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PATTERN OF PROPHYLACTIC ANTIBIOTIC PRESCRIBING IN SURGICAL PATIENTS AT THE UNIVERSITY OF INDONESIA HOSPITAL

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ABSTRACT

Surgical procedures involve interventions that may compromise tissue integrity, necessitating prophylactic antibiotics to prevent surgical site infections (SSIs). Proper timing, selection, and administration of antibiotics are crucial to achieving optimal therapeutic outcomes. This study aimed to evaluate the prescribing patterns of prophylactic antibiotics in patients undergoing surgical procedures at the University of Indonesia Hospital and assess adherence to established guidelines. A retrospective observational study analyzed the medical records of patients who underwent surgery. Data collected included the type of antibiotics prescribed, timing of administration, dosage, duration, and adherence to national and international guidelines. Descriptive statistics were used to summarize the findings. The study analyzed 213 surgical patients at the University of Indonesia Hospital in September 2024. Prophylactic antibiotics were prescribed in 90.61% of cases, predominantly Cefazolin (86.48%), with doses of 2 g (76.12%) and 1 g (10.36%). Most patients (97.93%) received antibiotics 30–60 minutes pre-incision. All antibiotics were administered intravenously, and in research results, 4.29% were affected by IDO. These findings highlight overall adherence to prophylactic antibiotic guidelines, with minor deviations in timing and dosage observed in a few cases. Optimal prescribing practices were achieved in most surgical patients to reduce the risk of SSI.

KEYWORDS *prophylactic antibiotics, surgical site infections, and prescribing patterns*

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INTRODUCTION

Surgical operations use instruments to destroy or restore tissue integrity, repair or reconstruct damaged tissue, and place implants in the living body, performed by a surgeon (Bass & Garbey, 2014). In surgical procedures, antibiotics are needed to prevent colonization or the development of bacteria that enter the patient's body tissue. Prophylactic antibiotics can be given before, during, and after surgery to prevent surgical site infections (SSI) (IDO) (Permenkes RI, 2021).

The timing of antibiotic administration may vary, but the purpose of preoperative systemic prophylactic antibiotic administration is to ensure that the concentration in the tissue is at the highest level when surgery begins and during surgery (Tarchini et al., 2017). The perioperative period relates to the time before, during, and after surgery. Antimicrobial agents are widely used to prevent and treat infections during the perioperative period of surgical operations (Lambrini, 2017). The literature supports a time of at least 30 minutes but no more than 60 minutes before skin incision is made as the optimal time to administer the most commonly used preoperative antibiotics (Tarchini et al., 2017).

Antibiotics are the most commonly prescribed medications in surgical departments due to their significant benefits to patients undergoing surgical procedures (Tariq Salman et al., 2013). Antibiotics can be misused through inappropriate prescribing, such as unnecessary indications, incorrect doses, varying durations, and not following recommended guidelines and pharmacological principles (Saini et al., 2014).

A study by Ng et al. (2020) evaluated the compliance of surgical antibiotic prophylaxis practices with international guidelines in a Malaysian tertiary hospital, finding suboptimal adherence, particularly in timing and duration. Similarly, Thabit et al. (2022) investigated antibiotic prescribing patterns in perioperative patients in Jordan, revealing high rates of prolonged prophylaxis beyond recommended durations. While these studies highlight the global concern over antibiotic misuse in surgery, there is limited literature focusing on Indonesian hospital settings, particularly tertiary academic hospitals like the University of Indonesia Hospital (Zhou et al., 2016).

This study aimed to determine the pattern of prescribing prophylactic antibiotics in patients undergoing surgical procedures at the University of Indonesia Hospital. The benefits of this research are twofold: first, it will provide evidence-based recommendations for improving prophylactic antibiotic use in surgical settings; second, it will contribute to efforts to reduce the risk of antimicrobial resistance and surgical site infections through more rational antibiotic use in perioperative care.

RESEARCH METHODS

This study employs a descriptive observational research design with a cross-sectional method based on prospective hospital data collection. The study was conducted at the University of Indonesia Hospital and involved 213 patients who underwent surgical procedures in the surgical department during September 2024. Ethical approval was obtained from the University of Indonesia Hospital's Ethics Committee before data collection. The population in this study includes all patients undergoing surgical interventions during the study period, while the sample comprises those meeting the inclusion criteria: aged 18 years and above, and undergoing surgery at the hospital. Exclusion criteria include patients receiving implant procedures with therapeutic antibiotics and those who died within 24 hours post-surgery. The sampling technique used was total sampling, as all eligible patients were included in the study during the defined period.

