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EVALUATION OF PROPHYLACTIC ANTIBIOTIC USE IN SURGICAL PATIENTS USING THE GYSSENS METHOD AT A PRIVATE HOSPITAL IN YOGYAKARTA

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ABSTRACT
Prophylactic antibiotics are used before, during, and up to 24 hours after surgery, and can be administered to patients 30-60 minutes before surgery, must adhere to the principle of "Right Antibiotics". This study aims to assess the application of prophylactic antibiotics in surgical patients in a private hospital in Yogyakarta to promote rational antibiotic use. This study is quantitative and non-experimental. Data were collected prospectively over a period of 30 days from August 4 to September 4, 2024. The study sample consisted of all surgical patients who received prophylactic antibiotics. Prophylactic antibiotic data were analyzed using the Gyssens method. Out of the data collected, 110 patients received preventive antibiotics, and 97 of these patients met the inclusion criteria. Patient characteristics predominantly included a 46% incidence of cesarean sections. Prophylaxis employed three antibiotics, *viz.* ceftriaxone in 78 patients (79.38%), cefazolin in 19 patients (19.59%), and cefotaxime in 1 patient (1.03%). The assessment utilizing the Gyssens approach revealed that 31 patients were classified into category V (no indication), 49 patients into category IVA (more effective antibiotics available), and one patient into category I (not suitable during prophylaxis). Sixteen patients in category 0 were included in the reasonable antibiotic regimen. This study states that most antibiotics are not in accordance with the Guidelines for Antibiotic Use established by the Ministry of Health of the Republic of Indonesia in 2021.

Keywords: Patient with surgery; Prophylaxis antibiotic; Gyssens Method.

1. INTRODUCTION

Prophylactic antibiotics are used prior to, during, and within 24 hours following the surgery. These antibiotics are not solely prescribed based on infection indicators; their purpose is to prevent infection in the surgical site after the operation (Kemenkes RI, 2021). The selection of these antibiotics must adhere to the principle of "Right Antibiotics," which encompasses the appropriate indication, the correct medication, the accurate dosage, the proper administration route, and the time of delivery (Ierano et al., 2017).

The World Health Organization (WHO) received a report from the European Center for Disease Prevention and Control (ECDC) detailing a 9.5% increase in Hospital Acquired Infections (HAIs) associated with 100 surgical procedures in colon surgeries, followed by a 3.5% increase in graft surgeries, 2.9% in cesarean sections, 1.4% in cholecystectomies, 1% in hip surgeries, 0.8% in laminectomies, and 0.75% in knee prostheses (WHO, 2018). The Infection Control Committee (ICC) of Haji Surabaya General Hospital documented surgical site infections in the operating room in 2016, with rates of 6.66% for gross surgeries, 1.61% for clean contaminated surgeries, and 0.10% for clean surgeries (Agustina & Syahrul, 2017).

The use of antibiotics in hospitals for surgical prophylaxis varies between 30% and 50%. Surgical prophylaxis aims to avert clinical signs of infection by administering prophylactic antibiotics prior to the onset of infection signs and symptoms (Bratzler et al., 2013). The guideline specifies that the selection of surgical prophylactic antibiotics includes the first-generation systemic cephalosporin, specifically cefazolin administered at a dosage of 2 grams (children's dosage: 30 mg/kg body weight). Cefazolin has demonstrated efficacy in inhibiting germ colonization in incision site (Crader & Varacallo, 2023).The notion of prophylactic antibiotic administration entails selecting the suitable type based on the antibiotic concentration in the body, both before and during surgery (Kemenkes RI, 2021).

The Gyssens method can be employed for assessing antibiotic usage. It utilizes an algorithm that categorizes antibiotics into six distinct groups. The objective of assessing antibiotic usage is to determine the volume of antibiotic consumption, evaluate the quality of antibiotic application, provide a basis for the development of systematic and standardized monitoring of antibiotic use, and serve as an indicator of hospital service quality (Sihite et al., 2021). A study assessing the application of prophylactic antibiotics in gynecological surgeries revealed that 55.5% of antibiotic administration in the research sample conformed to the prescribed guidelines. Consequently, there is limited compliance with the institution's clinical practice guidelines (Arteaga-Livias et al., 2023).

