

## **Effect of Hemoglobin Levels on the Process of Healing Post Sectio Caesarea Wounds**

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### **ABSTRACT**

The long healing of post sectio caesarea wounds has an impact on patients and their families. In addition to the additional burdensome costs, patients can experience trauma due to the wound healing process that lasts a long time. Hemoglobin is the main component that transports oxygen and nutrients needed for the wound healing process. This study aims to analyze the effect of hemoglobin levels on the healing process of post sectio caesarea wounds at Aminah Hospital Blitar. The research design uses a case control approach samples were taken using consecutive sampling techniques with research inclusion criteria of 89 respondents. Data on hemoglobin levels were taken from secondary data on preoperative hemoglobin levels of patients in medical record documents and data on the process of wound healing seen from the results of one-time observation when the patient controls the obstetric polyclinic between day 7 to day 10 post sectio caesarea. Data were analyzed using a simple linear regression test. The results showed that 62.9% of respondents had normal hemoglobin levels and 79.77% of respondents showed good wound healing processes. The results of the statistical test analysis showed a p value of 0.000 which was smaller than  $\alpha$  of 0.05 with an R-square of 0.196. This means that there is an effect of hemoglobin levels on the wound healing process post sectio caesarea. So it is expected that pregnant women and their families pay attention to the value of hemoglobin levels during pregnancy and after delivery to ensure health and wound healing post sectio caesarea.

**Keywords:** Hemoglobin, Wound, Post sectio caesarea

### **Background**

The act of giving birth by caesarean section shows an increasing trend from year to year, but there is also an increased risk for pregnant women who give birth by caesarean section, namely that the healing of the caesarean section wound takes a long time (1). Long healing of surgical wounds has an impact on patients and health service providers. The increasing number of hospitalizations and costs burden patients and families, and patients can even experience trauma due to the long wound healing process. Oxygen and nutrients play an important role in the wound healing process, because no new tissue is formed without a supply of oxygen and nutrients (2). Hemoglobin is the main component of red blood cells which transports oxygen and nutrients. A decrease in hemoglobin in the blood will reduce oxygen and nutrient levels in the capillaries and disrupt tissue repair, thereby inhibiting the wound healing process.

Based on the results of Basic Health Research (2018), the percentage of pregnant women with low hemoglobin levels increased by 11.8%, pregnant women who gave birth by caesarean section was still high (17.6%), while in East Java it was 22.4%. Based on Basic

Health Research data, it was found that the rate of prolonged wound healing in caesarean sections in Indonesia reached 7.3% (3). At Harapan Jayakarta Hospital, the incidence of prolonged Caesarean section wound healing is 8%. At Aminah Blitar Regional Hospital, the number of patients undergoing slow healing for Caesarean sections in 2021 was 2.8% of patients, while in 2022 it increased by 3.2% of patients.

The high prevalence of anemia in pregnant women combined with the increasing number of caesarean section operations globally indicates that perioperative low hemoglobin levels in pregnant women are also a significant global health problem. Lack of blood volume, especially hemoglobin levels, will result in vasoconstriction and decreased availability of oxygen and protein nutrients which can inhibit wound healing. However, low hemoglobin levels are often not considered a risk factor, so they are sometimes not corrected before a planned Caesarean section surgical procedure, which is associated with the risk of prolonged post-operative wound healing (4).

Wounds require a healing process, wound healing is the process of replacing and repairing tissue function (5). The wound healing process starts from the process of hemostasis, inflammation, formation of new tissue, replacement of old tissue with new tissue. The wound healing process always involves active biological agents whose job is to regenerate damaged tissue. Hemostasis and inflammation processes, it starts immediately when tissue is damaged, while the formation of new tissue will take place simultaneously with migration and proliferation of tissue in the damaged area, this process takes place from the first week to 10 days (6). Wounds will fail to heal if there are inhibiting factors (7). A decrease in oxygen supply due to low hemoglobin levels has a detrimental effect due to poor blood supply and hypoxia at the wound site, so that in the proliferation phase wound healing becomes hampered and wound healing takes a long time because wound healing requires an adequate supply of oxygen and nutrients (8). Clinically, the wound showed no signs of erythema, warmth on the skin, edema and pain after the 3rd or 4th day. However, in theory the wound should be observed 7 to 10 days after surgery, where the wound healing phase of collagen formation begins with the fusion of skin tissue (9).

