

Placental Morphometry In Post-Partum Mother With Anemia

Running title : Placental Morphometry

Sri Rejeki¹, Septiana Arum Nur Aifa², Wulandari Meikawati³, Sandeep Poddar⁴

¹Lecturer and Nursing Practical Faculty of Nursing and Health Sciences Universitas Muhammadiyah Semarang, Indonesia

²Practical of Faculty of Public Health Universitas Muhammadiyah Semarang, Indonesia

³Lecturer of Faculty of Public Health Universitas Muhammadiyah Semarang, Indonesia

⁴Senior Research Director, Lincoln University College, Malaysia

Abstract: Title of the Article: Placental Morphometry in Post-Partum Mother with Anemia

Context: Anemia in pregnancy affects the abnormality of the placenta, thereby causing a decrease in placental function. Babies born with an abnormal placenta carry a risk of developing arterial blockage, heart failure, hypertension, and cancer in the future.

Aims: Thus, the objective of this study was to determine the correlation between anemia in the third trimester of pregnancy and placental morphometry.

Method: A total of 44 placentas from pregnant women with anemia and no anemia were selected by consecutive sampling techniques. The placentas were measured directly in weight, diameter, thickness, surface area, length of the umbilical cord, and the shape of the placenta. The measurement results were tested with Pearson correlation and Rank Spearman, while the placenta shape was tested by Chi-square.

Result: As many as 75% of pregnant women experience anemia in the third trimester, by most of the placenta has normal weight and thickness, the diameter and length of the umbilical cord are all normal, and the size is mostly oval. The weight of placenta ($p = 0.000$), thickness of the placenta ($p = 0.023$), surface area of the placenta ($p = 0.000$) and diameter of the placenta ($p = 0.000$) have a correlation with anemia in pregnant women. Umbilical cord length ($p = 0.872$) means that it has no correlation with anemia in pregnant women. All of them have a direction of the correlation (r) negative.

Statistical analysis used: The test is carried out at a significance level (α) of 95%. Placenta shape ($p = 1.00$) meaning that it has no correlation with anemia in pregnant women, OR = 0.939 (95%, CI = 0.861-1.024).

Conclusion: The condition of anemia in third-trimester pregnant women has correlation with the weight, thickness, surface area, and diameter of the placenta but has no correlation with the length of the umbilical cord and the shape of the placenta.

Keywords: Anemia, placenta, placental morphometry.

1. INTRODUCTION

The prevalence of anemia globally is still relatively high, 38.17% spread throughout the world.^[1] The percentage of cases in developing countries is 53-61% in Africa, 44-53% in Southeast Asia and 17-31% in Europe and North America^[2] and 29.6%^[1] in Indonesia, mostly experienced by pregnant women,^[3] for 37.1%.^[4] Based on data from WHO, anemia in pregnancy is still a 40% cause of maternal death worldwide.^[2] During pregnancy, the placenta functions as a means of excretion and transportation of nutrients and oxygen from mother to fetus.^[5] However, anemia in pregnant women will decrease the function of the placenta, affecting the growth and development of the fetus in uterus.

Anemia may induce the growth and changes in placental morphology and histology, morphometric characteristics of the placental tissue, the course of the pregnancy process, birth weight of the baby, APGAR score,^[6] development of the baby after birth,^[7] and reduction of iron stored in breast milk (ASI) and cord blood.^[8] Under this circumstance, anemia occurring in pregnancy brings a risk factor for abnormal placental growth.^[9] In this case, the babies born with a large placenta have a greater risk of developing hypertension in the future,^[10,11] while babies born with a small placenta have an indication of a lack of nutritional intake to the placenta resulting in placental hypoxia, which may ultimately interfere its function.^[9]

2. RESEARCH METHOD

The study was conducted on postpartum mothers at the Diponegoro National Hospital from June 16th - August 7th, 2018. It used a Consecutive Sampling as the technique. There were 44 placentas carefully selected from mothers who met the following inclusion and exclusion criteria: The inclusion criteria are (maternal age 20-35 years, gestational age 37-42 weeks, gestation 1-4, not smoking, not having pre-eclampsia, diabetes mellitus, hyperglycemia, and not experiencing a young gestational age. As exclusion criteria, they were mothers with pathological abnormalities during pregnancy, antepartum bleeding, having a history of systemic disease, or a fetus with congenital abnormalities.

