



The Relationship Between Anemia, Hypertension, Diabetes Mellitus and the Incidence of Surgical Wound Infections in Post-Caesarean Section Mothers at RSUD Arga Makmur, North Bengkulu

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ABSTRACT

Background: Surgical site infection (SSI) is a complication that can occur after a cesarean section (CS) and is a leading cause of postoperative maternal morbidity. Several medical conditions, such as anemia, hypertension, and diabetes mellitus (DM), are suspected to contribute to the incidence of SSI.

Objective: To determine the relationship between anemia, hypertension, and diabetes mellitus with the incidence of surgical wound infections (SSI) in post-caesarean section mothers at Arga Makmur Regional Hospital, North Bengkulu

Methods: This study used a retrospective case-control design with a quantitative approach. The sample consisted of 384 post-caesarean section (CS) mothers, consisting of 128 SSI cases (total sampling technique) and 256 controls (purposive sampling). Data were obtained from medical records and analyzed using the chi-square test and multiple logistic regression.

Results: Bivariate analysis showed that anemia and hypertension were significantly associated with SSI, while DM was not significant ($p = 0.405$). Multivariate analysis revealed that hypertension (AOR 10.69) and anemia (AOR 6.36) were independent predictors of SSI. DM remained insignificant

Conclusion: Hypertension and anemia were identified as determinants of surgical site infection (SSI) among postpartum mothers following cesarean section (SC). Meanwhile, data in this sample do not show sufficient evidence to conclude an association with diabetes mellitus (DM) due to the limited number of participants.

Keywords: Surgical Wound Infection; Caesarean Section; Anemia; Hypertension; Diabetes Mellitus

Introduction

Globally, the maternal mortality rate (MMR) is 223 per 100,000 live births. In Indonesia, the maternal mortality rate (MMR) is still recorded at 189 per 100,000 live births, higher than in several other countries in Southeast Asia (SDKI, 2021). The maternal mortality rate (MMR) in several regions of Indonesia still exceeds the national average. In Bengkulu Province, the maternal mortality rate (MMR) reached 230 per 100,000 live births, higher than the national rate. In North Bengkulu Regency, the figure was 215 per 100,000 live births. This situation indicates that efforts to reduce the maternal mortality rate (MMR) remain a major challenge, especially in areas with limited health facilities.

The incidence of postpartum infections nationally ranges from 2–11% and is higher in Sumatra, including Bengkulu Province (8–14%), where SSI is reported to contribute 12–18% of postpartum infection cases (Kemenkes, 2023). This high rate contributes to the increase in maternal mortality (MMR) in North Bengkulu, triggered by maternal vulnerability during the postpartum period (decreased immune system and wound healing) and the lack of optimal wound care after cesarean section (CS) which allows pathogenic bacteria to invade the incision area. Furthermore, surgical wound infections (SWIs) are also significantly influenced by maternal comorbidities, such as anemia, hypertension, and diabetes mellitus (DM), which weaken the immune system and disrupt wound healing. The prevalence of these comorbidities in Bengkulu is reportedly even higher than the national average of 48.9% anemia, indicating that pregnant

women in the area are at a significantly higher risk of postpartum complications such as SWIs. Surgical site infections (SSIs) are significantly influenced by maternal comorbidities such as anemia, hypertension, and diabetes mellitus (DM). These three conditions contribute to a weakened immune system, impeding wound healing, and significantly increasing the risk of postpartum infection. This is despite national data showing a high prevalence of comorbidities. Anemia in pregnant women reaches 48.9%, followed by hypertension at 12–15%, and gestational diabetes at 3–5%. Surgical site infections (SSIs) represent a significant issue in obstetric care. These infections can hinder the wound-healing process and increase the risk of morbidity and mortality. Furthermore, SSIs can prolong a patient's length of hospital stay and raise healthcare costs (Trisnawati et al., 2023).

