

## Analysis of Prophylactic Antibiotic Administration in BPJS-Covered Patients Undergoing Caesarean Section at Husada Utama Hospital, Surabaya

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### ABSTRACT

**Background:** Considering the importance of the rational use of antibiotics to prevent the development of antibiotic resistance, especially in surgical patients who are at risk of developing Surgical Site Infections (SSI). A study will be conducted to evaluate the use of antibiotics in caesarean section patients at Husada Utama Hospital Surabaya.

**Subjects and Method:** This study uses a descriptive observational research design with a retrospective data collection approach on patients who underwent either emergency or elective caesarean section (CS) on January – May 2024 at Husada Utama Hospital Surabaya. The variables in this study are the antibiotic use patterns of CS patients, which include the type of antibiotics used, the antibiotic dosage, the duration of antibiotic administration, the amount of antibiotic use measured by the DDD/100 bed days method and DU90%, the appropriateness of antibiotic use according to the national formulary and hospital antibiotic guidelines, the response time for CS surgery, and the risk of developing surgical site infection (SSI). The sample for this study consisted of patients who underwent either emergency or elective CS surgery at the Husada Utama Hospital Surabaya from January to May 2024.

**Results:** From January to May 2024, 69 samples were analysed. These included 65 patients undergoing elective caesarean sections and 4 patients undergoing emergency caesarean sections with a response time of <30 minutes. The antibiotics used were cefazolin 2 g and ceftriaxone 1 g, administered intravenously over 30-60 minutes. Antibiotic consumption was measured using the DDD/100 bed days method and DU 90% segment. The amount of cefazolin used was 26.50 DDD/100 bed days and the amount of ceftriaxone used was 0.96 DDD/100 bed days. Cefazolin was the most commonly used antibiotic in all types of surgery, accounting for 95.65% of the DU 90% segment. Antibiotic use 95.65% was in accordance with PPAB guidelines and Ministry of Health regulations in terms of type, dosage and route of administration. There were no surgical site infections during the study period.

**Conclusion:** Ninety five percent of antibiotic use in caesarean section patients in the hospital is in accordance with the type of antibiotic recommended in the antibiotic use guidelines, which is cefazolin. The use of the broad-spectrum antibiotic ceftriaxone is 0.96 DDD/100 bed days. The programme to control antimicrobial resistance in the obstetrics and gynaecology unit, especially regarding the prophylactic use of antibiotics, is effective.

**Keywords:** cesarean section, prophylactic antibiotics, response time, surgical site infection.

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## BACKGROUND

Cesarean section (CS) is a surgical procedure used to ensure the safety of both mother and baby when a safe vaginal delivery is not feasible (Da Cunha, 2018). Initially performed for specific reasons, such as a narrow pelvis or placenta previa, the indications for CS have expanded with advancements in science, technology, surgical techniques, and anesthesia (Ginting and Priyayi, 2012). Medical indications, such as postnatal bleeding, pose significant risks during the delivery process and are among the reasons CS has become the most frequently performed procedure in modern obstetrics (Lazasniti et al., 2020). Currently, there is a trend toward performing cesarean sections without medical indications. The increasing mortality and morbidity rates among mothers and infants have contributed to the rising use of cesarean sections in non-emergency cases. Indonesia is also affected by this global trend. The rate of cesarean deliveries as a substitute for vaginal births increased from 12% in 2012 to 17% in 2017, with Jakarta recording the highest rate at 31.1% (Islam et al., 2022).

Surgical site infections (SSI) can develop in the tissue at the surgical site within 30 days of the procedure if left untreated with antibiotics, potentially leading to death (Owens and Stoessel, 2008). Compared to vaginal delivery, women undergoing cesarean sections face a 5-20 times higher risk of infection if preventive antibiotics are not administered (Muzayyanah et al., 2018). Bacteria commonly associated with surgical wound infections include *Staphylococcus*

*aureus*, *coagulase-negative staphylococci*, *Enterococcus spp.*, and *Escherichia coli*. Additionally, factors such as procedural errors during surgery can further increase the risk of postoperative infections (Owens and Stoessel, 2008).