A preliminary study conducted on 7-14 February 2023 at Aminah Blitar General Hospital, base on data on surgical patients from November 2022-January 2023, there were 263 cases of Sectio Caesarea operations. Data obtained in January 2023 included 92 patients who underwent Sectio Caesarea surgery. Of the 92 patients who underwent Sectio Caesarea surgery, 26 patients or 28% had pre-operative hemoglobin levels below 11. Of the 26 patients, 7 operations were carried out as emergencies and 19 operations were carried out electively or planned. Of the 26 patients who underwent Sectio Caesarea surgery with low hemoglobin levels, 11 patient's wound was not well until the 10th day after the Sectio Caesarea operation. Based on the information obtained, most of this occurs because the skin tissue has not yet fused until the 10th post-operative day, so longer wound care is required. The failure of skin tissue to unite immediately due to surgical wounds is mainly caused by the blood supply to the tissue.

The blood supply in question is the supply of oxygen bound by hemoglobin to the tissues. The results of research, factors related to the post caesarean section wound healing process at Prof. Dr. R.D Kandou Hospital with a sample size of 127 respondents found that there was a relationship between anemia and the post caesarean section (10). The results of section patients at the Palembang Muhammadiyah Hospital in 2017 with a total of 96 respondents (. It was found that the most dominant factor influenced wound healing after caesarean section surgery. is anemia. Other supporting research regarding factors that influence wound healing after cesarean section with a sample size of 150 respondents, found a relationship between a decrease in hemoglobin levels and the process of wound healing after cesarean section. Normal pregnant women before delivery must have a hemoglobin level  $\geq 11$

g/dl. During post partum or post caesarean section surgery the minimum hemoglobin level is  $\geq 10$  g/dl, if it is less than this amount it will cause hemodilution (blood thinning) which disrupts oxygen circulation. Ensuring that the mother is not anemic both before and after surgery is a wise action because a decrease in hemoglobin levels (anemia) can interfere with wound healing (11).

Based on the conditions above, researchers were interested in researching "The influence of hemoglobin levels on the post-caesarean section wound healing process at Aminah Blitar Hospital".

## Method

This study used an observational analytic research approach, with a case control approach that examined the relationship between hemoglobin levels and wound healing in post-caesarean section patients who visited the obstetrics clinic at Aminah Blitar Hospital. The number of respondents was 89 who were taken using Consecutive Sampling with the inclusion criteria being that patients were early adulthood 17-35 years old, did not receive blood transfusions after surgery, upper arm circumference was not below normal, and did not have comorbidities. Hemoglobin levels were seen from the patient's preoperative records, while wound healing was assessed based on the REDDA scale (Redness, Edema, Ecchymosis, Discharge, Approximation) on days 7 to 10 after caesarean section surgery. The resulting data was analyzed using a simple linear regression test.

## Result

### Frequency Distribution of Post Sectio Caesarea Patients Who Undergo Control at the Obstetric Polyclinic

Table 1 Frequency Distribution of Post Sectio Caesarea Patients Who Undergo Control at the Obstetric Polyclinic

Respondent characteristics	Frequency	%
<b>Age</b>		
17 – 20 y	4	4,49
21 – 25 y	24	27
26 – 30 y	38	42,7
31 - 35 y	23	25,8
<b>LILA(Upper arm circumference)</b>		
Normal $\geq 23,5$ cm	89	100
<b>Education</b>		
Elementary school	2	2,2
JHS	15	16,9
SHS	44	49,4
University	28	31,5
<b>Total Respondents</b>	89	100

Based on table 1 above, it can be seen that the majority of respondents were in the 26 - 30 year age range with a percentage of 42.7% and the smallest percentage was in the 16 - 20 year age range (4.49%). Meanwhile, based on LILA measurements, all 89 respondents (100%) had

normal LILA  $\geq 23.5$  cm. Respondents with a history of high school education had the largest proportion (49.4%), followed by respondents with a history of tertiary education (31.5%), respondents with a history of junior high school education (16.9%) and respondents with a history of elementary school education (2, 2%).

**The respondent's hemoglobin level value was measured from the respondent's hemoglobin level before undergoing caesarean section surgery.**

Table 2. Pre Sectio Caesarea Hemoglobin Levels

Amount	Minimum	Maximum	Mean	St. Deviation
89	9,8	14,10	11,4022	0,97233

Based on the data in table 2, it was found that the pre-caesarean section hemoglobin level value ranged from a minimum value of 9.8 mg/dl and the highest value was 14.10 mg/dl with an average of 11.4 mg/dl. However, according to WHO (2022), hemoglobin levels are classified into 4 categories, namely normal (more than equal to 11.0 mg/dl), mild anemia (9.0 – 10.9 mg/dl), moderate anemia (7.0 – 8.9 mg/dl), and severe anemia ( $< 7$  mg/dl). The results of this study based on WHO categories showed that 62.9% of respondents had normal hemoglobin levels and 37.1% had mild anemia.