Numerous studies have shown the use of antibiotics in patients undergoing surgical procedures is often inappropriate. A retrospective study conducted by Megawati et al. (2015) at a private hospital in Semarang reported that the results of the analysis using the Gyssens method revealed a 0% rate of rational antibiotic administration among surgical patients (Megawati et al., 2015). Meanwhile, a study conducted at a private hospital in Bandung reported an evaluation of antibiotic usage, revealing an indication inaccuracy of 0.39%, excessive dose of 2.26%, insufficient dose of 0.50%, a pre-operative antibiotic administration timing inaccuracy of 22.34%, and drug interactions of 1.78% (Zazuli et al., 2015).

A private hospital in Yogyakarta, with an average of 150 surgical patients each month, lacks an analysis of antibiotic consumption. The researcher deemed it necessary to investigate the use of prophylactic antibiotics to promote collaboration with physicians in improving the quality of rational antibiotic use. This study aims to evaluate the use of prophylactic antibiotics in accordance with the 2021 Indonesian Ministry of Health Guidelines on Antibiotic Use. This evaluation is important to determine the extent of compliance with national guidelines.

2. METHODS

This was a quantitative, non-experimental study with a prospective design. The population was all patients receiving prophylactic antibiotics prior to surgery throughout a 30-day timeframe from August 4 to September 4, 2024. This study obtained ethical approval No. Skep/330/KEP/VI/2024 issued by the Kartika Eka Paksi Foundation at Universitas Jenderal Achmad Yani, Yogyakarta.

2.1. Tools and Materials

This study used initial questionnaires related to patient data information and Gyssens diagrams. Gyssen is one of the World Health Organization and Indonesian Ministry of Health's recommended methods for evaluating antibiotics, which comprehensively assesses the quality of antibiotic use. It incorporated medical record data and prescription information from physicians.

2.2. Research sample

The sample was patients who underwent surgical procedures and met the inclusion and exclusion criteria. The inclusion criteria comprised in patients who received surgical procedures and utilized antibiotic prophylaxis. Exclusion criteria comprised pediatric patients under 18 years of age, those with a history of antibiotic allergy, and deceased patients.

2.3. Data Analysis

Patient data characteristics were conveyed through presentations and narratives. The assessment of prophylactic antibiotics was performed using the Gyssens method, in accordance with the 2021 Antibiotic Use Guidelines issued by the Ministry of Health. The Gyssens evaluation process began with an examination of the comprehensiveness of medical record data (patient information, treatment history, insurance details, to name a few), categorized under category VI. Upon meeting the prerequisites, it advanced to the subsequent phase regarding the suitability of indications for antibiotic use, categorized under category V. In category IV, the evaluation continued concerning the availability of alternative antibiotics that are more effective (IVa), those with lower toxicity (IVb), more cost-effective medicines (IVc), and those with a narrower spectrum of activity (IVd). In the absence of essential conditions, the category III assessment continued, particularly involving the application of extremely prolonged (IIIa) or excessively brief (IIIb) periods. If neither is included, the category II evaluation was proceeded for the appropriate dosage (IIa), the correct interval (IIb), and the suitable method (IIc). Subsequently, it proceeded to category I, particularly involving the optimal timing of delivery (prophylaxis). If factors I-VI are unmet, the administration of antibiotics is classified as prudent use, specifically category 0.

3. RESULTS AND DISCUSSION

Prophylactic antibiotics are given to patients deemed at risk of infection. The primary objective of prophylactic antibiotics in surgical patients is to reduce the occurrence of surgical site infections (WHO, 2018). The use of prophylactic antibiotics must adhere to the principle of “appropriate” use of antibiotics, i.e., for the appropriate patient in the right time, the right dose, and the right duration (Ierano et al., 2017).

This study involved 110 patients who received prophylactic antibiotics. Among these patients, 97 met the inclusion criteria, while 13 were excluded due to antibiotic allergies and being under 18 years of age. This study aims to evaluate the rationale of antibiotic administration through the Gyssens method. The subsequent section will present the analyses.