The research instrument consisted of a structured observation sheet to record patient demographics (age, gender, diabetes history), diagnosis, type of surgery, type and details of antibiotics used (name, route, dosage, duration), and preoperative hospitalization length. The instrument was developed based on clinical practice guidelines and previously validated hospital forms. The instrument's validity was ensured through expert judgment involving surgeons and pharmacologists, while reliability was tested through inter-rater agreement in a pilot data collection with a subset of 20 patients, yielding a kappa coefficient > 0.80, indicating high reliability.

Data collection was conducted prospectively by trained clinical researchers who monitored surgical wards and retrieved data from patient medical records and direct observations. The data collection procedure followed a standardized protocol, ensuring consistency across all units. Data entry and processing were performed using Microsoft Excel and IBM SPSS Statistics version 26.0. The data analysis technique included descriptive statistics to determine frequencies and percentages of antibiotic prescribing patterns, cross-tabulations to observe trends across patient subgroups, and chi-square tests to assess associations between patient characteristics and antibiotic use patterns. Statistical significance was determined at a confidence level of 95% ($p < 0.05$).

RESULT AND DISCUSSION

The study of the pattern of prophylactic antibiotic prescription in surgical patients in September 2024 obtained 213 subjects who underwent surgical procedures according to the inclusion and exclusion criteria. The characteristics of patients in the study are shown in Table 1. The patient characteristics are age, gender, pre-operative hospitalization duration, and smoking status.

Table 1. Characteristics of Patients Undergoing Surgical Procedures (N=213)

Characteristics	Patients	Percentage
Age		
≥65 years	33	15.49%
18 - 65 years	180	84.51%
Gender		
Man	66	30.99%
Woman	147	69.01%
Obesity		
BMI ≤25	97	45.54%
BMI >25	116	54.46%

Characteristics	Patients	Percentage
History of Diabetes Mellitus		
Yes	30	14.08%
No	183	85.92%
Smoking status		
Smoking	19	8.92%
No Smoking	194	91.08%
Wound Classification		
Clean	108	50.70%
Clean Contaminated	96	45.07%
Contaminated	7	3.29%
Dirty	3	1.41%
ASA Index		
1	44	20.66%
2 - 5	169	79.34%
Duration of Pre-operative Hospitalization		
>24 hours	102	47.89%
≤24 hours	111	52.11%
Operative Duration		
>1 hour	95	44.60%
≤1 hour	118	55.40%

In characteristics based on age, there are two main categories of patients, namely ≥65 years and <65 years, with a percentage of 15.49% for patients aged ≥65 years and 84.51% for patients aged <65 years. Patients aged ≥65 years are associated with physiological changes in the dermis and the skin's basal membrane, which are getting thinner. These physiological changes are related to slow wound-healing processes (Reddy, 2008).

The characteristics of gender in the study obtained a percentage of 30.99% for male patients and 69.01% for female patients. Men have a higher risk of experiencing SSI, especially in orthopedic and trauma procedures, with more severe complications. Research shows that men are more often colonized by Staphylococcus aureus, the primary pathogen causing SSI. Factors such as comorbidities, fat distribution, and the type of surgical procedure also affect the risk of infection (Aghdassi et al., 2019).

In this study, 85.92% of obese patients with BMI criteria >25 were obese, compared to 45.54% of non-obese patients. The researchers found that the risk of SSI in obese patients was almost twice that of SSI in non-obese patients (Yuan & Chen, 2013). Obese patients may be at higher risk of SSI due to the depth of adipose tissue and decreased blood flow in adipose tissue (Korol E., 2013).

Patients with a history of diabetes mellitus in this study were relatively few, namely 14.08%, compared to patients without a history of diabetes mellitus, 85.92%. Patients diagnosed with diabetes were twice as likely to experience SSI compared to patients without a diagnosis of diabetes. Diabetic patients have a high incidence of small vessel disease, which causes impaired delivery of oxygen and nutrients to peripheral tissues. Hypoxemia and lack of nutritional support can reduce the systemic ability to prevent infection (Zhang et al., 2015).

The following patient characteristic is smoking status, with the results obtained as 8.92% of patients have a history of smoking, and 91.08% of patients do not have a history of smoking. Postoperative wound healing complications are more common in smokers and former smokers compared to those who have never smoked. The many compounds in tobacco smoke interfere with wound healing and increase the risk of SSI (Fan Chiang et al., 2023).

