

## Determinants That Influence on Infection in Sectio Caesarea Patients at Hermina Bekasi Hospital Period 2021-2022

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### ABSTRACT

*Nosocomial infections are the leading cause of the world's high rates of morbidity and death. In 2002 the CDC estimated the incidence rate of nosocomial infections in hospitals at approximately 1.7 million people and about 99,000 people dying from these infections. Surgical area infection (IDO) is one of the most nosocomial infections that occurs in hospitals. The use of appropriate prophylactic antibiotics can reduce the incidence of surgical wound infections. In 2014 WHO survey showed that the incidence of surgical area infection (IDO) increased by 1.2 cases per 100 surgical procedures to 23.6 cases per 100 surgical procedures. One of the infections included in the Health Care Associated Infections (HAIs) group is surgical area infections (IDO). The study aims to determine the determinants that affect the incidence of infection in caesarean section patients in hospitals through several determinants studied, namely age, gestational age, maternal parity, comorbidities, maternal health conditions (Hb value), antibiotic type, time of administration, duration of use, route of administration, type of surgery, duration of surgery and Length Of Stay (LOS) with the incidence of IDO in Sectio Caesarea (SC) patients at Hermina Bekasi Hospital for the 2021-2022 period. The design of the retrospective observational study research was carried out with a sample of 350 people. Data were obtained through the Medical Record File (BRM), observation from the time the patient finished SC treatment until control 7 days after treatment at the polyclinic. Data analysis includes univariate analysis, bivariate analysis using quadratic kai test and multivariate analysis with multiple logistic regression non-parametric tests. The results showed that there was an influence between comorbidities (OR = 3,886; 95% CI = 0.948 \_ 15,925) and the incidence of IDO. Other factors did not have a significant influence on the incidence of IDO. The results of the double logistic regression non-parametric test found comorbidities to be the most dominant determinant of IDO events. Identification of IDO risk factors can be useful for planning efforts to minimize the incidence of IDO in post-caesarean patients. The use of an improper type of prophylactic antibiotic (ceftriaxone injection) shows an IDO incidence of 0.85% with an effective and efficient cost to be considered to the management of Hermina Bekasi Hospital.*

### Keywords

Prophylactic antibiotics, Cesarean section, Surgical wound infections, Comorbidities, Types of antibiotics.

Care Associated Infections (HAIs) group is Surgical Site Infection (IDO).

### Introduction

The hospital is a health facility that provides promotive, preventive, curative and rehabilitative services. The 2014 WHO survey showed the incidence of surgical site infections (IDO) increased by 1.2 cases per 100 surgical procedures to 23.6 cases per 100 surgical procedures. One of the infections included in the Health

Nosocomial infection is the main cause of high morbidity and mortality in the world. In 2002 the CDC estimated the incidence of nosocomial infections in hospitals was around 1.7 million people and around 99,000 people died from this infection. Surgical site infection (SSI) is one of the most common nosocomial infections that occur in hospitals. The use of appropriate prophylactic antibiotics can reduce the incidence of surgical wound infections.

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Research conducted by Fifin Oktaviani et al. showed that the high incidence of SSI due to cesarean section was 9 patients (6.4%) of a total of 140 patients [1]. The suitability of the use of prophylactic antibiotics showed that the route and interval of administration was 100% (140 patients) according to the guidelines [2].

Cesarean section shows an increasing trend from year to year. Delivery by caesarean section continues to increase in various countries, including in Indonesia. According to the World Health Organization (WHO) the number of deliveries by Sectio Caesarea is around 10-15% of all deliveries [3]. In Indonesia the number of deliveries by Sectio Caesarea reaches 9.8 [4].

The incidence of birth by cesarean section increases every year, so that most cesarean section patients are given prophylactic antibiotics to prevent the incidence of surgical site infection (SSI). The use of prophylactic antibiotics in the implementation of cesarean sections is included in the Highly Recommended. In the Highly Recommended category, antibiotics are stated to be firmly proven to reduce morbidity, reducing treatment costs and reducing overall consumption of antibiotics [5]. The use of antibiotics is important in reducing morbidity and mortality rates, but intensive use of antibiotics can lead to resistance [6]. Skjeldestad et al. reported that hospitals that provide prophylactic antibiotics for women undergoing cesarean section can reduce the infection rate of the surgical wound [7].

