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Association between Maternal Hemoglobin Level and Incomplete Abortion in A West Java Tertiary Hospital, Indonesia

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Abstract

Objective: To evaluate the association between maternal hemoglobin concentrations and incomplete abortion.

Methods: An analytic, cross-sectional study with consecutive sampling method was conducted using medical records of 45 pregnant women aged 18–35 years old visiting the Obstetrics and Gynecology Department of Dr. Hasan Sadikin General Hospital, Bandung, Indonesia from January 1, 2017 to December 31, 2019. Participants were grouped into incomplete abortion and non-abortion groups.

Results: Maternal characteristics in the incomplete abortion group showed that the majority of pregnant women in this group were 25.58 years of age, non-anemic (n=37, 82.22%), had no previous spontaneous abortion (n=40, 88.89%), and were nulliparous (n=25, 55.55%) with a mean interpregnancy interval of 4.03 years. The characteristics in both incomplete abortion group and non-abortion group were homogenous in the level of anemia (p-value=0.380), previous spontaneous abortion (p-value=1.00), and interpregnancy intervals (p-value=0.667). The mean hemoglobin concentration for the incomplete abortion group was 11.81 gr/dL (95% CI, 11.30 to 12.26). Heterogenous data was found in age (p-value=<0.001) and parity (p-value=0.002). Parity was a strong confounder, causing the hemoglobin concentration insignificantly associated to incomplete abortion (p-value=0.884).

Conclusion: No statistically significant association is found between hemoglobin concentration and incomplete abortion. Most women with incomplete abortion are around 25 years old, nulliparous, non-anemic with a mean hemoglobin concentration of 11.81 gr/dL with no history of previous abortion, and a rather secure interpregnancy intervals.

Keywords: Anemia, hemoglobin, incomplete abortion, interpregnancy intervals, parity

Introduction

Incomplete abortion is partial expulsion of conception or placenta weighing 500 grams or less with some parts left inside the uterus at gestational age before 20 weeks.[1] The incidence of spontaneous abortion is estimated at 23 million each year worldwide.[2] Causes of spontaneous abortion is multifactorial, primarily due to chromosomal anomalies.[3] In Indonesia, according to a meta-analytic study, the most prominent factors are maternal age and parity.[4] Other factors are education, early menarche, interpregnancy intervals, anemia, previous abortion, infections obesity, and hypertension.[3,4]

Anemia in pregnancy is a condition in which pregnant women have a hemoglobin (Hb) concentration below 11 gr/dL.[5] This condition can be due to hemodilution, excretion of iron through sweat, inadequate intake, heavy menstruation, malaria or parasitic infection, and anemia before gestation.[3] The World Health Organization (WHO) stated that the global prevalence of anemia among pregnant women aged 15 to 49 years is 36.5% in 2019.[6] In Indonesia, the national prevalence for this condition is 48.9% or 5 out of 10 pregnant women suffer anemia in 2018.[7] A study by Judistiani *et al*.[8] in West Java, Indonesia, in 2020 followed first trimester pregnant women. Their findings demonstrated an increased in anemia in the first trimester from 7.5% to 8.48%. This is concerning as anemia is linked to premature birth, low birth weight, preeclampsia, infections, and cardiac failure, which ultimately increases the mortality and morbidity rates of mothers and their infants.[3,9]

Some theories have presented a correlation between anemia and decreased oxygen supply or iron for the development of fetus, increased oxidative stress production and infection risk, and dysfunctional iron-dependent thyroid peroxidase.[10,11] A large-scale study involving almost 4 million women in China shows a significant association between severe anemia (<7 gr/dL) and an increased risk of abortion, while mild anemia (<11 gr/dL) is protective towards abortion.[10] Despite the facts that various studies had been performed regarding anemia and spontaneous abortion, they are rarely specifically connected with incomplete abortion or using categorized hemoglobin concentration. This study aimed to evaluate the association between maternal hemoglobin concentration and incomplete abortion.