Prophylactic antibiotics are used to reduce the risk of infection following cesarean section. First-generation cephalosporins, such as cefazolin, are preferred for prophylaxis over later generations due to their high efficacy against Gram-positive bacteria commonly involved in infections related to cesarean sections and their ability to penetrate wider tissues (Muzayyanah et al., 2018). Cefazolin, administered in a single dose of 1-2 grams depending on the patient's weight, is recommended. Other antibiotic regimens include metronidazole 500 mg combined with gentamicin 1.5-3 mg/kg body weight. Postoperative use of oral or parenteral antibiotics is generally not required. Additional doses may be necessary if blood loss exceeds 1500 ml or if the surgery lasts more than 3 hours (Wardhana et al., 2022).

Antibiotic use must be appropriate and in accordance with the guidelines applicable in a given country or region, as indiscriminate use can lead to ineffective treatment and may even cause antibiotic resistance. Adherence to hospital guidelines for antibiotic use in Indonesian hospitals is reported to be low. Only 6.1% of antibiotics used for orthopedic surgery were in accordance with the guidelines at Dr. Mintohardjo General Hospital in Jakarta. The percentage of appropriate antibiotic use for clean-contaminated wounds in surgeries at district

tertiary care hospitals in Jakarta was 21.5% (Herawati et al., 2019). Guidelines vary by country. In Indonesia, the Ministry of Health has formulated the Antibiotic Use Guidelines (PPAB) to serve as a reference for healthcare services. PPAB are used as benchmarks for the healthcare provided to the public under the National Health Insurance (JKN) program, ensuring that patients receive medications that are appropriate, effective, high-quality, safe, and affordable. Adhering to these guidelines can lead to improved public health outcomes.

Given the importance of rational antibiotic use to prevent antibiotic resistance, particularly in surgical patients who are at risk for surgical wound infections (SWI), a study will be conducted to evaluate antibiotic use among cesarean section (CS) patients at Husada Utama Hospital in Surabaya.

## SUBJECTS AND METHOD

### 1. Study Design

This study uses a descriptive observational research design with a retrospective data collection approach on patients who underwent either emergency or elective caesarean section (CS) on January to May 2024 at Husada Utama Hospital Surabaya. Data sources include medical records and operative notes.

### 2. Population and Sample

The population in this study comprises all cesarean section (CS) patients at Husada Utama Hospital. The sample used in this study consists of patients who undergo either emergency or elective CS surgeries from January to May 2024 at Husada Utama Hospital Surabaya.

### 3. Study Variables

The variables in this study are the patterns of antibiotic use in CS patients, which include the type of antibiotics used, antibiotic dosage, duration of antibiotic

administration, quantity of antibiotic use measured by the DDD/100 bed days method and DU90%, compliance with hospital antibiotic guidelines, and the risk of developing surgical site infections (SSI).

### 4. Operational Definition of Variables

**Prophylactic Antibiotics:** Antibiotics used to prevent infections during surgical procedures.

**Type of Antibiotics:** The category of prophylactic antibiotics administered to patients undergoing cesarean section (CS).

**Antibiotic Dosage:** The appropriate amount of prophylactic antibiotics required to prevent infections in patients undergoing CS.

**Duration of Antibiotic Administration:** The time from when prophylactic antibiotics are first administered until the time they are completely given.

**DDD (Defined Daily Dose):** The average daily dose of a drug.

**DDD/100 Bed Days:** The pattern of prophylactic antibiotic use per 100 bed days.

**DU 90%:** The amount of drugs that account for 90% of the total volume of use.

**Compliance with National Antibiotic Guidelines:** The degree to which the use of prophylactic antibiotics conforms to the national antibiotic guidelines.

**Frequency of Surgical Site Infection (SSI):** The number of patients who return for follow-up after the procedure.

### 5. Study Instruments

Data will be collected from medical records, including the type, dosage, route, and duration of antibiotic use, and then recorded using a data collection sheet. The data will then be processed and analyzed using Excel.