The number of SC actions for the 2021-2022 period at Hermina Bekasi Hospital obtained 2758 data, with IDO data obtained from PPI for 8 patients. Actually, Hermina Bekasi Hospital has made efforts to prevent SSIs, including:

1. The PPRA Committee made PPAB Hermina Bekasi Hospital in which there was the use of prophylactic antibiotics in SC patients.
2. Socialization of the PPRA Committee at the Medical Committee meeting regarding the use of recommended prophylactic antibiotics.
3. Hospitals make SOPs for administering prophylactic antibiotics to pre-surgery patients
4. For preoperative preparation of patients including:
  - a. Transferring the patient to the operating table.
  - b. Operating area cleaning
  - c. Installation of the device according to the operator's doctor's instructions.
  - d. Special instructions according to the surgery to be performed: Install NGT, Urine Catheter.
  - e. Changing outer clothing with special operating room.
  - f. Recheck the marking and shearing of the operating area.
  - g. Doing hand washing with 6 steps of hand washing.

This study aims to determine and analyze the influence of determinants between the characteristics of respondents (age, gestational age, maternal parity, comorbidities and maternal health conditions in this case the Hb value), pattern of use of prophylactic antibiotics (type of antibiotic, time of administration, duration of use, and route administration), Sectio Caesarea action (type cito

or elective surgery, duration of surgery, and length of patient stay) with the incidence of SSI in post-cesarean section patients at Hermina Bekasi Hospital. The SSI rate in SC patients was found to be 0.23% of all SC patients, therefore researchers are interested in conducting a study related to the determinants that influence the incidence of infection in Sectio Caesarea Patients at Hermina Bekasi Hospital for the 2021-2022 period.

## Method

This study uses a quantitative approach with the Cohort method. The type of research used was a case study with data from BRM patients undergoing cesarean sections. This study uses a quantitative data collection method. The research subjects to measure the clinical performance of cesarean section services were the cesarean section patients. To support the design of this study using a data collection form from BRM by inputting each variable. This research was conducted at Hermina Bekasi Hospital in January - February 2023. The population in the independent and dependent variables in this study were all Medical Record Files (BRM) of patients who performed SC procedures at Hermina Bekasi Hospital. Research data collection was carried out in 2021 – 2022. Data collection was carried out retrospectively on the patient population who underwent a cesarean section and received prophylactic antibiotics by tracing the medical record data of patients undergoing a sectio caesarea operation, namely data on antibiotic use (type of antibiotic, dose, and time administration, route of administration) while being treated at Hermina Bekasi Hospital for the 2021-2022 period.

Retrospective observational study design, with research subjects namely patients who underwent cesarean section and controls 7 days after SC hospitalization at Hermina Bekasi Hospital during the period 2021 – 2022 to measure the incidence of SSI after cesarean section and IDO determinants. In this study, a sample of 350 people who underwent cesarean section up to control 7 days after the cesarean section hospitalization (according to the inclusion criteria) as a sample.

In this study, not all BRM were included as samples, with the random sampling method, namely randomly selected patients who met the inclusion criteria as research samples. From BRM, which are the independent variables and which are the dependent variables are entered into the formula that has been prepared as collecting data.

The ILO diagnostic criteria and definitions refer to the Guidelines for prevention of surgical site infection issued by the Centers for Disease Control and Prevention (CDC) National Nosocomial Infections Surveillance System (NNIS) in 1999 [8]. ILO is an infection in a surgical wound acquired during a patient's hospitalized for up to 30 days postoperatively. ILO is classified into three types, namely superficial incisional SSI, deep incisional SSI and organ/space infection.

