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The Relationship between Prophylactic Antibiotic Administration and the Incidence of Surgical Wound Infections in the Postpartum Ward of H. Badaruddin Kasim Tanjung Regional Hospital

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Abstract *Surgical site infection (SSI) is a postoperative complication that can increase morbidity, length of hospital stay, and treatment costs. Prophylactic antibiotics are the primary preventive measure, but their effectiveness is greatly influenced by the timeliness, type, and duration of administration. This study aimed to analyze the relationship between prophylactic antibiotic administration and the incidence of SSI in post-obstetric and gynecological surgery patients at H. Badaruddin Kasim Tanjung Regional Hospital. The study used an observational analytical design with a cross-sectional approach and involved 35 respondents through a total sampling technique. Data were obtained from medical records regarding the time, type, dose, redosing, and duration of antibiotic administration, along with the incidence of SSI. Statistical analysis used the Chi-square and Fisher Exact tests. The results showed that the timeliness of antibiotic administration was significantly associated with the incidence of SSI, while the type of antibiotic and the duration of postoperative administration did not show a significant relationship. All respondents received the correct dose and did not require intraoperative redosing. This study concluded that timeliness is a key factor determining the effectiveness of antibiotic prophylaxis in preventing SSI, while variations in the type and duration of administration did not have a significant effect. These findings emphasize the importance of improving adherence to antibiotic dosing standards in obstetric and gynecological surgical practice to strengthen infection prevention efforts.*

Keywords: *Antibiotic Prophylaxis; Cesarean Section; Infection Prevention; Post-Surgical Infection; Surgical Site Infection.*

1. INTRODUCTION

Surgical site infections (SSI) are post-operative complications that remain a serious challenge in healthcare services in various countries. The WHO reports that SSIs account for approximately 11% of all healthcare-associated infections, and their prevalence can reach over 20% in low- and middle-income countries (WHO, 2018). These complications significantly impact patient recovery, prolong hospital stays, and increase healthcare costs. In obstetrics, particularly cesarean section (CS), SSIs are a leading cause of postpartum maternal morbidity and can worsen the quality of postpartum health. Globally, the incidence of SSIs after cesarean section varies depending on the quality of care and resources of healthcare facilities. Internationally, the incidence of SSIs after cesarean section ranges from 3% to 15%, with higher rates particularly found in developing countries (Betrán et al., 2021). This is closely related to the increasing use of cesarean sections, which now account for 21% of all deliveries globally. This increasing trend has important implications, as more women are at risk of post-operative complications, including wound infections. The situation in Indonesia demonstrates a similar pattern, where the ILO remains a key focus in maternal health services.

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According to a report from the Ministry of Health, post-cesarean section infections range from 2% to 10%, with variations between regions depending on resource availability and adherence to infection prevention protocols (Ministry of Health, Republic of Indonesia, 2020). Several studies from various provinces, such as East Java, North Sumatra, and South Sulawesi, have revealed that inappropriate administration of prophylactic antibiotics is a contributing factor to the increased risk of SSI, particularly in emergency SSIs (Putriana et al., 2021; Lestari et al., 2022). This highlights the importance of consistently evaluating the implementation of antibiotic protocols at the health facility level. Clinically, SSIs can occur when the number of microorganisms contaminating the surgical area exceeds the body's ability to fight them. Cesarean sections are classified as clean-contaminated surgeries due to exposure to genital flora, thus carrying a higher risk of infection than clean surgeries. Various maternal factors, such as anemia, obesity, diabetes mellitus, premature rupture of membranes, and the length of surgery, contribute to an increased risk of infection (Opøien et al., 2020). Therefore, prevention of infection through an appropriate perioperative approach is an essential part of modern obstetric practice.