Maternal hemoglobin levels during the third trimester of pregnancy were measured using a hematology analyzer at the Diponegoro National Hospital laboratory. Placenta measurements were carried out an hour after childbirth with the weight measured by scales, diameter, thickness, the surface area of the placenta, the length of the umbilical cord measured by the mid-line, and the shape of the placenta measured by observation.

3. RESULTS AND DISCUSSION

Based on 44 research subjects, the following results were obtained:

Table 1

Most of the third trimester pregnant women had anemia, as many as 33 subjects (75%), and the rest 11 subjects (25%) did not it. For the hemoglobin level, the lowest was 8.1 gr/dl, while the highest was 12 g / dl. On average, the subjects had hemoglobin level of 10.11 g / dl.

The hemoglobin level of pregnant women in third trimester and umbilical cord length had $p\text{-value} > 0.05$, meaning that the data were normally distributed. On the other hand, the weight of the placenta, placenta thickness, placenta surface area, and placenta diameter had a $p\text{-value} < 0.05$, so these variables were not normally distributed.

Table 2

All variables had negative correlation coefficient (r), meaning that the lower hemoglobin level in the third trimester was, the greater the size of the placenta was. The variables of placental weight, placenta thickness, placental surface area, and placental diameter had p -value < 0.05 , meaning that hemoglobin levels of the third trimester pregnant women had correlation with placental weight, placenta thickness, surface area, and placental diameter. The umbilical cord length variable had p -value > 0.05 so the hemoglobin level of the third trimester of pregnant women had no correlation with the length of the umbilical cord.

Table 3

In this case study, the subjects were 33 pregnant women with anemia, 2 of them had round placentas, and 31 others had oval placentas. Meanwhile, the rest 11 subjects with no anemia had oval placentas.

The correlation between anemia and placenta shape had p -value = 1.00 (p -value > 0.05), showing that there was no significant correlation between the placental shape of anemic or non-anemic pregnant women, while the odds ratio was = 0.939. (95% CI 0.861-1.024) meaning that subjects with anemia had 0.939 times the chance of having round placenta.

4. DISCUSSION

From the results of the study, it discovered that the hemoglobin level of third trimester pregnant women has correlation with placental weight, placental thickness, placental surface area, and placental diameter, yet has correlation with umbilical cord length and placenta shape. The correlation coefficient of the hemoglobin level of the subjects with previous variables is negative. If the hemoglobin level of the subjects is higher in the third trimester, the weight of the placenta, the thickness of the placenta, the surface area of the placenta, and the diameter of the placenta are more reduced.

Research on big placenta and anemia in pregnancy^[10] stated that anemia in pregnant women is a dangerous factor. Their babies will experience hypoxia and stimulate the growth of the placenta, resulting in significant changes in the morphology and histology of the placenta. Research on differences in birth weight and placental weight in pregnant women with anemia and no anemia^[12] showed that the placental weight is lower in pregnant women with anemia than the latter. A quantitative (stereological) study of placental structures in pregnant women with iron-deficiency anemia^[13] explained that placental hypertrophy connects to mild and moderate anemia in pregnant women. Meanwhile, the expansion of the placenta is a physiological growth unit of the placenta itself.

Factors that may cause the subjects with anemia to give birth to a larger placenta are the experience hypoxia and lack of blood flow to the uterus, causing the flow of oxygen and nutrients to the placenta disrupted, thus stimulating the placenta to grow bigger^[10] as a form of adaptation to the reduced supply of oxygen and nutrients.^[14]

Pregnant women with anemia are more likely to experience placental hypertrophy, which will affect the weight of the placenta and its surface area^[9,13] where the surface area of the placental villi has increased, and the thickness of the placental membrane was getting thin for the said subjects.^[12, 13]

The growth of the placenta occurs rapidly in the first trimester of pregnancy, and the growth rate begins to slow down in the fifth month of pregnancy, even then stops growing when it is completed. However, there are times when the placenta may continue to grow and

increase its size, if it is influenced by unfavorable maternal environment such as intra-uterine hypoxia.^[14]

The hemoglobin levels of pregnant women in the third trimester has no correlation with the length of the umbilical cord and the round or oval shape of the placenta. Until now, there has been no research explaining the shape of the placenta, umbilical cord insertion, thickness of the placenta at the umbilical cord insertion site, has any correlation with anemia. Most of the placentas in pregnant women with mild, moderate, and severe anemia are round and oval.