Data was collected by observing cesarean section patients, from

the time the patient was admitted to the control 7 days after treatment at Hermina Bekasi Hospital (from BRM data there were 350 samples). Observation of the surgical wound was carried out twice, namely during treatment at the hospital and when the patient was in control at the polyclinic (7 days after being hospitalized and having gone home). Data related to the characteristics of the respondents, the results of supporting examinations, were all obtained from the patient's BRM. The data were analyzed using a computerized system, namely the Software Statistical Program for Social Science (SPSS) version 25 using a univariate analysis test to see a descriptive description of the respondents and their risk factors. Bivariate analysis was used to see the relationship between risk factors and the incidence of SSI, namely to see the difference in mean values between variables, chi square test to examine the relationship between categorical dependent variables and categorical independent variables. Multivariate analysis aims to see the effect between the dependent variable (IDO) and the independent variables (respondent characteristics, pattern of use of prophylactic antibiotics and SC measures).

Multiple logistic regression non-parametric test was performed. Multivariate analysis was carried out to measure the relationship between variables together with multiple logistic regression tests with a Confidence Interval (CI) of 95% and a significance level with a value of  $p < 0.05$ . This research has obtained ethical approval from the Research Ethics Commission of the University of Respati Indonesia, as well as operational approval from the research hospital.

## Results

Most of the respondents were in the age category not at high risk, gestational age appropriate (term), however Hb levels were normal 42.6%, and 21.1% had comorbidities. Most of the patients with multiparous pregnancies. As many as 46.6% of patients used the right prophylactic antibiotics (cefazolin/cefuroxime) with the right time of administration and route of administration, 69.4% of the time of use of the right antibiotics. 91.6% of the types of surgery are emergencies (Table 1).

**Table 1:** Patient Characteristic Variables

| Variable                | Category                  | N   | %    |
|-------------------------|---------------------------|-----|------|
| Age                     | Risk                      | 57  | 16,3 |
|                         | Non Risk                  | 293 | 83,7 |
| Nativity age            | Non Adequate              | 105 | 30   |
|                         | Adequate ( <i>Aterm</i> ) | 245 | 70   |
| Birth                   | Primigravida              | 110 | 31,4 |
|                         | Multigravida              | 240 | 68,6 |
| Comorbid                | Comorbid                  | 74  | 21,1 |
|                         | Non Comorbid              | 276 | 78,9 |
| Mother Health (Hb Rate) | Non Normal                | 201 | 57,4 |
|                         | Normal                    | 126 | 42,6 |
| Antibiotic              | Effective                 | 163 | 46,6 |
|                         | Non Effective             | 187 | 53,4 |
| Input Time              | Non Effective             | 0   | 0    |
|                         | Effective                 | 350 | 100  |

|                    |                  |     |      |
|--------------------|------------------|-----|------|
| Duration           | Effective        | 243 | 69,4 |
|                    | Non Effective    | 107 | 30,6 |
| Location           | Effective        | 350 | 100  |
|                    | Non Effective    | 0   | 0    |
| Operation Type     | <i>Emergency</i> | 229 | 34,6 |
|                    | Elective         | 121 | 65,4 |
| Operation Duration | > 3 hours        | 1   | 0,3  |
|                    | ≤ 3 hours        | 349 | 99,7 |
| LOS                | > 5 days         | 7   | 2    |
|                    | ≤ 5 days         | 343 | 98   |

Of the 350 patients who had a cesarean section, it was found that 8 people (2.3%) had SSIs and 342 people (97.7%) did not experience SSIs. Most of the SSI incidents were found on the fifth day during wound care in the inpatient room, namely 4 people (1.14%) and the rest were found on the 10th day during control at the obstetrics and gynecology polyclinic. The forms of ILO that were found varied from pain and soreness in the surgical wound, wet surgical wound, discharge, blood, pus from the surgical wound, redness and swelling of the wound, even an open surgical wound. Most of the SSIs, namely 8 cases (2.3%), were identified as superficial incisions and a small number were classified as deep incisions which did not require repeated operations because dehiscence occurred (Table 2).