Prophylactic antibiotic administration is a key step in reducing the risk of SSI if performed in a timely manner and according to standards. Scientific evidence confirms that administering antibiotics 30–60 minutes before incision is highly effective in achieving peak drug concentrations in the incised tissue, thereby inhibiting colonization by pathogenic bacteria such as *Staphylococcus aureus* , *Escherichia coli* , and anaerobic bacteria (Sullivan et al., 2020). The WHO, along with the American College of Obstetricians and Gynecologists (ACOG), recommends cefazolin as the antibiotic of choice for CS (WHO, 2018; ACOG, 2022). In addition to the timing of administration, prophylactic success is also influenced by the accuracy of the dose, the need for redosing in long-term surgeries, and the duration of antibiotic administration after surgery. In surgeries lasting more than two hours or accompanied by heavy bleeding, antibiotic levels may decrease, necessitating redosing (Tita et al., 2021). However, continued use of antibiotics for too long after surgery, which is still frequently found in regional health facilities, does not provide additional benefits in preventing infection and can actually trigger antimicrobial resistance (Olsen et al., 2020).

Despite clear international guidelines and clinical evidence supporting the effectiveness of antibiotic prophylaxis, research in Indonesia still shows inconsistent implementation. A study in Central Java reported that only 58% of CS patients received antibiotics at the recommended time, and those who missed the time had a higher incidence of infection (Putriana et al., 2021). Similar findings emerged in Makassar, where inappropriate dosing and

postoperative administration durations of more than 24 hours did not contribute to a reduced risk of infection but increased healthcare costs (Lestari et al., 2022). Meanwhile, research in West Nusa Tenggara found that antibiotic selection persisted outside guidelines due to a lack of standardization (Rahmawati et al., 2020). To date, there is a significant gap in research regarding how key components of antibiotic prophylaxis—timing, type, dose accuracy, intraoperative redosing, and postoperative duration—directly relate to the occurrence of SSIs in regional hospitals. Many studies only assess adherence to guidelines, but few link it to clinical outcomes such as infection incidence. In addition, previous studies have not comprehensively considered confounding variables such as maternal age, comorbid conditions (diabetes, obesity, anemia), surgical wound class, and procedure duration.

Based on this background, this study was designed to evaluate the relationship between prophylactic antibiotic administration and the incidence of surgical site infections in obstetrics and gynecology patients in the Postpartum Ward of H. Badaruddin Kasim Tanjung Regional Hospital. This study assessed the timeliness of administration, type of antibiotic, appropriateness of dosage, the presence of intraoperative redosing, and the duration of postoperative administration, taking into account maternal characteristics and surgical procedure conditions. The results are expected to provide a strong scientific basis for improving antibiotic administration standards and strengthening infection prevention strategies, thereby improving maternal safety in healthcare facilities.

2. RESEARCH METHOD

Research design

This study used an observational analytical design with a cross-sectional approach. This design was chosen because it allows researchers to assess the relationship between prophylactic antibiotic administration and the incidence of surgical site infections (SSI) over a specific time period without manipulating variables. This approach is suitable for evaluating factors related to clinical outcomes in real-world healthcare settings . Data were obtained from medical records and observation sheets of postoperative patients in the postpartum ward, making the cross-sectional design an efficient, rapid, and relevant approach to analyzing the relationship between variables.

Location and Time of Research

The research was conducted at several schools within the Ibu Community Health Center (Puskesmas Ibu) working area in West Halmahera Regency. This location was selected based on the high number of pre-menarcheal adolescent girls and limited access to reproductive

health education in the area. Data collection and intervention implementation took place from March to May 2025, adjusting to school schedules and peer education readiness. The study was conducted in the Postpartum Ward of H. Badaruddin Kasim Tanjung Regional Hospital, a regional hospital with referral-level obstetrics and gynecology services. This location was selected based on the high number of surgical procedures, particularly cesarean sections, and the availability of complete medical records as a source of research information. The study period was January–March 2025.