3.1. Characteristics of Patients

Patient characteristics in this study are described in Table 1 depicts the gender variable showing a significant difference, with female patient are dominant. This is because the most

common diagnosis is caesarian section. Which is related to the highest surgical criteria are clean contaminated surgery.

The majority of surgical patients included to the category of contaminated clean surgery, where the guidelines state that contaminated clean surgery is recommended for prophylactic antibiotics (CDC et al., 2024). Surgeries classified as clean-contaminated include those involving the respiratory tract, gastrointestinal tract, urinary tract, and reproductive organs except the ovaries (Berriós-Torres et al., 2017). An evaluation of the use of prophylactic antibiotics in patients undergoing clean and clean-contaminated surgery conducted by Erdani et al. at Dr. Zainoel Abidin General Hospital indicated that 76.5% of prophylactic antibiotic administration was deemed rational using the Gyssens method (Erdani et al., 2021).

Table 1. Characteristics of Surgical Patients in a Private Hospital in Yogyakarta

No	Variable	Number (n=97)	Percentage (100%)
1	**Age**		
	Adult (18-44 years)	79	81,44
	Pre-Elderly (45-59 years)	14	14,43
	Elderly (>60 years)	4	4,12
2	**Gender**		
	Female	87	89,69
	Male	10	10,31
3	**Body Mass Index**		
	Underweight (<18.5)	4	4,12
	Normal (18.5 - 25)	28	28,87
	Overweight (25-30)	39	40,21
	Obese (>30)	26	26,80
4	**Classification of Surgery**		
	Clean	38	39,18
	Clean Contaminated	57	58,76
	Contaminated	1	1,03
	Dirty	1	1,03
5	**Surgery Diagnosis**		
	Cesarean Section	45	46,39
	Excision	15	15,46
	Curettage	12	12,37
	Others	25	25,77

3.2. Prophylactic antibiotics

The pattern of prophylactic antibiotic use in the sample is illustrated in Table 2. The data indicated that among 97 patients who underwent surgical operations in this type D private hospital, three types of prophylactic antibiotics were administered: ceftriaxone, cefazolin, and cefotaxime.

The three antibiotics belong to the cephalosporin class but represent different generations. Cefazolin is the first-generation cephalosporin effective against gram-positive bacteria and becomes the preferred antibiotic for prophylaxis. Ceftriaxone and cefotaxime belong to the third category of cephalosporins, exhibiting efficacy against gram-negative bacteria, and are frequently used in patients exhibiting resistance to first and second generation cephalosporins (Bui et al., 2024).

Table 2. Overview of Prophylactic Antibiotics Used in Surgical Procedures

No	Antibiotic Name	Number (n=97)	Percentage (100%)
1	Ceftriaxone 1 gram	77	79,38%
2	Cefazolin 2 gram	19	19,59%
3	Cefotaxime 1 gram	1	1,03%

Cephalosporins were the most widely used antibiotics for prophylactic purposes. They possess an excellent safety profile and antimicrobial efficacy against several infections in the surgical area. A single dose of antibiotics can effectively reduce the incidence of postoperative infections. A meta-analysis study comparing the administration of cefazolin, cefuroxime, ceftriaxone, and cefamandole in preventing postoperative infections indicated that cefazolin is more effective than others (Ahmed et al., 2022).

The time administration of prophylactic antibiotics illustrated in Table 3. There were 12 patients who given antibiotic prophylactic >60 minutes due to several things such as CITO surgery or a delayed surgery schedule because the hospital only had one operating room. The Standford Health Care recommends that prophylactic antibiotics be administered 30-60 minutes before surgery (SHC, 2017). Prophylactic antibiotics need only be administered once before surgery. Prophylactic antibiotics may be administered repeatedly if the surgery lasts more than 24 hours and there is bleeding of more than 1.5 L during surgery. This is because most prophylactic antibiotics have a short half-life (1–2 hours). However, prophylactic antibiotics cannot be recommended for administration more than 24 hours prior to surgery (Sartelli et al., 2021). In a meta-analysis study, the administration of prophylactic antibiotics was evaluated, and data were collected at different time points. The antibiotic guidelines state that the half-life of cefazolin is 1.2-2.2 hours (Kemenkes RI, 2021).