Methods

An analytic observational study with cross-sectional design was performed on secondary data from medical records of pregnant women diagnosed with incomplete abortion at a gestational age of <20 weeks treated at the Department of Obstetrics and Gynecology, Dr. Hasan Sadikin General Hospital Bandung, West Java, Indonesia, from January 1, 2017 to December 31, 2019. The ethical clearance for this study was obtained from the Research Ethic Committee of Universitas Padjadjaran Bandung (no. 1155/UN6.KEP/EC/2022) and Dr. Hasan Sadikin General Hospital Bandung (no. LB.02.02/X.2.2.1/292/2023).

The inclusion criteria used were pregnant women in the age group of 18–35 years old; diagnosed for incomplete abortion as confirmed by ultrasound results, and had hemoglobin concentration recorded when patient first came to the emergency room of the hospital. Participants were excluded if data were incomplete data, such as patients' age, gestational age, and recorded hemoglobin concentration; had a history of diabetes mellitus, thyroid dysfunction, and hypertension; had multiple gestation; and had a history of lupus, antiphospholipid syndrome, and thalassemia. Data that were required in this study were age, interpregnancy intervals, and hemoglobin concentration as numerical variables; abortion incomplete, concluded level of maternal anemia, history of previous abortion, and parity as categorical variables. Consecutive sampling technique was used with a minimum sample of 35 for each incomplete abortion and non-abortion groups, based on a calculation using the unpaired numeric formula based on the hemoglobin concentration in a study by Guo *et al*.[12]

Diagnosis of incomplete abortion were confirmed by ultrasound. Data on hemoglobin concentration on admission were obtained from medical records for incomplete abortion cases. The Hospital Information System was used to obtain data for non-abortion cases from women with spontaneous delivery in the same time period. The data presented in mean, median, standard deviation, minimum, maximum values, and further categorized using the classification of anemia according to the WHO into non-anemia (Hb ≥11 gr/dL), mild anemia (Hb 10–10.9 gr/dL), or moderate anemia (Hb 7–9.9 gr/dL).[5] Cases were also categorized by parity based on past delivery at gestational age ≥24 weeks. The categories used were nulliparity (0 child), primiparity (1 child), and multiparity (≥2 children). Qualified data were processed using Microsoft Excel and IBM® SPSS® 26.

Univariate analysis was performed to analyze the subjects' characteristics. Data on hemoglobin concentration were tested for its normality using the *Kolmogorov-Smirnov* test. Then, a bivariate analysis with a confidence interval (CI) of 95% was used to test the hypothesis on the association of maternal hemoglobin concentration and incomplete abortion. The *Chi Square* test was used for anemia level and parity, whereas the *Fisher-exact* test was used to analyze the number of previous spontaneous abortions. Results of these analysis were considered as statistically significant and interpreted as having a cause-

effect association if the p-value ≤0.05.

Results

To obtain participants, consecutive sampling was applied on secondary data registry of patients treated from Janury 1, 2017 to December 31, 2019 and 45 samples each were selected for the incomplete abortion and non-abortion groups.

Maternal characteristics (Table 1) showed a mean age of 25.58 years old for the incomplete abortion group. A high number of cases of non-anemia was found in both incomplete abortion and non-abortion groups. Mild and moderate anemia cases was higher among non-abortion group, albeit not significantly different. Most subjects in both groups had no previous history of spontaneous abortion. The mean interpregnancy intervals in the incomplete abortion group and non-abortion groups were 4 years and 3.45 years, respectively. Both groups had a high number of nulliparous women, which was significantly higher in the non-abortion group. Both groups were found to have similar comparable baseline characteristics in terms of anemia level (p-value=0.380>0.05), number of previous spontaneous abortion (p-value=1.00>0.05), and interpregnancy intervals with a p-value of 0.667 (>0.05). However, for the parity (p-value 0.002<0.05) and age (p-value <0.001<0.05), the two groups were not similar. The *Post-hoc* test was then performed to each parity category, resulting in 1.00>0.05, 0.833>0.05, and 1.00>0.05 for nulliparity, primiparity, and multiparity, respectively. This showed that heterogeneity of parity in the compared groups was significantly associated with the association of hemoglobin concentration and incomplete abortion. This means that the number of parity could confound and cause no significant association between hemoglobin concentration and incomplete abortion.