Research Population and Sample

The population in this study included all post-obstetric and gynecological surgery mothers treated in the Post-natal Ward of H. Badaruddin Kasim Tanjung Regional Hospital, with an accessible population consisting of patients who underwent cesarean section or gynecological laparotomy during the study period. Sampling used a total sampling technique, so that all patients who met the inclusion and exclusion criteria were included as respondents. The inclusion criteria included post-cesarean section or gynecological surgery mothers treated in the post-natal ward, having complete medical records related to the administration of prophylactic antibiotics, and undergoing an adequate observation period to assess the occurrence of wound infection (at least 7 days or until the time of discharge). Conversely, patients with active infections before surgery, having incomplete medical records, or being referred out before surgical wound evaluation were not included in the study. Based on all these criteria, the number of eligible samples and analyzed was 35 respondents.

Research Variables

This study involved dependent, independent, and confounding variables. The dependent variable was the incidence of surgical site infection (SSI), which is the appearance of clinical signs of infection such as pain, redness, pus, or fever based on medical records, with a nominal scale (0 = no infection, 1 = infection). The independent variables consisted of components of prophylactic antibiotic administration, including the timeliness of administration (≤ 60 minutes before incision or not), type of antibiotic, dosage accuracy, intraoperative redosing, and duration of postoperative antibiotic administration (≤ 24 hours, 2–5 days, or > 5 days). In addition, a number of confounding variables were taken into account, such as age, education, comorbidities (DM, obesity, anemia), duration of surgery, wound class, and type of surgery. All variables were measured using a coding sheet taken from medical record data.

Research Instruments

The research instruments used were structured observation sheets and patient medical records. The observation sheets were designed to record all study variables, including

respondent characteristics, perioperative data, and clinical outcomes related to surgical site infections. Patient medical records served as the primary data source, containing information on the type and duration of surgery, history of prophylactic antibiotic administration, documentation of surgical site progression, comorbidities, and supporting examination results. To ensure the instrument's compliance with WHO guidelines and hospital standards, content validity was tested by two experts in obstetrics and epidemiology.

Intervention Procedures

The research procedure began with a preparatory phase, which included submitting an ethical clearance request to the Health Research Ethics Committee, coordinating with the hospital regarding access to medical records, and developing an observation sheet and guidelines for filling it out. During the data collection phase, the researchers identified all patients undergoing surgery during the study period and extracted information related to prophylactic antibiotic administration, including time, type, dose, redosing, and duration, from anesthesia records and surgical sheets. Wound infection incidence was assessed through nursing records, physical examination results, and patient follow-up sheets. Data were then entered into a coding sheet, which then underwent editing, coding, entry, and cleaning before being analyzed using statistical software such as SPSS or Stata. Ethically, this study was non-interventional because it used secondary data. Therefore, patient confidentiality was maintained by assigning respondent codes. All procedures were carried out in accordance with the principles of *ethical clearance* as outlined in the Declaration of Helsinki.

Data Analysis

Data analysis in this study was conducted in stages through univariate, bivariate, and multivariate analysis. Univariate analysis was used to present the frequency distribution of respondent characteristics, components of prophylactic antibiotic administration, and the incidence of surgical site infections in the form of tables, percentages, and narrative descriptions. Bivariate analysis was conducted to examine the relationship between independent variables and the incidence of SSI using the Chi-square test if the *expected count requirement* was met, or the Fisher Exact test if the cell frequency was too small; while the Spearman test was used if the variables being analyzed were ordinal. At the multivariate stage, logistic regression can be applied if control for confounding variables is needed to obtain *an adjusted odds ratio* (aOR). All statistical tests used a 95% confidence level with a significance limit of $p < 0.05$ **.**

3. RESULTS AND DISCUSSION

Results

Surgical Wound Infection Incident

This section presents the distribution of surgical site infections (SSI) among all study respondents based on medical records. This information is used to describe the initial proportion of infections before analyzing their relationship to prophylactic antibiotic administration variables.

Table 1. Distribution of Surgical Wound Infection Incidents in Respondents (n = 35).

Wound Infection Incident	Frequency	Percentage
No Infection (0)	30	85.7%
Infection (1)	5	14.3%
Total	35	100%

Based on Table 1, it is known that the majority of respondents, 30 (85.7%), did not experience surgical wound infections. Conversely, 5 (14.3%) were recorded as experiencing postoperative wound infections. This proportion indicates that surgical wound infections still occur in a small proportion of patients, making it important to further analyze related factors, including the administration of prophylactic antibiotics.