The risk of SSI is also influenced by wound classification; based on the CDC wound classification system, the likelihood and level of bacterial contamination during surgical procedures are divided into four separate classes, namely clean wounds (50.70%), clean-contaminated wounds (45.07%), contaminated wounds (3.29%), and dirty wounds (1.41%). In clean wounds, the SSI rate is relatively lower, namely <2%, compared to other wound classifications. While in clean-contaminated wounds, the SSI rate is 4-10%, in contaminated wounds, it is> 20%, and in dirty wounds, it is> 40% (Pear, 2007).

Preoperative ASA score influences the incidence of SSI. ASA score evaluates the individual's basal status, including patient comorbidities, which is also a good predictor of SSI. In this study, patients with an ASA score of 1 were 20.66%, while patients with an ASA score of 2-5 were 79.34%. The SSI rate was significantly higher in patients with ASA 2-5 compared to ASA 1 (Cheng et al., 2007).

The following patient characteristics are related to the length of hospitalization, especially pre-operatively, with the percentage of results obtained, namely 47.89% of patients who underwent preoperative hospitalization >24 hours and 52.11% ≤24 hours. In the preoperative period, a preoperative stay of less than 24 hours is recommended as a process for preventing SSI. A preoperative stay of more than 24 hours is associated with an increased incidence of patient contamination during hospitalization and facilitates the development of the infection process (de Carvalho et al., 2017).

The duration of surgery can also affect SSI; in this study, patients who had a duration of surgery >1 hour were 44.60% compared to those with a duration of surgery ≤1 hour, 55.40%. Each increase in the duration of surgery can increase the likelihood of SSI by 34% per hour (de Carvalho et al., 2017).

Table 2. Types of Surgical Procedures (N=213)

Characteristics	Patients	Percentage
Cardiovascular Thoracic	11	5.16%
Vascular and Endovascular	18	8.45%
Digestive	23	10.80%
Urology	16	7.51%
Obstetrics - Gynecology	59	27.70%
ENT - Head and neck	25	11.74%
Neurosurgery	3	1.41%
Oncology Surgery	18	8.45%
Orthopedic	34	15.96%
General surgery	4	1.88%
Plastic surgery	2	0.94%

The characteristics of the surgical procedures in this study are listed in Table 2, which shows 11 types of surgical procedures. The most common surgical procedures were obstetric-gynecological surgery (27.70%), orthopedics (15.96%), head and Neck (11.74%), and digestive (10.80%). The type of surgical procedure will affect the selection of prophylactic antibiotics used for patients by the Regulation of the Minister of Health of the Republic of Indonesia in 2021 and the Guidelines for the Use of Antibiotics at the University of Indonesia Hospital.

Table 3. Use of Preoperative Prophylactic Antibiotics (N=213)

Characteristics	Patients	Percentage
Using prophylactic antibiotics	193	90.61%
Not using prophylactic antibiotics	20	9.39%

In the study, there were characteristics of the use of prophylactic antibiotics. According to Table 3, 90.61% of patients used prophylactic antibiotics, while 9.39% of patients did not use prophylactic antibiotics. The need for antibiotics can be carried out according to the guidelines of the Indonesian Minister of Health, Permenkes RI (2021). Prophylactic antibiotics are indicated in clean and clean-contaminated surgical procedures. Prophylaxis is given by targeting the most likely pathogens according to considerations of the type of surgery and local epidemiology (Saini et al., 2014).

Table 4. Types of Prophylactic Antibiotics (N=193)

Characteristics	Dose	Patients	Percentage
Cefazolin	1 g	20	10.36%
	2 g	147	76.12%
Ceftriaxone	2 g	4	2.07%
Ceftriaxone + Metronidazole	2 g + 500 mg	2	1.04%
Cefoperazone-Sulbactam	2 g	17	8.81%
Ampicillin – Sulbactam	1,5 g	1	0.52%
	2 g	2	1.04%

