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The Correlation between Anemia and Abortion in Pregnant Women

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ABSTRACT

Background: Anemia in pregnancy can occur when the hemoglobin concentration is less than normal so that oxygen binding cannot occur optimally. Insufficient oxygen supply for the mother's metabolism can indirectly affect both the mother and the fetus. Anemia in pregnancy can increase the risk of abortion. In 2021, there were 7,389 maternal deaths, one of which was caused by abortion. This study aims to determine whether there is an increased risk of abortion in pregnant women with anemia.
Methods: Analytical observational study using a case-control design with a ratio of case group and control group of 1:2. This study collected data from 52 subjects of pregnant women with abortion as the case group and 104 subjects of pregnant women with vaginal delivery as the control group during the period from January 2021 to December 2023. Subjects were determined based on inclusion and exclusion criteria using purposive sampling. The analysis of univariate and bivariate employed chi-square test; and as multivariate analysis the study employed logistic regression test.
Result: Pregnant women with anemia have 2.67 times higher risk of experiencing abortion compared to pregnant women without anemia and this was a statistically significant (OR= 2.67; 95% CI= 1.31 to 5.49; p=0.007). In addition, there was a confounding variable of maternal age (OR= 3.03; 95% CI= 1.36 to 5.74; p=0.007) and gravidity (OR= 2.48; 95% CI= 1.19 to 5.19; p=0.015).
Conclusion: There is a significant correlation between anemia and abortion in pregnant women.

Keywords: ***Abortion; Anemia; Pregnancy***

INTRODUCTION

The anemia is a condition in which the level of hemoglobin or the number of red blood cells in the blood is below normal. This condition reduces the blood's ability to transport oxygen to tissues and organs. Anemia can cause several non-specific clinical manifestations, such as fatigue, dizziness, cold extremities, headache, and shortness of breath, especially during physical activity.[1] Anemia can occur at any age, but it is most commonly experienced by pregnant women, children, and adult women.[2]

Anemia remains a common condition in developing countries, including Indonesia. The etiology of anemia is multifactorial, such as iron deficiency anemia, vitamin deficiencies (vitamin A, vitamin B), parasitic infections (malaria, hookworms), and chronic infectious diseases.[3] In 2019, the prevalence of anemia in pregnancy was 37%, affecting approximately 32 million people aged 15 to 49 years[1]. In Indonesia, the prevalence of anemia in pregnancy has increased, from 37.1% in 2013 to 48.9% in 2018.[4]

Anemia during pregnancy can occur when the hemoglobin concentration is lower than normal, resulting in suboptimal oxygen binding. Subsequently, the insufficient oxygen supply to the mother's metabolism can indirectly affect both the mother and the fetus.[5] There are several risks to the fetus include Intrauterine Growth Restriction (IUGR), prematurity, congenital abnormalities, Intrauterine Fetal Death (IUFD), and low birth weight (LBW). In addition, there are also risks associated with anemia during pregnancy for the mother, including hypertension, sleep disturbances, shortness of breath, fatigue, palpitations, abortion, and increased risk of bleeding, which can lead to maternal death. Therefore, anemia during pregnancy is a major nutritional issue in Indonesia.[6]

Abortion is the termination of a pregnancy before the fetus can survive outside the uterus or before 20 weeks of gestation. Spontaneous abortion can be classified into imminent, insipient, incomplete, and complete. Additionally, there are other types such as habitual abortion (recurrent abortion), septic abortion, infectious abortion, and missed abortion.[7] Abortion occurs in approximately 10% of all clinically recognized pregnancies, and around 80% of abortions happen during the first trimester.[8] Abortion carries risks for the pregnant woman, including hypovolemic shock caused by excessive bleeding and the risk of infection due to retained products of conception. Bleeding and infection resulting from abortion can contribute to maternal death, particularly in areas with inadequate access to healthcare services.[9] In Indonesia, the maternal mortality rate increased from 2019 to 2021. In 2021, there were 7,389 maternal deaths, with one of the causes being abortion.[7]

A study conducted in 2023 in Brebes with a case-control study showed that hemoglobin levels in pregnant women were significantly related to abortion. Pregnant women with low Hb levels have a 6 times higher risk of abortion than pregnant women with normal Hb level.[10] In another study at Dr. H. Abdul Moeloek Hospital, Lampung by Wardiyah (2017) using 95 subjects also stated that there was a significant correlation between anemia and abortion in pregnant women.[5]

Based on the theories that have been mentioned and still a few researches that raise the topic of the correlation between anemia and abortion in pregnant women, especially in Surakarta, the researcher intends to conduct further research at Dr. Moewardi Hospital Surakarta. This research will be able to provide an explanation regarding the mechanism of anemia in pregnancy that affects the incidence of abortion and can be used as educational material regarding the importance of Antenatal Care (ANC) during pregnancy, especially hemoglobin levels.