Anemia in pregnant women affects the growth process of the placenta during pregnancy. If they experience severe anemia at the beginning of pregnancy, it could affect the weight of the placenta and the structure of the placenta, thus it affects the transport of nutrients and oxygen to the fetus.^[16] Hemoglobin levels of pregnant women in the middle of the second trimester has more effect on the size of the placenta.^[17] Meanwhile, if pregnant women experience severe anemia during the third trimester of pregnancy, it will affect the thinning of the villous membrane.^[11] Anemia in the late trimester will also affect the structure of the placenta. High inbreeding rate and lack of appropriate medical care among tribal people of India as well as relation of anemia with hemoglobinopathies has been reported earlier.^[19,20]

The site of blastocyst nidation, as well as the change in the position of the placenta from the beginning of formation, is not influenced by the hemoglobin level of the pregnant woman.^[21] The changes in placental position ("dynamic placentation") occur due to changes in the uterus during pregnancy causing changes of the shape and position of the placenta.

5. CONCLUSION

1. There is a correlation between the anemia in pregnant women with the weight of the placenta, the thickness of the placenta, the surface area of the placenta, and the diameter of the placenta. Contrariwise, there is no correlation with the length of the umbilical cord and the morphology (shape) of the placenta.
2. As many as 75% of pregnant women experience anemia in the third trimester of their pregnancy.
3. Most of the placenta is born with normal weight and thickness, the diameter and length of the umbilical cord are all normal, and the size is mostly oval.

6. SUGGESTION

1. To the Diponegoro National Hospital: In order to reduce the prevalence of anemia in pregnant women, it is possible through efforts such as increasing health awareness regarding the matter, paying attention during examinations, and keeping medical records for measurement results of the birth weight of the placenta.
2. Pregnant women are recommended to do antenatal checks at least four times.
3. To the Next Researchers: It is necessary to carry out further research on anemia in pregnant women with medical records for hemoglobin levels from early pregnancy which affect placental morphometry with a larger number of study subjects.

Statement

In this study, there are no conflicts of interest, financial or otherwise.

Recognition

We would like to express our gratitude and appreciation to all the patients and intra-natal nurses who participated in this study.