### 6. Data analysis

Antibiotik usage profil: (1) Type of antibiotic number of patient given antibiotic divided by total number of patient and times 100%; (2) Dose of antibiotic number of patients

given antibiotic dosage x divided by total number of patient and times 100%; (3) Route of antibiotic administration number of patient given antibiotic route x divided by total number of patient and times 100%; and (4) Duration of antibiotic administration number of antibiotic duration administration x divided by total number of patient and times 100%

Quantity of antibiotic usage: (1) DDD = total dose of antibiotic administered divided by who DDD; (2) DDD/100 Bed Days = total DDD divided by total length of stay and times 100; (3) DU 90% = sigma DDD per 100 bed days for each antibiotic divided by total DDD per 100 bed days and times 100.

Compliance with National Antibiotic Guidelines: number of patients given antibiotic according to antibiotic guidelines divided by total number of patient and times 100%

Risk of surgical site infection (SSI): number of patient with SSI divided by total number of patient and times 100%

7. Research Ethics

Research ethical issues including informed consent, anonymity, and confidentiality, were addressed carefully during the study process. The research ethical clearance approval letter was obtained from the

Research Ethics Committee at Husada Utama Hospital, Surabaya. Indonesia, No 17/KEP-RSHU/VI/2024, on 10 June 2024

RESULTS

1. Sample Characteristics

During the period of January to May 2024, there were 137 medical records of CS patients available, with 69 BPJS patients selected as the research sample. Of the 69 research samples, 65 underwent elective CS, and 4 underwent emergency CS. Based on the age characteristics, the majority of patients were aged 20-30 years. Regarding gravida status (the total number of pregnancies a woman has had), most were Gravida 1-2. In terms of parity status (the number of live births), the majority of samples were in Parity 0-1. For abortion category (the number of miscarriages or pregnancies that ended before 20 weeks), most samples fell under Abortion 0-1. The majority of patients had a hospital stay of 2 days. The most commonly used antibiotics during the period of January to May 2024 were prophylactic antibiotics administered 30-60 minutes before surgery, including Jo1DBO4 (Cefazolin) and Jo1DDO4 (Ceftriaxone), with Cefazolin being the most frequently used.

Table 1. Sample characteristics

| Variable | N (frequency) | Percentage (%) |
|----------|---------------|----------------|
| Age      |               |                |
| 20-30    | 36            | 52.17          |
| 31-35    | 21            | 30.43          |
| 36-40    | 12            | 17.39          |
| Gravida  |               |                |
| 1-2      | 55            | 79.72          |
| 3-4      | 11            | 15.94          |
| ≥5       | 3             | 4.34           |
| Partus   |               |                |
| 0-1      | 59            | 85.5           |
| 2-3      | 9             | 13.04          |
| ≥4       | 1             | 1.46           |
| Abortus  |               |                |
| 0-1      | 66            | 95.65          |
| 2-3      | 3             | 4.35           |

| Variable                   | N (frequency) | Percentage (%) |
|----------------------------|---------------|----------------|
| Length Of Stay (Day)       |               |                |
| 1                          | 8             | 10.14          |
| 2                          | 36            | 53.62          |
| 3                          | 25            | 36.23          |
| Category                   |               |                |
| Elective                   | 65            | 94.20          |
| Emergency                  | 4             | 5.80           |
| Prophylaxis                |               |                |
| Cefazolin (2g)             | 66            | 95.65          |
| Ceftriaxone (1g)           | 3             | 4.35           |
| Route of administration    |               |                |
| IV drip                    | 69            | 100            |
| Oral                       | 0             | 0              |
| Duration of administration |               |                |
| <30 minute                 | 0             | 0              |
| 30 – 60 minute             | 69            | 100            |
| >60 minute                 | 0             | 0              |

## 2. Analysis of Antibiotic Usage Quantity

The profile of antibiotic use based on ATC codes during the period of January to May 2024 includes J01DB04 (Cefazolin) and J01DD04 (Ceftriaxone). All antibiotics used during procedures were administered before surgery, with a total hospital stay of 155 days. The antibiotic with the highest DDD per 100 bed days was Cefazolin, at 26.50 for elective CS and 1.72 for emergency CS. To identify the segment with the highest antibiotic use among CS patients from January to May 2024, a DU 90% calculation is re-

quired. DU 90% is derived from the cumulative %DU. The segment with the highest antibiotic use in both types of surgeries is the same, with Cefazolin being the antibiotic that falls within the DU 90% segment for both elective and emergency CS procedures.