**Table 2:** Bivariate Analysis of Surgical Site Infections in Post-Caesarean Section Patients

| Risk Factor             | Category                  | IDO |     | Non IDO |      | P value | OR   | 95% CI      |
|-------------------------|---------------------------|-----|-----|---------|------|---------|------|-------------|
|                         |                           | n   | %   | N       | %    |         |      |             |
| Age                     | Risk                      | 1   | 1,8 | 56      | 98,2 | 0,769   | 0,67 | 0.073-6,29  |
|                         | Non Risk                  | 7   | 2,4 | 286     | 97,8 |         |      |             |
| Nativity age            | Non Adequate              | 4   | 3,8 | 101     | 96,2 | 0,212   | 2,23 | 0,48- 10,31 |
|                         | Adequate ( <i>Aterm</i> ) | 4   | 1,6 | 241     | 98,4 |         |      |             |
| Birth                   | Primigravida              | 2   | 1,8 | 108     | 98,2 | 0,692   | 1,65 | 0,30 – 8,96 |
|                         | Multigravida              | 6   | 2,5 | 234     | 97,5 |         |      |             |
| Comorbid                | Comorbid                  | 4   | 5,4 | 70      | 94,6 | 0,043   | 2,52 | 0,56 – 11,3 |
|                         | Non Comorbid              | 4   | 1,4 | 272     | 98,6 |         |      |             |
| Mother Health (Hb Rate) | Non Normal                | 5   | 2,5 | 196     | 97,5 | 0,769   | 1,40 | 0,31 – 6,37 |
|                         | Normal                    | 3   | 2   | 131     | 98   |         |      |             |
| Location                | Effective                 | 8   | 2,3 | 342     | 97,7 | -       | -    | -           |
|                         | Non Effective             | 0   | 0   | 0       | 0    |         |      |             |
| Input Time              | Effective                 | 8   | 2,3 | 342     | 97,7 | -       | -    | -           |
|                         | Non Effective             | 0   | 0   | 0       | 0    |         |      |             |
| Antibiotic ztype        | Effective                 | 6   | 1,7 | 157     | 44,9 | 0,103   | 0,48 | 0,09 – 2,57 |
|                         | Non Effective             | 2   | 0,6 | 185     | 52,9 |         |      |             |
| Duration                | Effective                 | 8   | 2,3 | 235     | 67,1 | 0,058   | 0,00 | 0,00_ -     |
|                         | Non Effective             | 0   | 0   | 107     | 30,6 |         |      |             |
| LOS                     | > 5 days                  | 0   | 0   | 7       | 2    | 0,683   | 0,00 | 0,00_ -     |
|                         | ≤ 5 days                  | 8   | 2,3 | 335     | 95,7 |         |      |             |
| Operation Type          | Elective                  | 3   | 0,9 | 226     | 64,6 | 0,093   | 1,97 | 0,41 – 9,40 |
|                         | Cito                      | 5   | 1,4 | 116     | 34,6 |         |      |             |
| Operation Duration      | >3 hours                  | 0   | 0   | 1       | 0,3  | 0,878   | 0,00 | 0,00_ -     |
|                         | <3hours                   | 8   | 2,3 | 341     | 97,4 |         |      |             |

There was no significant difference between the healthy reproductive age groups and those at risk for ILO events. Likewise, the type of operation, Hb value, gestational age, maternal parity, type of antibiotic, length of use, time of administration, route of administration, type of elective/cito surgery, duration of surgery, and Length of Stay (LOS) did not show significant results on the incidence of SSI. The average comorbidities of cesarean section patients are Diabetes Mellitus (DM), Anemia, and Hypertension. Comorbidities in SC patients had a proportion of SSI events that were four times greater than patients who had no comorbidities during SC (OR = 3.8; 95% CI = 0.948 \_ 15.925).

|                     |          | Variables in the Equation |       |        |    |      |        |                     |        |
|---------------------|----------|---------------------------|-------|--------|----|------|--------|---------------------|--------|
|                     |          | B                         | S.E.  | Wald   | df | Sig. | Exp(B) | 95% C.I. for EXP(B) |        |
|                     |          |                           |       |        |    |      |        | Lower               | Upper  |
| Step 1 <sup>a</sup> | Komorbid | 1.357                     | .720  | 3.557  | 1  | .059 | 3.886  | .948                | 15.925 |
|                     | Constant | -5.577                    | 1.131 | 24.317 | 1  | .000 | .004   |                     |        |

a. Variable(s) entered on step 1: Komorbid.