In terms of regulations, the government has issued strategic policies such as Minister of Health Regulation No. 27 of 2017 concerning infection prevention and control (PPI) in health care facilities, which obligatorily regulates strict standards for operating room sterilization, hand hygiene, use of sterile equipment, and administration of prophylactic antibiotics before performing a caesarean section (CS). The success of infection prevention efforts in post-caesarean section (CS) mothers depends heavily on the active role of the community and the mother's healthy behavior. The risk of infection is triggered by behavioral factors (poor knowledge and adherence to postpartum visits) and environmental factors (sanitation and unsupportive cultural practices). Furthermore, comorbidities such as anemia, hypertension, and diabetes mellitus (DM) are crucial medical determinants that weaken the immune system and interfere with wound healing, significantly increasing the risk of surgical site infections (SSI). Therefore, family support and increased public health education regarding wound care and warning signs of infection are essential.

Previous research has shown that comorbidities increase the risk of surgical site infections (SSI). Patients with diabetes mellitus (DM) have a 2.5-fold higher risk, anemia increases the risk 1.9-fold, and hypertension 1.6-fold compared to mothers without comorbidities (Djuwita et al., 2023). Both studies suggest re-examining the study with a larger sample size and the addition of comorbidity variables to obtain more comprehensive results. (Rusmawati et al., 2023)

A preliminary study at Arga Makmur Regional Hospital (RSUD Arga Makmur) of several cases of surgical site infections (SSI) found that most mothers had a history of comorbidities such as anemia, hypertension, and diabetes mellitus (DM). Data from RSUD Arga Makmur shows that the number of cesarean deliveries (CS) increased significantly between 2021 and 2024, with a total of 2,461 procedures (Dinas Kesehatan Kota Bengkulu, 2024)

Secondary data from Arga Makmur Regional Hospital (RSUD) in 2024, sourced from patient medical records without direct primary data collection, showed that out of 384 cesarean section (CS) patients, there were 128 cases of SSI. This averages 32 cases per quarter, or approximately 128 cases per year. Most of them occurred on the 7th postoperative day, according to medical records and clinic monitoring. This high rate confirms that surgical site infections (SSI) at Arga Makmur Regional Hospital are a serious problem that requires special attention to improve the quality of postoperative care. The results of this preliminary study serve as the foundation for formulating the research problem and supporting the implementation of a retrospective case-control study design to analyze which factor among anemia, hypertension, and diabetes mellitus (DM) is the most dominant influence on the incidence of surgical site infection (SSI) among post-sectio caesarea (SC) mothers at Arga Makmur General Hospital, North Bengkulu?

Methods

Study Design

This study employed a retrospective case-control design involving two groups of participants. The case group consisted of 128 post-caesarean section (CS) mothers who developed surgical site infection (SSI) based on physicians' diagnoses and clinical findings, selected using a total

sampling technique. The control group consisted of 256 post-cesarean section (CS) mothers who did not develop surgical site infection during the same period and at the same hospital, selected using purposive sampling from medical records.

Setting

This study was conducted at Arga Makmur Regional General Hospital, North Bengkulu, Indonesia, using retrospective data collected from patient medical records between June 30 and July 6, 2025. Patients were monitored throughout the postpartum period to classify surgical site infection (SSI) status both during hospitalization and through follow-up visit records or post-discharge monitoring.

Research Subject

This study employed a retrospective case-control design involving 384 participants selected from a total population of 1,800 postpartum mothers following cesarean section (CS). The sampling technique used a retrospective case-control design. The case group sample consisted of all post-cesarean section (CS) mothers who developed a surgical site infection (SSI), selected using total sampling to obtain 128 respondents. Meanwhile, the control group comprised post-cesarean section (CS) mothers without SSI, selected using purposive sampling to obtain 256 respondents with a 1:2 ratio relative to the number of cases. The selection of controls took into account the completeness of medical record data and conformity with inclusion criteria.

The inclusion criteria were mothers who underwent cesarean section at RSUD Arga Makmur in 2024, mothers with complete medical records, including hemoglobin level, blood pressure, and random blood glucose measurements during hospitalization and mothers diagnosed with surgical site infection after cesarean section based on medical records for the case group, and mothers without surgical site infection for the control group. The exclusion criterion was mothers with incomplete medical records, particularly those lacking information on hemoglobin level, blood pressure, or random blood glucose measurements during hospitalization.