7. REFERENCES

- [1] Health TLG. Prevalence of anemia among pregnant women (%). 2013; <http://data.worldbank.org/indicator/SH.PRG.ANEM?end=2011&start=2011&view=map>. Accessed 29 Desember, 2016.
- [2] Scholl TO, Reilly T. Anemia, iron and pregnancy outcome. *The Journal of nutrition*. 2000 Feb 1;130(2):443S-7S.
- [3] KESEHATAN BDPD. Riset Kesehatan Dasar 2013. In: RI KK, ed. Jakarta: Kementerian Kesehatan RI; 2017.
- [4] Indonesia KKR. Infodatin Situasi Gizi di Indonesia. Jakarta: Kementerian Kesehatan Republik Indonesia; 2017.
- [5] Wiknjosastro H. Ilmu Kandungan Edisi Kedua. Jakarta: Yayasan Bina Pustaka Sarwono Prawirohardjo. 2005..
- [6] Lelic M, Bogdanovic G, Ramic S, Brkicevic E. Influence of maternal anemia during pregnancy on placenta and newborns. *Medical Archives*. 2014 Jun;68(3):184.
- [7] Baptiste-Roberts K, Salafia CM, Nicholson WK, Duggan A, Wang NY, Brancati FL. Gross placental measures and childhood growth. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2009 Jan 1;22(1):13-23..
- [8] Kumar A, Rai AK, Basu S, Dash D, Singh JS. Cord blood and breast milk iron status in maternal anemia. *Pediatrics*. 2008 Mar 1;121(3):e673-7.
- [9] Baptiste-Roberts K, Salafia CM, Nicholson WK, Duggan A, Wang NY, Brancati FL. Maternal risk factors for abnormal placental growth: the national collaborative perinatal project. *BMC pregnancy and childbirth*. 2008 Dec 1;8(1):44.
- [10] Mahamuda Begum SA, Begum S, Kishwara S, Rayhan KA, Hossain A, Nahar A. Big placenta and anaemia in pregnancy. *Journal of Shaheed Suhrawardy Medical College*. 2009;1(2):17-20.
- [11] Reshetnikova OS, Burton GJ, Teleshova OV. Placental histomorphometry and morphometric diffusing capacity of the villous membrane in pregnancies complicated by maternal iron-deficiency anemia. *American journal of obstetrics and gynecology*. 1995 Sep 1;173(3):724-7.
- [12] Surinati IDAK. Perbedaan berat badan lahir dan berat plasenta lahir pada ibu hamil aterm dengan anemia dan tidak anemia. Denpasar: Pasca Sarjana Magister Ilmu Kesehatan Masyarakat, Universitas Udayana; 2011.
- [13] Huang A, Zhang R, Yang Z. Quantitative (stereological) study of placental structures in women with pregnancy iron-deficiency anemia. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2001 Jul 1;97(1):59-64..
- [14] Lestari DK. Proses Pembentukan Janin pada Daerah Ketinggian. Bogor, Institut Pertanian Bogor; 2006.
- [15] Bhavika Panchal JP, CD Mehta. Morphological study of placental changes in anemia with its clinical signifiant. *International Journal of Medical Science and Public Health*. 2016;5(12):4.

- [16] El-Sokkary FM, Hanafy M, Mohamed HA. Influence of maternal anemia on placental volume with study of uterine artery Doppler. The Egyptian Journal of Hospital Medicine. 2014 Oct 1;57(1):630-8.
- [17] Kinare AS, Natekar AS, Chinchwadkar MC, Yajnik CS, Coyaji KJ, Fall CH, Howe DT. Low midpregnancy placental volume in rural Indian women: A cause for low birth weight?. American journal of obstetrics and gynecology. 2000 Feb 1;182(2):443-8.
- [18] Lunney LH. Compensatory placental growth after restricted maternal nutrition in early pregnancy. Placenta. 1998 Jan 1;19(1):105-11.
- [19] Sen R, Chakrabarti S, Sengupta B, De M, Halder A, Poddar S, Gajra B, Talukder G, Sengupta S. α -thalassemia among tribal populations of Eastern India. Hemoglobin. 2005 Jan 1;29(4):277-80.
- [20] De M, Halder A, Podder S, Sen R, Chakrabarty S, Sengupta B, Chakraborty T, Das U, Talukder G. Anemia and hemoglobinopathies in tribal population of Eastern and North-eastern India. Hematology. 2006 Oct 1;11(5-6):371-3.
- [21] Kurt Benirschke GJB, Rebecca N. Baergen. Pathology of the human placenta. In: 6, ed. 13. Placental Shape Aberrations 2012: www.springer.com

* Table 1. Percentage of anemia during pregnancy in third-trimester

Incidence of anemia	Amount	Percentage
Anemia	33	75
Non-Anemic	11	25
Total	44	100

* Table 2. The Correlation between hemoglobin levels of third-trimester pregnant women and placental size

	R	P	Conclusion
Placental weight	-0,712	0,000	Correlated
Placental thickness	-0,342	0,023	Correlated
Surface area	-0,560	0,000	Correlated
Cord length	-0,025	0,872	Not Correlated
Diameter	-0,555	0,000	Correlated

*Table 3. Cross-table of anemia incidence in third-trimester pregnant women with placenta shape

Anemia Incidence	Placental Shape		Total	X ²	P	OR
	Round	Oval				
Anemia	2	31	33	-	1,00	0,939
Non-Anemic	0	11	11			
Total	2	42	44			