In the incomplete abortion group, the mean and median hemoglobin concentrations were 11.81 gr/dL and 11.80 gr/dL, respectively, while the same values for non-abortion group were 11.90 gr/dL and 12.20 gr/dL. To define the association between the hemoglobin concentration level and incomplete abortion, an analysis was conducted after the normality test using the non-parametric independent-sample analysis of *Mann-Whitney U* test due to the fact that the data of the abortion group and non-abortion groups were not

Table 1 Study Population Characteristics

Characteristics	Incomplete Abortion (n=45)	Non-Abortion (n= 45)	p-value
Age (years)			
Mean (SD)	25.58 (4.59)	29.16 (4.79)	<0.001
Anemia Level, n (%)			
Non-Anemia	37 (82.22%)	32 (71.11%)	
Mild Anemia	2 (4.45%)	5 (11.11%)	**0.380**
Moderate Anemia	6 (13.33%)	8 (17.78%)	
Number of Previous Spontaneous Abortion, n (%)			
0	40 (88.89%)	40 (88.89%)	**1.00**
1	5 (11.11%)	5 (11.11%)	
Interpregnancy Intervals (years)			
Mean (SD)	4.03 (2.86)	3.45 (3.08)	0.667
Parity, n (%)			
Nulliparity	25 (55.55%)	40 (88.89%)	
Primiparity	12 (26.67%)	1 (2.22%)	0.002
Multiparity	8 (17.78%)	4 (8.89%)	

Table 2 Association between Hemoglobin Concentration and Incomplete Abortion

Variable	Hemoglobin Concentration (gr/dL)		95% CI	p-value
	Mean (SD)	Median (range)		
Incomplete Abortion	11.81 (1.53)	11.80 (7.60-14.70)	11.30 – 12.26	0.884
Non-Abortion	11.90 (1.68)	12.20 (8.30-14.70)	11.31 – 12.31	

normally distributed. This analysis resulted in a p-value of 0.884 (>0.05), demonstrating no statistical significant association between the hemoglobin concentration and incomplete abortion (Table 2).

Discussion

It was revealed in this study that the maternal hemoglobin concentration in early pregnancy is not associated with incomplete abortion. Hemoglobin concentration in the incomplete abortion group presents a lower mean level of 11.81 gr/dL when compared to the non-abortion group (11.90 gr/dL). A similar difference in concentration is also reported by Guo *et al*.[12] among women treated at the Beijing Obstetrics and Gynecology Hospital, in which first trimester pregnant women have a higher mean hemoglobin concentration level of 13.22 gr/dL as opposed to women with spontaneous abortion (12.59 gr/dL). A study by Díaz-López *et al*.[11] in 2021 and Xu *et al*.[10] in 2020 do not correspond to the findings of the present study by showing that an increased risk of spontaneous abortion is found in women suffered from severe anemia (p-value=<0.001; OR, 1.52; 95% CI, 1.25 to 1.86), low concentration (Hb <11 gr/dL; *p*-value=0.002<0.05) and high concentration (Hb>14 gr/dL; p-value=0.012<0.05).