**Table 3:** Final Model of SSI Occurrence Multivariate Analysis.

At the end of the modeling, it was found that the most influential determinant was comorbid.

## Discussion

In this study, the incidence of SSI was around 2.3% of all CS patients at Hermina Bekasi Hospital, this rate was lower than SSIs in Australia (6.9%), Estonia (6.2%), England (5.1%), New Zealand (5%), and in America (5%). 9,10,11 Most of the incidents of SSI in this study were found on the fifth day (when going home) wound care in the inpatient room and on the 12th day during control patients in the polyclinic midwifery. In the UK and New Zealand, patient get an IDO event can occur while the patient is being treated in the hospital and after the patient is discharged from hospital [9-11].

The results of the multivariate analysis showed that three determinants had a significant relationship to the incidence of SSI, namely the type of antibiotic, comorbidities, and type of surgery. In Iran and the UK, timing of prophylactic antibiotics, length of preoperative stay and length of postoperative stay are risk factors for surgical wound infection.

In this study, all cesarean section patients were given prophylactic antibiotics intravenously before surgery. Standard operating procedure (SOP) for administering antibiotics prophylaxis for Caesarean section at Hermina Bekasi Hospital is given 30-60 minutes before surgery. 100% of prophylactic antibiotics were administered correctly. In this study, it was found that 1.43% of SC patients who used prophylactic antibiotics appropriately (Cefazolin or Cefuroxim injections) experienced SSI. In contrast to the research by Nita Rusdiana, Meta Safitri, Anis Resti (2014), which stated that the analysis of the type, time, and dose of

antibiotics administered was not in accordance with the basic guidelines of pharmacology and therapy according to Gooman & Gilman [12]. The results of another study showed that there was a relationship between the time of giving prophylactic antibiotics (OR = 1.16; 95% CI = 1.09 \_ 1.37), length of preoperative stay (OR = 1.12; 95% CI = 1.02 \_ 1.24) and length of stay after surgery (OR = 1.21; 95% CI = 1.04 \_ 1.39) with the incidence of SSI in post-cesarean sections at Dr. Sardjito Yogyakarta [13].

Multivariate analysis found significant differences between comorbidities and the incidence of SSI. Comorbidities are a risk factor for SSI. In this study, 1.14% of SC patients with comorbidities experienced SSI. The results of the analysis of this study indicate that comorbidities have a positive and significant influence on the incidence of SSI in SC patients at Hermina Bekasi Hospital. This illustrates that the more comorbidities a patient has, the higher the incidence of SSI. The results of previous studies have never examined comorbidities that can affect the incidence of SSI.

Other studies have shown that the nature of surgery, the type of antibiotics and the time of administration of antibiotics had a significant relationship with the incidence of SSI (p <0.05) and Mah et al. stated that the type of emergency surgery has a risk of 2.6 times for SC infection to occur compared to the type of elective surgery.

Meanwhile, in the current study, it was found that 1.42% of SC patients experienced SSI incidents. The results of the analysis of this study indicate that The type of surgery has a positive effect on the incidence of SSI in SC patients at Hermina Bekasi Hospital. This illustrates that the cito/emergency type of operation will increase the incidence of SSI.

The risk factors in this study were the patient's age, gestational age, maternal parity, maternal health condition (Hb value), comorbidities, type of prophylactic antibiotic used, duration of antibiotic use, time of administration, route of administration, type of operation, duration of operation, patient's LOS. Previous research found that age, nutritional status, type of surgery, hemoglobin level and duration of surgery were not significantly different between patients with ILO and not ILO [10,11]. Based on age category, the incidence of SSI was found to be the same in the age group at risk and the age group not at risk. However, the patient's age was not significantly related to the incidence of ILO. In England, no significant difference was found between the ages of the ILO patient group and the control group [14]. The incidence of SSI was found in patients with maternal health conditions, but there was no significant relationship between the maternal health condition (Hb value) and the incidence of SSI. Previous research has found that obese mothers are at twice the risk of developing ILO compared to mothers with normal weight

In this study, it was found that 1.42% of SC patients experienced SSI incidentally. However, the multivariate test found that the type

of operation had not been found to be a determinant of the incidence of SSI. In previous studies, emergency surgical procedures were not significantly associated with the incidence of ILO in post-cesarean section patients. Operations in emergency and elective patients are well planned so that infectious complications can be minimized.