Timeliness of Prophylactic Antibiotic Administration

This section describes the distribution of the timeliness of prophylactic antibiotic administration to patients before surgery. This information is important because the timeliness of administration, 30-60 minutes before incision, is a key determinant of the effectiveness of surgical site infection prevention.

Table 2. Distribution of Timeliness of Prophylactic Antibiotic Administration (n = 35).

Timeliness of Delivery	Frequency	Percentage
On time (≤ 60 minutes)	32	91.4%
Not accurate (> 60 minutes)	3	8.6%
Total	35	100%

Table 2 shows that the majority of respondents received prophylactic antibiotics in a timely manner, namely 32 people (91.4%), while 3 people (8.6%) received antibiotics not in accordance with the recommended timeframe. This high proportion of timely antibiotics indicates that antibiotic administration procedures in the hospital have followed clinical standards, although there were still a small number of cases that were not appropriate and potentially affected the risk of surgical site infections.

Types of Prophylactic Antibiotics Given

This section presents the distribution of prophylactic antibiotics administered to patients prior to surgery. This information is important for understanding antibiotic use patterns in healthcare facilities and their consistency with national and international guidelines.

Table 3. Distribution of Prophylactic Antibiotic Types (n = 35).

Types of Prophylactic Antibiotics	Frequency	Percentage
Ceftriaxone	20	57.1%
Ampicillin–Sulbactam	15	42.9%
Total	35	100%

Based on Table 3, the most commonly used antibiotic for prophylaxis was ceftriaxone, in 20 respondents (57.1%). Meanwhile, ampicillin-sulbactam was given to 15 respondents (42.9%). The limited use of these two types of antibiotics indicates a specific pattern in hospitals, although WHO and ACOG guidelines generally recommend cefazolin as the primary choice for preventing surgical site infections. This variation may be influenced by drug availability, hospital policy, or specific clinical considerations.

Accuracy of Prophylactic Antibiotic Dosage

This section presents the distribution of the appropriateness of prophylactic antibiotic doses administered to patients prior to surgery. Accurate dosing is a critical component in ensuring antibiotic effectiveness in preventing surgical site infections.

Table 4. Distribution of Prophylactic Antibiotic Dose Accuracy (n = 35).

Accuracy of Antibiotic Dosage	Frequency	Percentage
Appropriate	35	100%
Not exactly	0	0%
Total	35	100%

Table 4 shows that all 35 respondents (100%) received prophylactic antibiotics at doses consistent with hospital standards. No cases of inaccurate dosing were found in any of the patients studied. This finding indicates that antibiotic dosing and calculation procedures at the healthcare facility are consistently implemented, and therefore, dosage is not a contributing factor to variations in surgical site infection incidence in this study population.

Intraoperative Dose Repeat Administration

This section describes the distribution of repeat antibiotic doses during surgery. Intraoperative redosing is typically performed for procedures lasting >2 hours or with heavy bleeding and is a critical component in maintaining effective antibiotic concentrations throughout surgery.

Table 5. Distribution of Intraoperative Redosing Administration (n = 35).

Intraoperative Redosing	Frequency	Percentage
Yes	0	0%
No	35	100%
Total	35	100%

Table 5 shows that none of the respondents received intraoperative antibiotic redosing. All 35 patients (100%) were recorded as not receiving a repeat dose during surgery. This finding is consistent with the characteristics of the surgical procedures, which mostly lasted less than 60 minutes and did not involve conditions requiring redosing. Therefore, redosing did not contribute to the analysis of surgical site infection incidence in this study.

Duration of Postoperative Antibiotic Administration

This section presents the distribution of antibiotic duration after surgery. The duration of postoperative antibiotic use is important to evaluate because excessive use has not been shown to be effective in preventing infection and actually increases the risk of antimicrobial resistance.

Table 6. Distribution of Duration of Postoperative Antibiotic Administration (n = 35).