### Healing of post caesarean section wounds

Table 3 Post Sectio Caesarea Wound Healing Process

Amount	Minimum	Maximum	Mean	St. Deviation
89	0,00	8,00	0,7191	1,81527

Based on the data in table 3, the score for the post-caesarean section wound healing process shows a minimum value of 0 and the highest value is 8 with an average of 0.71. Caesarean section wound healing process according to the REEDA scale can be categorized into 3 categories, namely good wound healing process with a score of 0, poor wound healing process with a score of 1-5, poor wound healing process with a score of 6-15. The results of this study according to the REEDA scale showed respondents whose wound healing process was good (76.05%), respondents whose wound healing process was poor (15.7%) and 4.5% of respondents showed poor wound healing at the first control. Go to a specialist ob-gyn clinic between the 7th and 10th day after caesarean section surgery.

The results of analysis using a simple linear regression statistical test showed that the p value was 0.000, which was smaller than  $\alpha$  0.05 with an R-square value of 0.196. So it can be concluded that preoperative hemoglobin levels influence the post-caesarean section wound healing process with a total influence of 19.6% and 80.4% of wound healing is influenced by other factors. From the data in table 4.4, it is found that the calculated F value = 21.199 with a significance level of  $0.000 < 0.05$ , so this regression model can be used for the data or in other words, there is an influence of pre-operative hemoglobin levels on the post-caesarean section wound healing process. The result of the constant number on unstandardized coefficients is 11.573, which means that the consistent value of the respondent's preoperative hemoglobin level is 11.573. The regression coefficient value is -0.237, which means that for every 1% increase in the preoperative hemoglobin level value, the wound healing score will increase by - .237. The regression coefficient is negative, so it can be said that the respondent's preoperative

hemoglobin level has a negative effect on the score of the post-caesarean section wound healing process. This means that the higher the pre-operative hemoglobin level, the lower the REEDA scale, so it can be concluded that the higher the pre-operative hemoglobin level, the better the post-caesarean section wound healing process.

## Discussion

Based on the data in table 2, it was found that the pre-caesarean section hemoglobin level value ranged from a minimum value of 9.8 mg/dl and the highest value was 14.10 mg/dl with an average of 11.4 mg/dl. Anemia is a health risk factor in pregnancy and postpartum (12) stated that hemoglobin levels in the body indicate the levels of red blood cells which play a role in transporting oxygen from the lungs to the rest of the body. The condition of anemia indicates that the transport of oxygen from the lungs to target cells is inadequate. The condition of a caesarean section will put the mother at risk of experiencing more blood loss compared to a vaginal delivery so that the condition of anemia will greatly affect the healing process of the post caesarean section wound (13)

The majority of respondents in the study, namely 54 people (76.05%) indicated the status of having normal hemoglobin levels. This can be related to the age of the respondent. Research data shows that 42.69% of respondents were aged 26 - 30 years and 28.08% of respondents were aged 21 - 25 year. The research results showed that of the 58 respondents with normal hemoglobin levels, 19 people (32.7%) were aged 26 - 30 years shows that mothers who undergo pregnancy at the age of less than 20 years generally have unstable emotions so they pay less attention to the food they consume. Meanwhile, in pregnancies that occur when you are over 35 years of age, the body is no longer fit, where the body physiologically begins to regress and the body's endurance decreases. This condition indicates a mature reproductive age which is also balanced with adequate thinking wisdom so that respondents are able to decide on a good nutritional intake for themselves. Mature age has an impact on an individual's mindset and ability to capture information. The more mature a person is, the less resistant they will be to the information they have just received and their thought patterns will be more easily induced by the information they receive.