Instruments

The research instrument consisted of an observation checklist developed to extract secondary data from the medical records of post-cesarean section mothers treated at RSUD Arga Makmur in 2024. The checklist was used to collect medical information on anemia, hypertension, diabetes mellitus (DM), and the occurrence of surgical site infection (SSI). Data were obtained exclusively from objective sources, including medical records and hospital documentation.

Data Analysis

Data were analyzed using IBM SPSS Statistics software. Bivariate analysis was performed to determine the association between the three comorbidities (anemia, hypertension, and diabetes mellitus) and the incidence of surgical site infection (SSI) using the Chi-square test with a 95% confidence level. Variables with a p -value ≤ 0.25 in the bivariate analysis were subsequently entered into a multiple logistic regression model to identify independent risk factors associated with surgical site infection.

Ethical Consideration

This study was conducted in accordance with the ethical principles of research, including respect for persons, beneficence, non-maleficence, and justice. Participants' confidentiality was maintained by removing all personal identifiers from the data collection, analysis, and reporting processes. All data obtained were used solely for research purposes. Prior to data collection, ethical approval was obtained from the Health Research Ethics Committee of STIKES Guna Bangsa Yogyakarta with ethical approval number 063/KEPK/VI/2025. Research permission was

also obtained from RSUD Arga Makmur as the study site. All research procedures were conducted in accordance with applicable ethical standards and institutional regulations before data collection commenced.

Result

Univariate Analysis

Table 1 distribution of exposure based on case-control status

Variable		ILO			
		Case		Control	
		n	%	n	%
Anemia	Anemia	62	48.4	47	18.4
	No Anemia	66	51.6	209	81.6
Hypertension	Hypertension	56	43.8	25	9.8
	No Hypertension	72	56.3	231	90.2
Diabetes	Diabetes	3	2.3	3	1.2
	No diabetes	125	97.7	253	98.8

The distribution of anemia in the group with surgical wound infections (SWIs) showed that 62 mothers (48.4%) had anemia. Conversely, there were more mothers without anemia in the group without SWIs, namely 66 mothers (51.6%). This finding indicates a higher proportion of anemia in the SWIs group.

In the surgical wound infection (SWI) group, hypertension was recorded in 56 mothers (43.8%). Meanwhile, mothers without hypertension dominated the non-SWI group, with 72 mothers (56.3%). This distribution indicates that hypertension was more common in the SWI group.

In the diabetes mellitus (DM) variable, the number of mothers with diabetes mellitus (DM), in the surgical wound infection (SSI) group was only 3 mothers (2.3%). Most of the mothers in both groups did not have diabetes mellitus (DM), namely 125 mothers (97.7%). This condition shows that the proportion of diabetes mellitus (DM) is relatively small in both groups.

Bivariate Analysis

Bivariate analysis was performed using the chi-square (χ^2) test to determine the relationship between each independent variable and the dependent variable, namely the incidence of surgical site infections (SSI). The significance criterion was set at a p value < 0.05.

The Relationship Between Anemia and Surgical Wound Infections (SWIs)

Table 2 Relationship between anemia and surgical wound infections (SWIs)

Anemia	ILO				CI 95%	P-Value	OR
	Case		Control				
	n	%	n	%			
Anemia	62	48.4	47	18.4	(2,613-6,679)	0.001	4.17
No Anemia	66	51.6	209	81.6			
Total	128	100	256	100			

The chi-square test results showed a significance value of p-value = 0.001. This value is smaller than $\alpha = 0.05$, which means there is a statistically significant relationship between anemia and the incidence of surgical wound infections (SWIs). An OR value > 1 indicates that anemia is associated with an increased chance of SWIs (SWIs). Based on the OR value of 4.17, mothers with anemia have approximately four times higher odds of SSI compared to mothers without anemia.