METHODS

This research is an analytical observational study using a case-control design. The study was conducted in August 2024 at Dr. Moewardi Hospital Surakarta. The study population consisted of all pregnant women treated at Dr. Moewardi Hospital Surakarta for the period January 2021 to December 2023. The subject size was determined using the Lameshow formula, which calculated a minimum of 51 subjects. The case and control group ratio in this study was 1:2. A total of 52 subjects of women with

abortion (as the case group) and 104 subjects of women with vaginal delivery (as the control group) from the period of January 2021 to December 2023. The subjects were selected based on inclusion and exclusion criteria using purposive sampling techniques.

The inclusion criteria: (1) Pregnant women with abortion and gestational age <20 weeks, or with no abortion; (2) Pregnant women with documented anemia status or hemoglobin (Hb) levels in the medical records. The exclusion criteria: (1) Pregnant women with genital tract abnormalities; (2) Pregnant women with induced abortions; (3) Incomplete medical records.

Independent variable was anemia in pregnant women, the dependent variable was abortion, and the confounding variables included gravidity, education level, and employment. Data used were secondary data obtained from patient medical records at Dr. Moewardi Hospital Surakarta. The data were analyzed using univariate and bivariate analyses. Univariate analysis was presented in the form of a table showing the characteristics of the study subjects, bivariate analysis used the chi-square correlation test, and logistic regression was performed for multivariate analysis. Ethical Clearance for this study was issued from Dr. Moewardi Hospital Surakarta with the number 1591/VI/HREC/2024.

RESULT

Data for this study was collected in August 2024 at Dr. Moewardi Hospital Surakarta. The study included 52 subjects of pregnant women with abortion as the case group and 104 subjects of pregnant women with vaginal delivery as the control group from the period of January 2021 to December 2023.

Based on table 1, anemia was divided into two categories: anemia (Hb<11 g/dl) with 61 subjects (39.1%) and no anemia (Hb≥11 g/dl) with 95 subjects (60.1%). Maternal Age was divided into two categories: high risk (<20 and >35 years) with 42 subjects (26.9%) and no risk (20-35 years) with 114 subjects (73.1%). Gravidity was divided into two categories: primigravida with 72 subjects (46.2%) and multigravida with 84 subjects (53.8%). Employment was divided into two categories: work with 88 subjects (56.4%) and no work with 68 subjects (43.6%). Education was divided into two categories: low education (elementary, junior high school) with 45 subjects (28.8%) and high education (high school, university) with 111 subjects (71.2%).

Table 1. Subject Characteristics

Characteristics	Frequency (f)	Percentage (%)
Anemia		
Yes	61	39.1
No	95	60.1
Maternal Age		
High Risk	42	26.9
No Risk	114	73.1
Gravidity		
Primigravida	72	46.2
Multigravida	84	53.8
Employment		
Work	88	56.4
No	68	43.6
Education		
Low	45	28.8
High	111	71.2

Table 2. Results of bivariate tests of factors influencing abortion (analysis using chi square)

Independent Variables	Abortion				p-value
	Yes		No		
	f	%	f	%	
Anemia					
Yes	28	53.9	33	31.7	0.008
No	24	46.1	71	68.3	
Maternal Age					
High Risk	20	38.5	22	21.1	0.022
No Risk	31	61.5	82	78.9	
Gravidity					
Primigravida	30	57.7	42	40.4	0.041
Multigravida	22	42.3	62	59.6	
Employment					
Work	31	59.6	57	54.8	0.568
No	21	40.4	47	45.2	
Education					
Low	19	36.5	26	25	0.134
High	33	63.5	78	75	

Based on table 2, pregnant women with anemia tend to experience abortion more frequently, with a percentage of 53.9%, compared to pregnant women without anemia, who have a percentage of 46.1%. Abortion risk increased with anemia (p=0.008); risky maternal age (p=0.022), and gravidity (p= 0.041); and these results were statistically significant. Meanwhile, abortion risk did not increase with employment (p=0.568) and education (p=0.134); and these results were not statistically significant.

Multivariate logistic regression analysis is performed by selecting the confounding and independent variables using the chi-square test; if a significant p-value (<0.05) is obtained, the variable will be included in the multivariate model. Based on the chi-square test, significant p-values were found for the variable anemia (p=0.008), maternal age (p=0.022, and gravidity (p=0.041), so these variables can be included in the multivariate analysis.

Based on table 3, the Nagelkerke R Square value of 0.157 indicates that the variables of anemia, age, and gravidity together explain 15.7% of the occurrence of abortion in the study subjects. The p-value for anemia (0.007), maternal age (0.007), and gravidity (0.015) show that these variables are factors that influence abortion.

Based on this logistic regression analysis, the odds ratio (OR) for each variable can also be determined. Maternal age has the highest OR value of 3.03, meaning that pregnant women of higher risk age have a 3.03 times greater risk of experiencing abortion compared to pregnant women without risky age.

Pregnant women with anemia have a 2.67 times greater risk of experiencing abortion compared to pregnant women without anemia, while primigravida women have a 2.48 times greater risk of experiencing abortion compared to multigravida women. Therefore, it can be concluded that maternal age is the most influential factor of abortion in pregnant women, followed by anemia and gravidity.