Operation duration did not significantly influence the incidence of SSI. Length of surgery is not a risk factor for ILO post-cesarean section [11]. Increasingly long duration of operation, cause an increase in the level of surgical wound contamination and increase the risk of tissue damage. In addition, the long operating duration increases the fatigue of the operating team and affects the sterility level of the procedure.

Although it can be prevented, SSI is a relatively common complication of surgery. Various efforts can be made to reduce the risk of SSI in post-cesarean section patients. WHO carried out a global initiative for patient safety efforts by creating guidelines for safe surgery called the Surgical Safety Checklist (SSCL) [15]. The operation phase was identified as three stages, namely before induction of anesthesia (sign in), before skin incision (time out), and before the patient leaves the operating room (sign out). SSCL can be implemented in the service of cesarean section, one of the phases is time out, which is related to the time of administration of prophylactic antibiotics at 60 minutes before surgery. The timing of prophylactic antibiotics must be considered in accordance with the standards because various studies have shown that the proper administration of prophylactic antibiotics can reduce the risk of ILO after cesarean section.

SOPs for cesarean section services have been made and documented at Hermina Bekasi Hospital, including SOPs for giving prophylactic antibiotics used, namely Cefazolin 2 gram injection intravenously, but the results of the study showed that 53.4% of SC patients were given inappropriate antibiotics (using Ceftriaxone injection). caused the occurrence of SSI by 0.85% while patients who used antibiotics appropriately turned out to be 1.43% experienced SSIs. Inappropriate use of prophylactic antibiotics generally uses ceftriaxone injection, where the price of this drug is cheaper compared to cefazolin drugs. From these things we can draw conclusions that the use of ceftriaxone injection as a prophylactic antibiotic is not only inexpensive but also effective as a prophylactic antibiotic in patients SC (based on evidence base medicine from this research) [16].

## Conclusion

The determinants of the incidence of SSI in cesarean section are comorbidities, types of antibiotics, duration of use of antibiotics and type of surgery. However, the most influential determinant is co-morbidity. Other determinants were respondent's age, gestational age, mother's health condition (Hb value), mother's parity, timing of antibiotic administration, route of antibiotic administration, duration of surgery, and LOS, were not found as determinants of SSI in post-cesarean section patients. Hermina Bekasi Hospital is considered good enough in preventing the occurrence of SSI in SC patients. This can be seen in the results

of the study that comorbidities are the biggest determinant that influences the incidence of SSI.

## Suggestion

1. Hermina Bekasi Hospital continues to maintain the quality of SSI incidents at the hospital, because SSI incidents are one of the national quality indicators of hospitals monitored by the Ministry of Health.
2. The use of prophylactic antibiotics can be used with Ceftriaxone injections, which are evidence-based medicine, in this study they are still being used effectively. In addition, the drug Ceftriaxon has a relatively low price compared to Cefazolin, so it can be used as a cost-effective drug in preoperative SC patients.
3. Based on the results of the study that comorbidities are the biggest determinant that influences the incidence of SSI in SC patients at Hermina Bekasi Hospital, it is advisable to provide written information and education from all hospital staff to all patients who will do SC at the hospital when filling out the Informed Consent sheet the patient and family will sign it.
4. Particularly in patients at risk of gestational age, co-morbidities, who have been given the right type of antibiotic, proper use of antibiotics is recommended Length of stay > 5 days until the infection is cured/dry. Or in other words, SC patients with comorbidities should be treated for more than 5 days to anticipate the occurrence of SSI.

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