism of signs and symptoms that accompany preeclampsia. Vasospasm results from increased sensitivity to circulatory pressures, such as angiotensin I, a possible imbalance between prostacyclin prostaglandin and thromboxane A2, and further reduced intravascular volume predisposes mothers to preeclampsia. Preeclampsia is a hyperdynamic state in which the typical findings of hypertension and proteinuria result from renal hyperfunction. To control the amount of blood that fuses to the kidneys, a renal vasospasm reaction occurs as a protective mechanism, which affects protein in the urine.[8]

The limitation in this study is because not all pregnant women are willing to have their blood drawn to be examined by officers so it takes quite a long time to fulfill the number of respondents.

CONCLUSION

This study concluded that CRP and leukocyte examination proved effective for detecting the occurrence of preeclampsia in pregnant women. Pregnant women are expected to carry out routine pregnancy checks and health workers are expected to routinely carry out early detection to prevent pregnancy complications such as preeclampsia.

ACKNOWLEDGMENT

The researchers would like to thank the LPPM Nahdlatul Ulama University Surabaya, which has funded this research. As well as to pregnant women willing to be respondents in this study.

ETHICAL APPROVAL

The research procedure has received a letter from the ethics committee of the University of Nahdlatul Ulama Surabaya No. 109/EC/KEPK/UNUSA/2022.

AUTHOR CONTRIBUTION

All authors contributed equally in writing this manuscript.

FUNDING

This research was fully funded by LPPM Nahdlatul Ulama University Surabaya.

CONFLICT OF INTEREST

All authors in this research article do not have any conflict of interest with the results of this study

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