Cefazolin dominated the type of prophylactic antibiotics in this study, with 167 patients (86.48%), 193 of whom were using prophylactic antibiotics. Cefazolin was divided into two doses according to the doctor's prescription: Cefazolin 1 g for 20 patients (10.36%) and Cefazolin 2 g for 147 patients (76.12%). The dose of Cefazolin 1 g can be said to be inconsistent with the guidelines for the use of prophylactic antibiotics according to Bratzler et al (2014), who recommend that the dose of Cefazolin should be 2 g or 3 g (specifically for patients weighing ≥120 kg). However, the dose of Cefazolin 1 g is appropriate according to the guidelines for the use of antibiotics at the University of Indonesia Hospital. The next type of prophylactic antibiotic is Ceftriaxone 2 g for four patients (2.07%) and a combination of Ceftriaxone 2 g + Metronidazole 500 mg specifically for the type of colorectal surgical procedure, with a total of 2 patients (1.04%). In addition, there are Cefoperazone-sulbactam antibiotics 2 g with a total of 17 patients (8.81%), and also Ampicillin-sulbactam with a dose variation of 1.5 g for one patient (0.52%) and a dose of 2 g with a total of 2 patients (1.04%). This study used a combination of cefoperazone-sulbactam antibiotics; this combination therapy is only recommended for procedures with heavy contamination or when anaerobic bacterial coverage is needed (Khan Z., 2019).

The selection of an appropriate antibiotic agent for a particular patient should take into account the characteristics of the ideal antibiotic agent, the comparative efficacy of antibiotic agents for a specific surgical procedure, the patient's safety profile and drug allergies, cost, ease of administration, pharmacokinetic profile, bacteriocidal activity, and resistance patterns in the hospital. The prophylactic antibiotic chosen should be effective against the pathogens most likely to contaminate the surgical site, typically the skin flora. In addition, prophylactic antibiotics should be given in the appropriate dose and at a time that achieves the highest tissue concentration at the skin incision (Nasep, 2022). Standard single-dose antibiotic therapy is usually sufficient for prophylaxis in most surgical procedures. Repeated doses may be necessary if the surgery lasts more than 3 hours or if there is more than 1500 mL of bleeding (Linda, 2022).

Table 5. Timing of Prophylactic Antibiotic Administration (N=193)

Characteristics	Patients	Percentage
<30 minutes pre-incision	2	1.01%
30-60 minutes pre-incision	189	97.93%
>60 minutes pre-incision	2	1.01%

In this study, the time of administration of prophylactic antibiotics can be identified with three categories, namely <30 minutes, 30-60 minutes, and >60 minutes pre-incision. In this study, four patients were not right at the time of use of prophylactic antibiotics. As many as two patients (1.01%) were given prophylactic antibiotics <30 minutes and >60 minutes pre-incision. Meanwhile, most patients were suitable for prophylactic antibiotics, namely 189 (97.93%), within 30-60 minutes pre-incision. The route of use of prophylactic antibiotics was also recorded with intravenous administration from a total of 193 patients (100%) who used prophylactic antibiotics.

Proper administration of prophylactic antibiotics is necessary to obtain adequate tissue concentrations at the time of infection risk. Intravenous prophylactic antibiotics are given within 30-60 minutes before incision or surgical procedure to ensure the proper antibiotic levels in the target tissue of surgery (Linda, 2022). Antimicrobials must achieve serum and tissue concentrations that exceed the MIC of potential pathogens at the time of incision to prevent SSI. Administration, 16-60 minutes before incision, provides the lowest risk of SSI. Conversely, the risk of infection increases if administration is done >60 minutes before or too close (<15 minutes) to the time of incision (Bratzler et al., 2014).

Table 6. Surgical Site Infection (SSI) Incident (N=213)

Characteristics	Patients	Percentage
SSI	9	4.23%
No SSI	204	95.77%

Surgical Site Infection (SSI) is an infection seen within 30 days after a surgical procedure, most often between the 5th and 10th day after surgery (Mezemir et al., 2020; Nice, 2008). The study found 9 patients (4.23%) had SSI from 213 patients who underwent surgical procedures. SSI can affect around 0.5 - 3% of patients undergoing surgical procedures and is associated with a longer length of hospitalization compared to patients without SSI (Seidelman et al., 2023).

CONCLUSION

This study revealed the pattern of prophylactic antibiotic prescription in surgical procedures at the University of Indonesia Hospital. Of the total 213 patients who were the subjects of the study, 193 patients (90.61%) were prescribed prophylactic antibiotics. The findings showed that Cefazolin 2 grams was the most commonly prescribed antibiotic (76.12%) by the guidelines. The administration time was 30-60 minutes pre-incision, with 97.93% of cases complying with the recommended time for optimal efficacy. The route of prophylaxis administration via IV was by the guidelines in 100% of cases.

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