The identified association might be due to the fact that women were hemorrhaging for hours to days before hospital admittance, as well as the presence of strong confounding factors of parity and age, and/or other factors that were not established in current study. Moreover, blood test result data was based on the the data at patient admission. The very first antenatal care (ANC) hemoglobin data were not available as most patients had ANC outside the area of study and some may not even seek any care at all. Although current study showed that most pregnant women in first trimester have hemoglobin concentration above the lower cutoff of 11 gr/dL determined globally, this number is still lower compared to other pregnant women outside of Indonesia. This might be because of differences in the demography, climate, lifestyle, and health-seeking behaviors among different countries. A low hemoglobin level during adolescence (aged 10-18 years) is said to be carried over to adulthood and contribute to anemia in pregnancy; hence, it is important to prepare early and reach the adequate hemoglobin level in preconception stage.[13]

The mean age of women in the incomplete abortion group is 25 years, which is younger than those in the non-abortion group. A study in Norway has shown an absolute lowest risk of spontaneous abortion in 27 year-old pregnant women (range, 25–29 years old).[14] A case-control study by Yanti L.[15] has demonstrated that maternal age is significantly correlated positively with spontaneous abortion with a *p*-value of <0.01 (r=0.297), despite the fact that another study found no significant correlation (OR, 1.587; *p*-value=0.202<0.05).[16] Findings in the current study might show that women with more mature age have a more solid plan to conceive; therefore they are more open in finding supports or information, restricting their daily activities, and seeking more care or more likely to take supplements in order to achieve a successful pregnancy.

Most women in the incomplete abortion group fall into non-anemia category, which corresponds to the findings of a study done in Bahagia general hospital in Makassar City, Indonesia. However, this is different from a study done in Kediri district, Indonesia, in 2017, where the highest occurrence of abortion is seen in subjects with severe anemia (59.5%; p-value=0.000; r=0.504).[17,18] The non-anemic state presented by most subjects might suggest that they had received adequate care, such as taking Fe or multivitamins, consuming nutritious food, and applying healthy lifestyle. Still, hemoglobin concentration alone could not be accounted for adequate iron stores.

Several mechanisms caused by anemia and iron deficiency in pregnancy may also lead to spontaneous abortion. Hypoxic state due to decreased oxygen supply could stimulate fetal production of cortisol that will disturb the fetal development and estrogen-progesteron function, leading to myometrium contraction and cervix dilation.[11,19] Increased oxidative stress could disturb trophoblast invasion and the development of spiral arteries which were not yet embedded firmly.[18] Therefore, explained the early expulsion of conception.

Most subjects with incomplete abortion present no previous history of spontaneous abortion (88.89%). This finding is similar to the findings of a study performed in the same region of Bandung city that showed a higher number of subjects withouth previous abortion history in the incomplete abortion group with an insignificant correlation (56.98%; p-value=0.111).[20] Another study by Arnianti *et al*.[21] in 2021 had different results which abortion group with previous abortion had percentage of 56.5% and increased risk of 2.97 times (95% CI, 1.05 to 8.37) for subsequent abortion. A history of spontaneous abortion is not a predicting factor that the subsequent pregnancy would end in another abortion despite a 20% increase in the risk for abortion.[3] It is speculated that history of spontaneous abortion could cause trauma, both physically and psychologically. Curettage could scar the endometrium which will lead to a suboptimal condition for the fetus and placenta to grow. The preceding loss could lead to stress, substance abuse, and unhealthy lifestyle that could put current pregnancy at risk.

In terms of the interpregnancy intervals, the mean interval for subjects with incomplete abortion is 4 years, ranging from 4 months to 9 years. A case-control study by Purwaningrum *et al*.[22] stated that pregnant women with interpregnancy intervals of less than 6 months or more than 48 months have a four-fold increased risk (OR, 4.2; *p*-value=0.01<0.05) of spontaneous abortion than those with an interval between 6 to 48 months. Mremi *et al*.[23] in 2022 found that interpregnancy intervals is significantly correlated with post-partum anemia and is 10 times higher in women who have less than a 2-year interval between pregnancies. Pregnancy had been progressively using maternal iron stores for the development of the fetus in each trimester, hence it would be deficient by the end of the term. It was said that the body needed at least eight weeks to return red blood cells volume and hematocrit to normal, not to count other events that could make the wait time longer, such as anemia during pregnancy, blood loss during delivery, post-partum hemorrhage, and lochia that happened for weeks.[3] A big gap between pregnancies (>5 years) was also considered to be a risk due to an increased in maternal age and the need for the uterine wall to adjust as if it was the first pregnancy. Hence, preconception counseling and supplementations became important to anticipate such factors that could contribute to spontaneous abortion.