Based on table 1 above, it can be seen that the LILA size of all 89 respondents (100%) had a normal LILA  $\geq 23.5$  cm. The size of the upper arm circumference can be an indicator of the nutritional status of adults. Measuring upper arm circumference (LILA) is a way to determine a person's nutritional status and whether he or she experiences chronic energy deficiency (CED) or not. Unlike body weight which can change quickly, a person's LILA size takes a long time to change. LILA measurements cannot be used to monitor changes in nutritional status in the short term. LILA measurements describe muscle tissue and the fat layer under the skin or subcutaneous fat subcutaneous fat in a woman's upper arms. Therefore, LILA has been used as a way to measure nutritional status for a long time(14)

The normal limit value set by the Indonesian Ministry of Health for measuring LiLA is  $\geq 2$  cm. Therefore, based on the LILA value, if a woman or pregnant woman has a LILA of less than 23.5 cm, she is considered to have poor nutritional status and is experiencing chronic energy deficiency (KEK). Chronic energy deficiency (CED) is a nutritional problem caused by a lack of food intake over a long period of time, for example years. The nutritional status of the mother before delivery is a benchmark for determining the care that will be given to the mother during pregnancy, so attention must be paid to nutritional status so that it is not excessive or insufficient, because this condition can endanger the health of the mother and fetus.

Data in table 1 shows that 49.4% of respondents were high school graduates and 39.5% were university graduates. The research results showed that 58 respondents had normal



hemoglobin levels, 34 of whom (60.7%) were high school graduates and 13 (23.2%) were university graduates. Education is necessary for a person to obtain information about health so that there is an improvement in the quality of life. The level of education has an impact on the acceptance of new information. High school and college graduates are more receptive to new information. The majority of respondents in this study are the millennial generation who are exposed to a lot of information through the use of gadgets in their daily lives. The level of education and mature age is a combination that can make respondents open-minded and able to sort the information they receive. So information information obtained from health workers and other sources regarding pregnancy health will be well received.

Based on the data in table 4.3, the score for the post-caesarean section wound healing process shows a minimum value of 0 and the highest value is 8 with an average of 0.71. Of the 89 respondents, 71 respondents (79.8%) showed good wound healing, 14 respondents (15.7%) showed poor wound healing and 4 respondents (4.5%) showed poor wound healing.

Wound healing is a physiological process for replacing and repairing the function of damage tissue. A post caesarean section wound is a clean wound that has the potential to experience primary healing (primary intention) where the edges of the wound will close together so that there is a low risk of infection and healing can occur quickly.

The research results in table 4.1 show that the majority of respondents (42.69%) are aged 26 , 30 years states that there are several factors that can influence the wound healing process, namely age, hemoglobin levels, comorbidities, nutrition, obesity, immune factors. Increasing age triggers changes in the skin such as the use of epidermal cells, inflammatory responses to injury. , sensory perception, mechanical protection and skin barrier . The speed of skin tissue repair will occur at a relatively young age. This is in line with research(15) which states that there is a significant relationship between age and the wound healing process. The cell repair process is proportional to age. When you are young, cells will have Optimal speed for the cell regeneration process which will support the wound healing process. And as we get older, the ability of cell regeneration will decrease and this will have a big impact on the wound healing process.

On the other hand, nutritional status also shows good results. Based on table 4.1 above, it can be seen that the LILA size of all 89 respondents (100%) had a normal LILA  $\geq 23.5$  cm. LILA size  $\geq 23.5$  cm indicates good nutritional status. Where the body has sufficient energy and protein reserves needed to speed up the wound healing process. Several biological processes that occur in the skin require adequate nutrition to support the proliferation process. Protein and amino acids support the tissue healing process and accelerate the growth of new cells. Fat provides energy and substrate for proliferation, maturation and hemostasis in the dermis and epidermis tissues.

Data from the research results show that of the 71 respondents with a good wound healing process, 54.9% of them had secondary or high school education and the other 28.1% were college graduates. The respondent's education level is believed to influence the respondent's behavior regarding personal hygiene. The higher the level of education, the easier it will be for individuals to receive information and change thought patterns. So that the incoming information will be easily accepted and implemented in behavior related to personal hygiene which is known to contribute to helping the wound healing process. Likewise with wound healing after caesarean section surgery which showed poor wound healing with a score of 6-15. This study showed that there were 4 respondents with healing the wounds were bad and all respondents were aged between 26 – 35 years. Based on age, this age should be a mature age which allows respondents to be wiser in their behavior regarding healing their wounds. So poor wound healing could occur due to a low level of education. Respondents with poor wound healing scores were all primary education graduates (Elementary School and JHS). This causes

respondents to be limited in receiving and digesting the new information they get regarding the wound healing process. So this can disrupt the wound healing process in patients.