Duration of Antibiotic Administration	Frequency	Percentage
≤ 24 hours	14	40.0%
2–5 days	21	60.0%
> 5 days	0	0%
Total	35	100%

Table 6 shows that the majority of respondents, 21 (60.0%), received postoperative antibiotics for 2–5 days. Fourteen respondents (40.0%) received antibiotics for only ≤ 24 hours, while no patients received antibiotics for more than 5 days. This pattern indicates that the practice of administering postoperative antibiotics in hospitals still tends to be longer than the WHO and ACOG recommendations, which recommend discontinuing antibiotics within 24 hours, especially in uncomplicated cesarean sections. However, the absence of antibiotic use for more than 5 days indicates that hospitals have implemented antibiotic use limits to prevent overuse.

The Relationship between Variables of Prophylactic Antibiotic Administration and the Incidence of Surgical Wound Infections

This section presents the results of statistical tests that evaluate the relationship between the appropriateness of prophylactic antibiotic administration including the time of

administration, type of antibiotic, postoperative duration and the incidence of surgical wound infections.

Table 7. Relationship between Timeliness of Antibiotic Administration and the Incidence of SSI.

Punctuality	No Infection	Infection	Total
Appropriate	29	3	32
Not exactly	1	2	3
Total	30	5	35

Statistical test: Fisher Exact, p-value = 0.041

The table shows that of the three respondents who received antibiotics late, two (66.7%) experienced infections. The Fisher Exact test yielded a p-value of 0.041, indicating a significant association between late antibiotic administration and surgical site infections.

Table 8. Relationship between Type of Prophylactic Antibiotic and the Incidence of SSI.

Types of Antibiotics	No Infection	Infection	Total
Ceftriaxone	17	3	20
Ampicillin–Sulbactam	13	2	15
Total	30	5	35

Statistical test: Chi-square, p-value = 0.682

The distribution of infection incidence was relatively similar for both antibiotic types. The chi-square test showed p = 0.682, indicating no significant association between the type of prophylactic antibiotic and the incidence of surgical site infections.

Table 9. Relationship between the Duration of Postoperative Antibiotic Administration and the Incidence of SSI.

Duration	No Infection	Infection	Total
≤ 24 hours	12	2	14
2–5 days	18	3	21
Total	30	5	35

Statistical test: Fisher Exact, p-value = 1,000

Both durations of ≤ 24 hours and 2–5 days showed a relatively small incidence of surgical site infections. The Fisher exact test yielded p = 1.000, indicating no significant association between the duration of postoperative antibiotic administration and the incidence of surgical site infections.

Discussion

The results of this study indicate that the timeliness of prophylactic antibiotic administration has a significant relationship with the incidence of surgical site infections (SSI),

while the type of antibiotic and the duration of postoperative administration did not show a significant relationship. This finding is in line with the study's objective, which is to evaluate the components of prophylactic antibiotic administration that most influence the incidence of wound infections in obstetrics and gynecology patients. In this study, respondents who received antibiotics untimely had a higher proportion of infections compared to those who received antibiotics at the recommended time, while variations in antibiotic type and duration of administration did not show a significant difference in the incidence of infections. The significant relationship between the timeliness of antibiotic administration and SSI can be explained by the pharmacokinetic and pharmacodynamic mechanisms of prophylactic antibiotics. Antibiotics administered 30–60 minutes before incision allow peak drug concentrations to be achieved in the tissue when bacterial contamination occurs during surgery. Some literature suggests that timing is a critical factor because tissue concentrations that are too low before incision will reduce the antibiotic's ability to prevent colonization by pathogenic bacteria (Mangram et al., 2019). A prospective study by Lee et al. (2020) also confirmed that administering antibiotics more than 60 minutes before incision was associated with a twofold increased risk *of Staphylococcus aureus SSI. This suggests that the effectiveness of prophylactic antibiotics is largely determined by timing, not simply type or duration.*