Incomplete abortion most often occurred in nulliparity or women who were pregnant for the first time (55.56%). These findings corresponded to a study done in Mojokerto in 2022 which stated that first pregnancy had risk for abortion (42.4%).[24] Different results were reported from a study in Al-Ihsan General Hospital Bandung in 2020 that multiparity had higher number (66.67%) among women with incomplete abortion and more number of parity was causing higher proportion of abortion (*p*-value=0.08<0.05).[20] This study, supported by another study in Nepal showed that parity was a significant predictor of hemoglobin concentration, as well as maternal age.[25] Increasing parity numbers could lead to decrease hemoglobin concentration and serum ferritin in the subsequent pregnancy due to inadequate replenishment from the preceding spent of iron stores, which was also influenced by interpregnancy intervals.[4]

Thus, this study discovered no significant association between inclomplete abortion and maternal hemoglobin concentration, and that parity could be a strong confounder. The prevalence of anemia in pregnant women treated in Dr. Hasan Sadikin General Hospital Bandung is low; hence may explain the non-association. This study also has several limitations. Most subjects are not anemic and study populations are quite different as data for incomplete abortion were taken from medical records and the non-abortion data were collected from SIRS. Hemoglobin concentration data from the very first antenatal care cannot be acquired as subjects received care outside the study location. Limited time and being single-centred have made the sample study small and might not accurately reflect the actual condition. Future studies are suggested to involve multicenters and a longer period of time in the hope that more precise results can be obtained. It is recommended to do analysis solely among pregnant women with anemia.