The Relationship Between Hypertension and Surgical Wound Infections (SWIs)

Table 3 Relationship between hypertension and surgical wound infections (SWIs)

Hypertension	ILO				CI 95%	P-Value	OR
	Case n	%	Control n	%			
Hypertension	56	43.8	25	9.8	4,186-12,576	0.001	7.18
No Hypertension	72	56.3	231	90.2			
Total	128	100	256	100			

The chi-square test results show a significance value of $p\text{-value} = 0.001$. This value is much smaller than $\alpha = 0.05$, so it can be stated that there is a statistically significant relationship between hypertension and the incidence of surgical wound infections (SWIs). An OR value > 1 indicates that hypertension is a factor associated with an increased chance of SWIs (SWIs). Based on this OR value, mothers with hypertension have approximately 7 times the chance of experiencing SWIs (SWIs) compared to mothers without hypertension.

The Relationship Between Diabetes Mellitus (DM) and Surgical Wound Infections (SWIs)

Table 4 Relationship between Diabetes Mellitus (DM) and Surgical Wound Infections (SWIs)

Diabetes Mellitus	ILO				CI 95%	P-Value	OR
	Case n	%	Control n	%			
Diabetes	3	2.3	3	1.2	0.403-10.172	0.405	2.02
No Diabetes	125	97.7	253	98.8			
Total	128	100	256	100			

Bivariate analysis results showed no significant association between diabetes mellitus (DM) and the incidence of surgical wound infections (SSI) in post-caesarean section (CS) mothers. Fisher's exact test was used because 50% of cells had an expected count of less than 5.

This test shows a $p\text{ value} = 0.405$ ($p > 0.05$), so that diabetes mellitus (DM) is not proven to be statistically related to the incidence of surgical wound infections (SWIs).

The odds ratio calculation results ($OR = 2.02$; $95\% CI: 0.403-10.172$) indicate that mothers with diabetes mellitus (DM) numerically have a greater chance of experiencing surgical wound infections (SSI) compared to mothers without diabetes mellitus (DM), but the very wide range of confidence intervals and crossing the number 1 indicates that the estimate is unstable and not significant. The low number of respondents with DM (1.2%) also contributed to the lack of test power so that the actual relationship is difficult to clearly describe.

Multivariate analysis

Table 5 Multivariate Logistic Regression Results

Variables	P-value	AOR (Exp B)	95% CI	R ²
Hypertension	0.00	10.69	5,850 – 19,540	0.334
Anemia	0.00	6.36	3,704– 10,936	

The results of the logistic regression analysis showed that the two variables included in the model, namely hypertension and anemia, had a significant influence on the incidence of surgical wound infections (SSI) in postpartum mothers (Kilani, 2025).

The hypertension variable was recorded as having a p-value of 0.001, indicating a highly statistically significant relationship. The adjusted odds ratio (AOR) value of 10.69 with a 95% confidence interval between 5.850 and 19.540 indicates that mothers with hypertension have approximately a 10-fold greater chance of experiencing surgical site infections (SSI) compared to mothers without hypertension after being controlled for by other variables in the model. The confidence interval, which does not cross 1, confirms that the effect of hypertension on the incidence of surgical site infections (SSI) is stable and consistent.

In addition, the anemia variable also showed a significant influence on the incidence of surgical wound infections (SWIs), with a p value of 0.001. The AOR value of 6.36 and a 95% confidence interval ranging from 3.704 to 10.936 indicated that mothers with anemia had approximately 6.4 times greater chance of experiencing SWIs than mothers without anemia. Similar to hypertension, the confidence interval for anemia that did not cross 1 indicated that anemia was a significant independent predictor in increasing the risk of SWIs.

The logistic regression results showed that hypertension was the most dominant factor in increasing the risk of surgical site infection (SSI), followed by anemia. Both variables, This has been proven to provide a significant contribution to the prediction model for the incidence of surgical wound infections (SSI) in post-cesarean section (SC) mothers.

The model summary table shows that the Nagelkerke R Square value is 0.334. This value indicates that the regression model is able to explain approximately 33.4% of the variation in the incidence of surgical site infections (SSI) in post-cesarean section (CS) mothers. This means that comorbid anemia and hypertension contribute moderately to explaining the incidence of SSI, while the remaining influence is influenced by other factors not examined in this study.