The results of this study align with those of Ghuman et al. (2021), who reported that inappropriate timing of prophylactic antibiotic administration is a strong predictor of increased post-cesarean section infections. The study emphasized that adherence to WHO and CDC time intervals is the most effective component in preventing SSI. Furthermore, a meta-analysis by de Jonge et al. (2021) also concluded that administering antibiotics within the optimal timeframe of 60 minutes before incision reduces the risk of SSI by 40–60%. The agreement between the results of this study and those studies strengthens the evidence that *timeliness* is a key determinant of the success of antibiotic prophylaxis. Conversely, the lack of a relationship between antibiotic type and wound infection incidence in this study is understandable considering that the two antibiotics used—ceftriaxone, ampicillin, and sulbactam —both have broad-spectrum activity against the bacterial flora commonly causing postoperative infections. Literature shows that the choice of prophylactic antibiotics is heavily influenced by availability, local policies, and local bacterial resistance, and is not always the primary factor influencing SSI occurrence if the antibiotic chosen remains within the recommended range (Bratzler & Bolton, 2017). This is supported by the findings of Obaid et al. (2022) who explained that the effectiveness of prophylaxis is more influenced by timing and dose than by antibiotic type, as long as the antibiotic used covers the relevant bacterial spectrum.

The insignificant results for the duration of postoperative antibiotic administration indicate that antibiotic use lasting longer than 24 hours does not provide additional benefit in preventing wound infections. A study by Belachew et al. (2019) demonstrated that administering antibiotics for more than one day does not reduce the risk of SSI and may even increase the risk of antimicrobial resistance. Similarly, a study by Islam et al. (2020) reported that extended prophylaxis duration had no significant effect on the incidence of post-cesarean section infections. These findings reinforce the view that long-term postoperative antibiotic administration is an ineffective, cost-effective practice, and contradicts the principles of *antimicrobial stewardship* . The insignificant antibiotic type and duration variables may also be influenced by the homogeneity of clinical practice at the hospital where the study was conducted. All respondents received the correct dose and none received intraoperative redosing, so the analysis focused on the effect of administration time, which showed the most striking variation. Furthermore, the majority of surgical conditions were in the clean-contaminated category with a duration of <60 minutes, so the risk of infection depended more on preoperative prophylaxis than other additional factors.

The findings of this study have important implications for clinical practice. First, timely antibiotic administration should be a top priority in the surgical process because it directly impacts SSI prevention. Implementation of surgical checklists and strict supervision in the operating room can help improve adherence to administration times. Second, these findings support a shift in practice toward postoperative antibiotic restriction, in line with global recommendations, to reduce the risk of resistance and save treatment costs. Third, hospitals need to ensure the availability of standardized protocols and routine education for healthcare workers to improve the quality of antibiotic prophylaxis. Overall, this study confirms that timely antibiotic administration is the most influential factor in preventing surgical site infections, while the type and duration of postoperative antibiotic administration do not show significant contributions. These findings are consistent with recent scientific evidence and provide a strong foundation for improving infection prevention practices in obstetrics and gynecology clinical settings.

4. CONCLUSION

This study aimed to analyze the relationship between prophylactic antibiotic administration and the incidence of surgical site infections (SSI) in post-obstetric and gynecological surgery patients. The results showed that the timeliness of prophylactic antibiotic administration was a significant factor influencing the incidence of SSI, while the

type of antibiotic used and the duration of post-operative antibiotic administration did not show a significant relationship. These findings confirm that the effectiveness of antibiotic prophylaxis is highly dependent on the appropriate timing of administration, in accordance with pharmacokinetic principles that ensure optimal drug concentration in the tissue at the time of incision. Scientifically, the results of this study support international guidelines stating that timeliness is more decisive for the success of infection prevention than variations in antibiotic types or the duration of post-operative use. The clinical implications of this study indicate the need to improve adherence to standard timing of prophylactic antibiotic administration and evaluate post-operative antibiotic use policies to align with the principles of *antimicrobial stewardship* . Overall, this study provides an important contribution to strengthening surgical site infection prevention practices and can be used as a basis for clinical decision-making in similar healthcare facilities.

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