## 3. Compliance of Antibiotic Use with National Antibiotic Guidelines (PPAB)

The results of the analysis of prophylactic antibiotic use, focusing on the type, dosage, and route of administration, indicate that 66 samples (95.65%) were in compliance with the National Antibiotic Guidelines (PPAB) and the Ministry of Health regulations.

**Table 2. Analysis of Antibiotic Usage Quantity**

| Category  | Antibiotic  | DDD Total | DDD/100 Bed Days |        |          | Total DDD/100 Bed Days | %Du   | Du Kum | Segment DU |
|-----------|-------------|-----------|------------------|--------|----------|------------------------|-------|--------|------------|
|           |             |           | DDD Pre          | DDD On | DDD Post |                        |       |        |            |
| Elective  |             |           |                  |        |          |                        |       |        |            |
|           | Cefazolin   | 41.33     | 26.50            | -      | -        | 26.50                  | 96.50 | 96.50  | 90%        |
|           | Ceftriaxone | 1.5       | 0.96             | -      | -        | 0.96                   | 3.50  | 100    | 10%        |
|           |             |           |                  |        | Total    | 27.46                  |       |        |            |
| Emergency | Cefazolin   | 2.68      | 1.72             |        |          | 1.72                   | 100   | 100    | 90%        |

**Note:** DDD Pre (antibiotic used before surgery); DDD On (antibiotic used during surgery), DDD Post (antibiotic used after surgery).

**Table 3. Compliance of Antibiotic Use with National Antibiotic Guidelines (PPAB)**

| Guidelines                     | Recommendation                                                    | Antibiotic Used                                     | Accordance |      | Not Accordance |    |
|--------------------------------|-------------------------------------------------------------------|-----------------------------------------------------|------------|------|----------------|----|
|                                |                                                                   |                                                     | Total      | %    | Total          | %  |
| National Antibiotic Guidelines | 1. Cefazolin 1g-2g i.v drip for 30-60 minute                      | 1. Cefazolin 2g i.v drip for 30 - 60 minute (n=66)  | 66         | 100% | 3              | 0% |
|                                | 2. Gentamicin 3-5 mg /Kg body weight 2g i.v drip for 30-60 minute | 2. Ceftriaxone 1g i.v drip for 30 - 60 minute (n=3) |            |      |                |    |

#### 4. Analysis of Surgical Site Infection (SSI) Incidence

In this study, out of 69 patients, no cases of surgical wound infection (SWI) were

observed. Only 3 patients returned for follow-up after the cesarean section, and none of them received additional antibiotics.

**Table 4. The effect of lactapunctur massage for 7 consecutive days on changes in breast milk production in primiparous mother**

| Operasi   | Post SC monitoring |            | Additional Antibiotic After Control | % SSI Incident |
|-----------|--------------------|------------|-------------------------------------|----------------|
|           | Control            | No Control |                                     |                |
| Elective  | 2                  | 63         | -                                   | 0%             |
| Emergency | 1                  | 3          | -                                   | 0%             |