Discussion

Univariate

Surgical Wound Infection (SWI) Incident

These significant differences could be due to local factors such as wound management, adherence to antiseptic protocols, surgical duration, or population characteristics. The high incidence of surgical site infections (SSI) in this study underscores the need for increased postoperative infection prevention interventions in healthcare facilities, particularly for high-risk mothers. Prevalence of surgical site infections (SSIs) after cesarean delivery in many international studies, such as a systematic review and meta-analysis of post-CS SSI prevalence in Saudi Arabia, which reported an average prevalence of around 3% (Alshahrani NZ et al., 2025)

Anemia

Anemia in post-cesarean section (CS) mothers can contribute to impaired wound healing due to decreased oxygen supply to wound tissue, which can biologically inhibit the inflammatory and proliferative phases of wound healing. Mild to moderate anemia is a significant factor associated with surgical wound infection (OR ~2.8 for mild anemia) in postoperative patients (Alshahrani NZ et al., 2025). Good blood circulation can assist in the wound-healing process, as blood contains substances necessary for healing wounds (Thirtinia et al., 2025).

Anemia significantly affects the risk of surgical site infection (SSI). Low hemoglobin levels can impair the wound healing process, thereby increasing the risk of postoperative wound infection. Therefore, early detection of anemia during antenatal care (ANC) is essential. Regular consumption of iron (Fe) supplements during pregnancy is an important strategy to prevent and manage anemia, thereby potentially reducing the risk of cesarean section surgical site infection (Novelia et al., 2021).

Hypertension

Univariate results showed that 21.1% of mothers had a history of hypertension. Hypertension can affect the wound healing process through vascular mechanisms. High blood pressure often causes endothelial dysfunction, reduced tissue perfusion, and increased oxidative stress, which collectively slow wound healing and increase the risk of infection. This is supported by pathophysiological evidence that hypertension is associated with endothelial dysfunction and chronic inflammation, which can worsen the postoperative vascular response (Ambrosino et al., 2022). In the context of cesarean section, hypertension has also been identified as a risk factor for surgical site infection (SSI). A study in a cesarean section population reported that a history of hypertension/hypertensive pregnancy significantly increased the risk of surgical site infection. Therefore, hypertension in pregnant and postpartum women should be considered an important risk factor in surgical site infection (SSI) prevention protocols.

Diabetes Mellitus

Only 1.6% of respondents in this study had diabetes mellitus (DM), indicating a low prevalence of diabetes mellitus (DM) among the study sample. In theory, diabetes mellitus (DM) is a significant risk factor for surgical site infections (SSI) because hyperglycemia can impair immune cell function, such as neutrophil phagocytosis, slow angiogenesis, and decrease collagen synthesis, all of which are crucial for wound healing (Arshad et al., 2024).

However, the low number of mothers with diabetes mellitus (DM) in this sample may have resulted in univariate statistical analysis not being sensitive enough to detect a significant association. Furthermore, in meta-analyses and other large studies, diabetes mellitus (DM) is sometimes found to be a risk factor for surgical site infection (SSI), but its effect may vary depending on glycemic control and perioperative management (Molla et al., 2019). Factors that can increase the risk of a surgical site infection following a cesarean section (CS) include the presence of underlying medical conditions, such as diabetes mellitus particularly when the patient's blood sugar levels are uncontrolled. Such conditions can impair the wound-healing process and elevate the risk of infection. Therefore, preventive measures should be taken by optimizing the patient's health status prior to surgery, which includes monitoring and controlling blood sugar levels to ensure they remain within the recommended range (Andriani et al., 2024).

Thus, although Diabetes mellitus (DM) biologically has the potential to increase the risk of surgical wound infections (SWIs), in This research's role appears to be limited by low prevalence and sample limitations.