Table 3. Results of multivariate test of factors influencing the abortion (analysis using logistic regression)

Independent Variables	p-value	OR	95% CI		Nagelkerke R Square
			Lower	Upper	
Anemia	0.007	2.67	1.31	5.49	0.157
Maternal Age	0.007	3.03	1.36	6.74	
Gravidity	0.015	2.48	1.19	5.19	

DISCUSSION

Maternal age is significantly associated with abortion. These results are in line with case control research by Sari *et al.* (2020) which states that maternal age is related and it is 2,43 times greater risk factor for abortion with a p-value of 0.037.[11]

Between the ages of 20 and 35 years is the ideal age for a woman to get pregnant.[11] Pregnancy at an age younger than 20 can have negative impact on both the health of the mother and the growth and development of the fetus, as the mother's reproductive organs are not yet fully mature and the hormonal system is still unstable.[12] On the other hand, pregnancy after the age of 35 also carries high risks, including a decrease in uteroplacental perfusion due to reduced vascularization.[13] Furthermore, a higher risk maternal age can affect the psychological experience and behavior in accepting and coping with pregnancy.[14]

Gravidity is significantly associated with abortion. These results are in line with case control research by Yanti (2018) which states that gravidity is related to abortion with a p-value of 0.007.[15]

Primigravida is a woman who is pregnant for the first time where the woman has no experience of pregnancy or childbirth. They usually will rely on advice from their family members or

neighbors. One of the factors contributing to abortion in primigravida women is the lack of prior pregnancy knowledge and experience.[16] Additionally, in a primigravida pregnancy, the mother is still adapting to hormonal changes in her body as compensation for the developing fetus in the uterus, which requires space and nutrients for growth.[17]

Education is not significantly associated with abortion. These results are in line with case control research by Desyanti (2016) which states that education is not related to abortion with a p-value of 0.839.[18] However, in research conducted by Siregar and Saragih (2021), there was a significant correlation between education and abortion with p-value of 0.004.[19]

A mother's level of education generally reflects her knowledge and awareness. Pregnant women with higher education tend to experience improved quality of life and better preparedness for pregnancy. Higher levels of education make it easier to receive information, increasing knowledge on topics such as the importance of antenatal care (ANC) visits during pregnancy.[20] Pregnant women with higher education are more likely to monitor and pay attention to their pregnancy conditions and are more proactive in seeking information about health.[21] However, this discrepancy might arise because the study only focused on formal education. Formal education is not the only factor that determines mother's awareness about their pregnancy. The primary source of pregnancy-related information often comes from medical professionals, followed by informal sources such as the internet, friends and family. Therefore, the knowledge of pregnant women does not only depend on their level of formal education, but is also influenced by their personal desire to learn about pregnancy.[10]

Employment is not significantly related to abortion. These results are in line with cross sectional research by Alhidayati (2016) which states that employment is not significantly related to abortion with a p-value of 1.00.[22] However, in research conducted by Massa (2024), there was a significant correlation between employment and abortion with p-value of 0.006.[23]

Employment is an important factor to consider, as many hazards can be found in the workplace. Working mothers spend a significant amount of time at work, and various hazardous exposures, including shift work, long working hours, heavy lifting, prolonged squatting, and standing for long periods, are known to be related to an increased risk of abortion.[24] This discrepancy from previous studies may be due to several factors, such as the subject size and the location of subject collection. Additionally, abortion may be caused by low income due to unemployment. Low socioeconomic status reduces the purchasing power for nutritional needs, which can be harmful to the fetus. Malnutrition can affect fetal growth and may trigger abortion in pregnant women.[25]

Anemia is significantly associated with abortion. These results are the same as cross sectional study by Utami *et al.* (2022) which stated that anemia is related and is a 5.82 times greater risk factor for abortion with a p-value of 0.009.[26]

Low hemoglobin levels (anemia) can lead to decreased placental perfusion, thus preventing the fetus from receiving adequate nutrients.[27] Anemia can cause disturbances in fetal growth, both in body cells and brain cells. Moreover, pregnancy-related anemia is often associated with reduced maternal immunity, making the mother more susceptible to infections.[28] If an abortion is accompanied by an infection in the upper reproductive organs, such as endometritis or parametritis, it may lead to infectious abortion. Furthermore, if the infection spreads to the bloodstream (bacteremia) or the peritoneum (peritonitis), it can result in septic abortion.[29] Iron deficiency anemia is the

most common type of anemia in low-income or developing countries, such as Indonesia. This is because iron deficiency anemia is closely related to the socioeconomic status of the population in these countries.[30] Low consumption of both animal and plant-based proteins is one of the contributing factors, as these are primary sources of iron essential for hemoglobin (Hb) synthesis in red blood cells[4]. Additionally, iron deficiency is exacerbated by low adherence to iron supplement intake during pregnancy.[27]

CONCLUSION

There is a significant correlation between anemia and abortion in pregnant women, with a p-value of 0.007 ($p<0.05$), indicating an increased risk of abortion in anemic pregnant women, which is 2.67 times higher compared to pregnant women without anemia, with an odds ratio (OR) of 2.67.

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