The results of statistical analysis using a simple linear regression test showed a p value of 0.000 with an R square value of 0.196. This shows that hemoglobin has a significant effect on the wound healing process. The R-square value shows a value of 0.196, which means that hemoglobin influences the wound healing process by 19.6% and 80.4% is influenced by other factors. The significance level is  $0.00 > 0.05$ , so this regression model is suitable for use on this data, or in other words, there is an influence of pre-operative hemoglobin levels on the post-caesarean section wound healing process.

The wound healing process after caesarean section surgery is influenced by several things. Research result states that nutritional status and early mobilization influence the wound healing process after caesarean section surgery (15). Mentioned disease factors Others and nutrition influence the post-SC wound healing process in the proliferation phase. Hemoglobin levels indicate the level of red blood cells in the body which function as transporters of oxygen and nutrients to target cells so that they can optimize the wound healing process. This is in line with research conducted states that there is a relationship between hemoglobin levels and post-caesarean wound healing(12).

Hemoglobin is a protein molecule in red blood cells. Hemoglobin levels of less than 11 mg/dl have the potential to cause hemodilution conditions which will disrupt oxygen circulation. Individuals with anemia are at risk of experiencing impaired tissue oxygenation. The caesarean section process has the potential to put the mother at risk of bleeding compared to vaginal delivery. Lack of blood volume will trigger vasoconstriction and reduce oxygen and nutrient levels needed for the wound healing process. Mothers who suffer from anemia are also at risk of decreasing their body's resistance to infection so that wounds are at risk of failing to heal.

Inadequate oxygenation makes wounds more easily infected. Inadequate oxygenation provides an opportunity for agents (microorganisms) to act at the cellular level by damaging or destroying cell integrity which is important for ionic balance, the cell's ability to transform energy, the cell's ability to synthesize enzymes and other necessary proteins and the cell's ability to grow and develop breed.

In conditions of anemia, hypoxia in the tissue cannot be avoided. On the other hand, oxygen plays an important role in the formation of collagen, new capillaries, repair of epithelial tissue and plays a role in controlling infection. The wound edge area is an area with high metabolic activity. When hypoxia occurs, mitosis occurs in epithelial cells and fibroblast migration becomes inhibited. Likewise, collagen synthesis and the ability of macrophages to destroy bacteria will also be inhibited, thereby slowing down the healing process.

Hypoxia will also inhibit the destruction process by polymorphs and macrophages which aim to clean dead tissue. Hypoxia inhibits polymorph and macrophage activity so that it does not allow optimal proliferation to occur. Apart from that, hypoxia also causes disturbances in the cell's aerobic respiratory system, namely oxidative phosphorylation in the mitochondria. A decrease in oxygen within the cell causes a decrease in oxidative phosphorylation and ATP production. Prolonged hypoxia will exacerbate ATP depletion and lead to morphological damage. Mitochondria become swollen, the endoplasmic reticulum widens and the entire cell swells due to the addition of water, sodium and chloride, as well as a decrease in potassium. This condition will recover if oxygen needs can be met. On the other hand, if hypoxia is not resolved, mitochondrial swelling, lysosomal swelling and extensive plasma membrane damage will occur. This will cause a large-scale movement of potassium into the cells, especially if perfusion to the hypoxic area is not resolved immediately.

Ischemia that occurs in cells will lead to loss of proteins, enzymes, coenzymes and

ribonucleic acid due to the membrane becoming hyperpermeable. Metabolic disorders for the ATP formation process continue to be disrupted and cause a decrease in high-energy phosphate groups in cells. Cell damage is a central factor in the pathogenesis of irreversible cell injury. The entry of potassium into cells will cause potassium captured by mitochondria to increase and this condition will damage mitochondria, inhibit intracellular enzymes, destroy proteins and cause cytological changes in cells which ultimately disrupt cell regeneration in wound healing. The healing process of wounds that experience ischemia will be hampered so that the wound healing process will be prolonged or prolonged.

## Conclusion and Recommendations

Based on the research results, it can be concluded that the majority of respondents had hemoglobin levels above 11 mg/dl or did not experience anemia and the majority of respondents felt that post-caesarean section wound healing was good.

Based on the results of the linear regression test, it was found that the influence of preoperative hemoglobin levels on the wound healing process after caesarean section. with a p value of 0.000 with an R-square value of 0.196, which means that preoperative hemoglobin levels influence the wound healing process after caesarean section by 19.6% and 80.4%. influenced by other factors. .

So that future researchers are expected to be able to conduct research on other factors that influence the wound healing process. after Caesarean section and a larger number of samples.

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