Bivariate

The Relationship Between Anemia and the Incidence of Surgical Wound Infections (SWIs)

The results of the bivariate analysis in this study showed that anemia was strongly associated with the incidence of surgical site infection (SSI) after cesarean section (CS). The proportion of anemic mothers in the SSI group was significantly higher than in the non-SSI group, and the crude odds ratio reached approximately 4.18 (95% CI: 2.61–6.68) with $p < 0.05$ indicating a statistically strong association. This finding is in line with evidence from the international literature that preoperative anemia is an important risk factor for surgical site infection after cesarean section. (Riskesdas, 2021)

Furthermore, a prospective cohort study in Ethiopia found that postoperative hemoglobin <11 g/dl (anemia indicator) increased the risk of surgical site infection (SSI) with AOR = 3.42 (95% CI: 1.32–8.87) (Adane et al., 2023). From a pathophysiological perspective, anemia, particularly iron deficiency anemia, is known to impair innate immune function. Iron deficiency can decrease neutrophil activity, reduce phagocytic capacity, and inhibit the production of reactive oxygen species, which play a crucial role in killing pathogens in surgical wounds. Furthermore, anemia increases the risk of perioperative blood transfusions, which have been scientifically linked to immunosuppression and an increased risk of postoperative infection (Shander, 2022)

The findings of this study support the importance of preoperative anemia screening, especially in elective cesarean sections (CS). Preoperative anemia management through iron supplementation, evaluation of the underlying cause, and Hb optimization are effective strategies for reducing infectious complications. This aligns with international PBM recommendations that anemia correction can reduce the risk of infection and improve postoperative outcomes (Idaningsih, 2024)

Thus, based on the results of this study and existing scientific evidence, preoperative anemia can be categorized as an important risk factor for surgical site infections (SSI) in post-cesarean section mothers. Improving the detection and management of anemia before surgery is a significant step towards reducing the incidence of wound infections and improving the quality of obstetric care.

The Relationship Between Hypertension and the Incidence of Surgical Wound Infections (SWIs)

The results of this study indicate that hypertension is a significant factor in the incidence of surgical wound infections (SWIs) in post-cesarean section (CS) postpartum women. Bivariate analysis showed that women with hypertension had a 7.18-fold higher risk of developing SWIs than women without hypertension (95% CI: 4.18–12.34; $p < 0.001$). The large OR value and confidence interval that did not cross 1 indicate a strong and statistically significant association. This finding is in line with recent obstetric research that suggests that hypertension in pregnancy increases the risk of post-operative complications of SWIs (SWIs).

Physiologically, hypertension in pregnancy, whether chronic hypertension, gestational hypertension, or preeclampsia, directly affects vascular function. Hypertension causes endothelial dysfunction, decreased nitric oxide (NO) production, and increased arteriolar vasoconstriction. This condition leads to suboptimal tissue perfusion, including perfusion of wound tissue. When blood flow to the tissue is reduced, the body's ability to deliver oxygen and essential nutrients to the wound area also decreases, resulting in delayed wound healing and susceptibility to bacterial invasion. This mechanism has been described in modern cardiovascular literature (Suherni et al., 2023).

Pathophysiologically, chronic hypertension causes structural changes in blood vessels, such as thickening of the arterial walls and decreased vascular elasticity. These changes further impede microcirculation, a crucial component of surgical wound healing. Impaired microcirculation leads to tissue hypoxia, inhibiting fibroblast proliferation and collagen synthesis, and reducing the immune defense capacity in the wound area. Surgical studies have shown that tissue hypoxia is a major determinant of the increased risk of wound infection (Kartikasari & Apriningrum, 2020)

Besides directly affecting wound healing, hypertension in pregnancy is also often associated with other conditions that increase the risk of infection, such as tissue edema, systemic inflammation, and kidney dysfunction. For example, in preeclampsia, inflammatory system activation, oxidative stress, and the release of inflammatory mediators can occur, all of which can reduce the body's immune system. Recent studies have shown that women with preeclampsia are at higher risk of postoperative infection due to immune dysregulation and impaired tissue perfusion. The findings of this study have important clinical implications. Pregnant women with hypertension should receive close monitoring before, during, and after cesarean section. (Rohmah & Rahmawati, 2023)