References

1. Ministry of Health of the Republic of Indonesia. Pedoman Nasional Asuhan Pasca Keguguran Yang Komprehensif Komprehensif. Jakarta Kementerian Kesehatan Ri. 2020.
2. Miscarriage: worldwide reform of care is needed. The Lancet. 2021; 2021-05-01:1597.
3. Dutta DC, Konar H. DC Dutta's textbook of obstetrics: including perinatology and contraception. Ninth edition. ed. New Delhi: Jaypee; 2018.
4. Akbar A. Faktor penyebab abortus di indonesia tahun 2010-2019: Studi Meta Analisis. Jurnal Biomedik (JBM). 2019;11:182–91.
5. WHO. Haemoglobin Concentration for The DiagnosisofAnaemiaandAssessmentofSeverity. WHO/NMH/NHD/MNM/11.1. [cited 2022 October 26]. Available from: https://apps.who.int/iris/bitstream/handle/10665/85839/WHO_NMH_NHD_MNM_11.1_eng.pdf?sequence=22&isAllowed=y.
6. WHO. Prevalence of Anaemia in Pregnant Women (aged 15-49) (%). [cited 2022 October 26]. Available from: https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-anaemia-in-pregnant-women-(-).
7. Badan Pusat Statistik. Prevalensi Anemia Pada Ibu Hamil 2020. [cited 2022 October 26]. Available from: https://www.bps.go.id/indikator/indikator/view_data/0000/data/1333/sdgs_2/1.
8. Judistiani RTD, Madjid TH, Handono B, Sukandar H, Irianti S, Gumilang L, *et al*. First trimester ferritin is superior over soluble transferrin receptor and hepcidin in predicting anemia in the third trimester: result from a cohort study in Indonesia. Anemia. 2020;2020:1–6.
9. Smith C, Teng F, Branch E, Chu S, Joseph KS. Maternal and Perinatal Morbidity and Mortality Associated With Anemia in Pregnancy. Obstet Gynecol. 2019;134(6):1234–44.
10. Xu Q, Yang Y, Liu F, Wang L, Wang Q, Shen H, *et al*. Preconception Hb concentration with risk of spontaneous abortion: a population-based cohort study in over 3–9 million women across rural China. Public Health Nutr. 2020;23(16):2963–72.
11. Díaz-López A, Ribot B, Basora J, Arija V. High and low haemoglobin levels in early pregnancy are associated to a higher risk of miscarriage: a population-based cohort study. Nutrients. 2021;13(5):1578.
12. Guo Y, Zhang N, Zhang D, Ren Q, Ganz T, Liu S, *et al*. Iron homeostasis in pregnancy and spontaneous abortion. Am J Hematol. 2019;94(2):184–8.
13. Handari SRT, Anies, Kartasurya MI, Nugraheni SA. Haemoglobin level of pregnant women was associated with history of anemia during adolescent period: findings from the indonesia family life survey. Bali Medical Journal. Bali Medical Journal; 2022;11(3):1710–6.
14. Magnus MC, Wilcox AJ, Morken NH, Weinberg CR, Håberg SE. Role of maternal age and pregnancy history in risk of miscarriage: prospective register based study. BMJ. 2019;364:l869.
15. Yanti L. Faktor determinan kejadian abortus pada ibu hamil: Case control study. MEDISAINS. 2018;16(2):95.
16. Muliana N, Fitriani AD, Nasution YE. Kejadian abortus inkompletus di RSUD Chik di Tiro Sigli. Jurnal Serambi Akademica. 2019;7(3):194–204.
17. Ruqaiyah R, Herliana E, Mirnawati M. Faktor-Faktor Yang Berhubungan terhadap kejadian abortus pada ibu hamil di Rumah Sakit Umum Bahagia Makassar 2019. Jurnal Kesehatan Delima Pelamonia. 2019;3(1):1–9.
18. Jayani I. Tingkat anemia berhubungan dengan kejadian abortus pada ibu hamil. Care: Jurnal Ilmiah Ilmu Kesehatan. 2017;5(1):59-68.
19. Wu L, Sun R, Liu Y, Liu Z, Chen H, Shen S, *et al*. High hemoglobin level is a risk factor for maternal and fetal outcomes of pregnancy in Chinese women: A retrospective cohort study. BMC Pregnancy Childbirth. 2022;22(1):290.
20. Puspita T, Widjajanegara H, Setiapriagung D. Hubungan antara usia, paritas dan riwayat abortus dengan kejadian abortus inkomplit di Rumah Sakit Umum Daerah Al-Ihsan Bandung Periode Januari 2017-Agustus 2019. Prosiding Pendidikan Dokter. 2020;27:402–6.
21. Arnianti A, Umami N. Faktor risiko usia dan riwayat abortus dengan kejadian abortus. Jurnal Berita Kesehatan; 2021;14(1):1–11.
22. Purwaningrum ED, Fibriyana AI. Faktor risiko kejadian abortus spontan. HIGEIA (Journal of Public Health Research and Development). 2017 Aug 4;1(3):84–94.
23. Mremi A, Rwenyagila D, Mlay J. Prevalence of post-partum anemia and associated

factors among women attending public primary health care facilities: An institutional based cross-sectional study. PLoS One. 2022;17(2):e0263501.
24. Pricilia Lepith P, Lestari I, Lukita Dewi CP. Faktor-Faktor yang Mempengaruhi Abortus Inkomplit. JBS (Jurnal Bina Sehat): Jurnal Ilmu Keperawatan dan Kebidanan. Mojokerto.2022.
25. Sharma D, Amgain K, Panta PP, Pokhrel B. Hemoglobin levels and anemia evaluation among pregnant women in the remote and rural high lands of mid-western Nepal: a hospital based study. BMC Pregnancy Childbirth. 2020;20(1):182.