## DISCUSSION

Antibiotic use is measured by calculating Defined Daily Doses (DDD), in accordance with the recommendations of the World Health Organization (WHO). The DDD calculation is used to assess antibiotic usage in the 69 medical records obtained during the study. The DDD values are employed to understand the patterns of antibiotic consumption over time. Lower DDD values indicate a lower risk of resistance. A reduced amount of antibiotic use suggests that doctors are becoming more selective in choosing treatment options for patients and are adhering more closely to principles of appropriate antibiotic use (Andriani, 2020). In this study, two types of antibiotics were used in cesarean section (CS) procedures: Cefazolin and Ceftriaxone. Both Cefazolin and Ceftriaxone are cephalosporin antibiotics commonly used in surgery because cephalosporins are  $\beta$ -lactam antibiotics that inhibit bacterial cell wall synthesis. These antibiotics are effective against both Gram-

positive and Gram-negative bacteria. Cephalosporins have qualities and effectiveness similar to penicillins but with a broader antibacterial spectrum, covering a range of Gram-positive and Gram-negative organisms, such as *Escherichia coli*, *Klebsiella*, and *Proteus* (Fathirah, 2015). Cefazolin itself is a narrow-spectrum antibiotic effective against Gram-positive bacteria commonly found on human skin, where the incision or CS procedure is performed.

Antibiotic use is calculated using the DDD per 100 bed days formula. DDD/100 bed days is a tool that can be used to determine the intensity of medication use within a healthcare facility. This can assist in analyzing drug consumption trends, such as identifying potential overuse or misuse. The calculation of DDD per 100 bed days is detailed in Table 2, showing a total value of 29.18 DDD per 100 bed days for all CS procedures performed. Cefazolin emerged as the antibiotic with a value of 28.22 DDD per 100 bed days, used by 66 patients

undergoing both elective and emergency CS. In contrast, Ceftriaxone was used by 3 patients undergoing elective CS, with a value of 0.96 DDD per 100 bed days. DU90% is a statistical indicator used to evaluate drug use, measuring the extent of overall drug consumption within a patient population. It is a method for examining drug use patterns and determining whether the use of medications aligns with recommended standards or guidelines. Based on the DU90% calculation results in Table 2, the antibiotic within the DU90% segment is Cefazolin, with a value of 96.50% for all types of cesarean sections (CS) and 96.45% for elective CS. For emergency CS, all 4 procedures used Cefazolin as prophylaxis. The DU90% segment indicates the proportion of antibiotics whose use accounts for 90% of the total prescribed antibiotics.

Surgical wound infections are a serious issue for cesarean section (CS) patients and are a critical indicator of patient safety related to medical procedures. Globally, surgical wound infections occur in 3% to 15% of patients. According to the World Health Organization (WHO) through the World Alliance for Patient Safety, among the 27 million patients who undergo surgery each year, 2-5% experience wound infections postoperatively, with 25% of these infections occurring in hospitals (Kartikasari and Apriningrum, 2020). In various countries, including Indonesia, the rate of cesarean deliveries has increased by 6%. With a total of 480,622 cases, cesarean section is the most common procedure in Indonesia (Ministry of Health, 2018). This increase is closely correlated with the incidence of postoperative infections. Surgical wound infections typically appear within 30 days after surgery (Henman et al., 2012). Surgical wound infections are a leading cause of maternal mortality directly related to pregnancy. Infections from surgical wounds

represent a significant issue in obstetrics, potentially increasing morbidity and mortality by impairing wound healing. Additionally, these infections extend the duration of care and incur associated medical costs (Kartizkasari and Apriningrum, 2020). In this study, no patients experienced infections after surgery. Of the 69 patients who underwent either elective or emergency CS, only 3 returned for follow-up, and none received additional antibiotics. Therefore, it can be stated that no instances of surgical wound infections occurred following CS procedures at Husada Utama Hospital during the study period.

#### **AUTHOR CONTRIBUTION**

Rika Yulia raised the initial research question. Muhammad Daffa Alfarendra managed data collection, ran statistical analysis, drew tables and graphs. Fauna Herawati refined research questions, planned study design. Mufida Indrayati planned and ran statistical analysis. Fauna Herawati and Muhammad Daffa Alfarendra interpreted results, and wrote up manuscript. Rika Yulia and Mufida Indrayati suggested issues in the discussion. All author agree to submitted final version of manuscript

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### CONFLICT OF INTEREST

The authors declare that the study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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