However, this study still has limitations. The type of hypertension (gestational, chronic, preeclampsia) was not differentiated, so it cannot be determined which carries the highest risk of surgical site infection (SSI). Several confounder factors such as surgery duration, surgical technique, and use of antibiotic prophylaxis were also not included in the multivariate analysis. Therefore, further research stratifying hypertension type and controlling for peroperative factors is highly recommended to strengthen the evidence of a causal relationship. Overall, this study

demonstrates that hypertension is a strong risk factor for surgical site infection (SSI) in post-cesarean section (CS) mothers. Endothelial dysfunction, impaired tissue perfusion, local hypoxia, and immune dysregulation are the main biological mechanisms explaining this increased risk. Early detection and management of preoperative hypertension are key steps in reducing the incidence of wound infections in obstetric practice

The Relationship Between Diabetes Mellitus (DM) and the Incidence of Surgical Wound Infections (SWIs).

The results of this study indicate that diabetes mellitus (DM) is not significantly associated with the incidence of surgical wound infections (SSI) in post-cesarean section (CS) mothers. The very wide confidence interval, encompassing the number 1, indicates that the association is statistically insignificant. This insignificant finding is likely influenced by the very small sample size of diabetes mellitus (DM) patients ($n = 6$). Epidemiological literature suggests that small exposure samples often make the true effect undetectable (Regmi, 2022).

Physiologically, diabetes mellitus (DM) is known to affect the wound healing process through impaired glucose regulation, vascular dysfunction, and a decreased immune response. Chronic hyperglycemia causes endothelial damage, thickening of the capillary basement membrane, and impaired microcirculation, reducing the supply of oxygen and nutrients to wound tissue. This condition inhibits fibroblast proliferation, collagen formation, and angiogenesis, which are essential steps in wound healing. This mechanism has been demonstrated in modern surgical studies (Falanga, 2023).

Pathophysiologically, hyperglycemia can reduce neutrophil function, including chemotaxis, phagocytosis, and bacterial killing. This decreased innate immune function makes patients with diabetes mellitus (DM) more susceptible to infections, including surgical site infections (SSI). Furthermore, high glucose levels in wound tissue can act as a supportive medium for bacterial growth, particularly *Staphylococcus aureus* and gram-negative bacteria. Obstetric studies have shown that peripartum hyperglycemia is associated with an increased risk of post-cesarean section infection. This study did not find a significant association, which is likely due to the small sample size of patients with diabetes mellitus (DM). Previous studies involving larger samples have consistently shown that diabetes mellitus (DM) increases the risk of surgical site infection by 2–5 times. Therefore, although the data in this study do not support this association, the physiological and pathophysiological evidence still indicates that diabetes mellitus (DM) is a potential risk factor for infection (Rohmah & Rahmawati, 2023).

The main limitation of this study is the very small number of diabetes mellitus (DM) cases, which does not provide an accurate picture of the risk. Further research with a larger sample size of people with diabetes mellitus (DM), more detailed glycemic control, and analysis of preoperative factors such as surgery duration and surgical technique are needed to more reliably assess this association.

Overall, although the results of this study did not show a significant association, widely accepted biological mechanisms support that diabetes mellitus (DM) remains a factor that potentially increases the risk of surgical site infections (SSI). Optimizing preoperative and postoperative glycemic control is an important strategy in preventing infectious complications in post-cesarean section (CS) mothers.

Multivariate

Multivariate logistic regression analysis in this study showed that preoperative hypertension and anemia were significant independent predictors of surgical site infection (SSI) in post-cesarean section (CS) mothers. The confidence interval that did not cross the number 1 indicated that these two factors had a stable and significant effect on the risk of surgical site infection (SSI). The regression model showed a Nagelkerke R^2 value of 0.334, which means that

approximately 33.4% of the variation in the incidence of surgical site infection (SSI) can be explained by these two variables (Kebede, 2023).

Hypertension has been shown to be the most dominant risk factor, with hypertensive mothers having a more than 10-fold greater risk of developing surgical site infections (SSIs) compared to normotensive mothers. Physiologically, hypertension causes endothelial dysfunction and microvascular vasoconstriction, resulting in decreased wound tissue perfusion. Decreased blood flow results in local hypoxia, which inhibits fibroblast proliferation, collagen synthesis, and angiogenesis—all critical processes in wound healing. Hypoxia also weakens local immune defense mechanisms, making wound tissue more susceptible to bacterial colonization (Kebede, 2023). Structural changes in blood vessels due to chronic hypertension, including thickening of the arterial walls and decreased elasticity, impair microcirculation and delay wound healing. These findings align with previous research showing that preoperative hypertension is a strong predictor of postoperative infection, both in obstetrics and general surgery (Kebede, 2023).

From a clinical perspective, optimal blood pressure control before cesarean section is crucial to reduce the risk of surgical site infection (SSI). Tissue perfusion monitoring, hemodynamic stabilization, and preoperative hypertension management are recommended as part of the preoperative protocol.

Preoperative anemia remained significant in the multivariate model (AOR = 6.36; 95% CI: 3.704–10.936; $p = 0.000$). The physiological mechanism involves reduced oxygen-carrying capacity of the blood, resulting in wound tissue hypoxia. This hypoxia inhibits fibroblast proliferation, collagen synthesis, and angiogenesis, slowing overall wound healing. Furthermore, anemia reduces the effectiveness of cellular immune responses, including neutrophil phagocytosis and reactive oxygen species production, which play a role in defense against infection. (Hijratun, 2021) Correction of preoperative anemia through iron supplementation, nutritional optimization, and or therapy for the underlying cause of anemia can reduce the risk of surgical site infections (SSI). This strategy aligns with internationally recommended patient blood management principles (Kartikasari & Apriningrum, 2020).

Conclusion

Based on the results of research at RSUD Arga Makmur, North Bengkulu with a case-control study design, the following conclusions can be drawn the incidence of surgical wound infections (SSI) in post-cesarean section (CS) mothers at Arga Makmur Regional Hospital, North Bengkulu. Surgical wound infections (SSI) were more common in mothers with comorbidities such as anemia, hypertension, and diabetes mellitus (DM) than in mothers without these comorbidities. The results of the bivariate analysis showed a significant relationship between anemia and the incidence of surgical wound infections (SWIs), mothers with anemia have approximately four times higher odds of SSI compared to mothers without anemia.

Hypertension was also shown to be significantly associated with the incidence of surgical wound infections (SWIs). Mothers with Hypertension has a 7 times greater risk of experiencing surgical wound infection (ILO) compared to mothers without hypertension. Multiple logistic regression analysis confirmed that anemia and hypertension has been shown to be a significant risk factor for surgical site infections (SSI) in post-cesarean section (CS) mothers, with anemia increasing the risk approximately 6-fold and hypertension approximately 10-fold. Diabetes mellitus was not significantly associated with the incidence of SSI. These findings underscore the importance of anemia screening and blood pressure control before cesarean section to reduce the risk of SSI.

SUGGESTIONS

For Post-Cesarean Section (CS) Mothers. Post-cesarean section mothers are encouraged to follow healthcare providers' recommendations regarding proper wound care, maintain personal hygiene, and recognize the early signs and symptoms of surgical site infection (SSI), particularly those with comorbidities such as anemia, hypertension, or diabetes mellitus. They should seek immediate medical attention if any signs of infection develop.

For Hospitals are expected to strengthen the implementation of standard aseptic and antiseptic procedures, ensure the timely administration of prophylactic antibiotics, conduct regular training programs for healthcare professionals, and systematically monitor compliance with infection prevention and control protocols to reduce the incidence of surgical site infections.

For Midwives and Other Healthcare Professionals. Midwives and other healthcare professionals are encouraged to perform early screening and appropriate management of maternal comorbidities, including anemia, hypertension, and diabetes mellitus. They should also provide nutritional counseling, monitor patients' medical conditions before and after cesarean section, enhance effective communication with patients, and strengthen documentation and postoperative follow-up to prevent surgical site infections.

For Future researchers are encouraged to conduct prospective studies with larger sample sizes and involve multiple healthcare facilities to improve the generalizability of the findings. Subsequent research is recommended to prioritize perioperative confounding factors (BMI/obesity, emergency vs. elective cesarean section, duration of surgery, rupture of membranes/labor, antibiotic prophylaxis, wound class, and glycemic control).

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DECLARATION OF INTEREST

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