Table 3. Time Administration of Prophylactic Antibotics Use in Surgical Procedures

No	Time adimistration	Number (n=97)	Precentage (100%)
1	>60 minutes	12	12,37%
2	< 60 minutes	85	87,63%

3.3. Evaluation of Antibiotics Using the Gyssens Method

This study evaluated antibiotic rationale using the 2021 Antibiotic Use Guidelines issued by the Indonesian Ministry of Health. The evaluation results of antibiotic use through the Gyssens method, as presented in Table 4. Figure 1 illustrates the flow of evaluating antibiotic use based on data obtained from the Gyssens method (Gyssens, 2006). Figure 1 indicates that there is no use of antibiotics in category VI due to the complete information of the patients' medical record. Researchers have verified patient information, including medical record number, age, gender, and payment type.

In category V, 31 patients received antibiotics without any indication. This relates to the group of patients classified under surgical procedures, namely clean surgery, wherein the

guidelines suggest that antibiotics are administered just in clean surgeries involving the body cavity. Examples of clean surgical diagnoses that do not require antibiotics include fibroadenoma mammae, struma, soft tissue tumors, circumcision, excision of small benign skin tumors, incision and drainage of abscesses, wound suturing, and nail extraction (Kemenkes RI, 2021). International guidelines state that prophylactic antibiotics unnecessary for clean procedures unrelated to prosthetics (SHC, 2017). Prophylactic antibiotics are recommended for surgical procedures with a high frequency of surgical site infection (e.g., colorectal surgeries) and where the consequences of infection are significant (e.g., implant and heart valve placement) (Berriós-Torres et al., 2017).

The American College of Obstetricians and Gynecologist (ACOG) identifies several indications of gynecological surgery that do not require prophylactic antibiotics, including laparoscopy, laparotomy, IUD insertion, and endometrial biopsy (Arteaga-Livias et al., 2023). In abortion curettage surgery with induction, the Antibiotic Use Guidelines recommend prophylactic antibiotics, namely cefazolin 2 grams administered 30-60 minutes prior to surgery; however, antibiotics are not advised for spontaneous abortion curettage (Kemenkes RI, 2021). This study involved four patients who had curettage with induction, all of whom received prophylactic antibiotics, specifically ceftriaxone 1 gram prior to surgery.

Chong et al. reported that among 471 patients undergoing laparoscopic surgery, 279 received prophylactic antibiotic therapy with 1 gram of ceftriaxone, while 192 did not receive prophylactic antibiotics; there was no significant difference in the incidence of postoperative infections between the two groups. Hence, this study concluded that antibiotic therapy in laparoscopic patients is unnecessary; nevertheless, prophylactic antibiotics should still be considered for patients with poor nutritional condition (Chong et al., 2015). Charernensuk's retrospective study of clean surgical patients (excision, thyroidectomy, hernia repair, and breast surgery) indicated that 233 patients received prophylactic antibiotics, while 184 patients did not, resulting in a surgical infection incidence ratio of 1.3%. 2.2%: 2,2%. The provision of prophylactic antibiotics, therefore, does not significantly differ in preventing postoperative infections compared to the absence of prophylactic antibiotics in patients with clean wound types (Charernsuk et al., 2024).

Table 4. Evaluation Results of Prophylactic Antibiotics Using the Gyssens Method

No	Category	Number (n=97)	Percentage (100%)
1	0= Rational use	16	16,49%
2	I= Not appropriate during prophylaxis	1	1,03%
3	IVA= There is something more effective	49	50,52%
4	V= No Indication	31	31,96%

Category IV is intended for the assessment of antibiotic selection, specifically on the efficacy of antibiotics (IVa), safety and reduced toxicity (IVb), cost-effectiveness (IVc), and narrower spectrum (IVd). This study involved 49 patients (50.52%) classified in the IVa category. Among the 49 patients, one received 1 gram of cefotaxime, while the remaining 48 received 1 gram of ceftriaxone. The guidelines specify that the two antibiotic therapies are recommended as empirical treatments for infections caused by gram-negative bacteria, rather than for prophylactic use (Lofholm & Katzung, 2024).

Numerous guidelines suggest that first-generation cephalosporin antibiotics, such as cefazolin, which target narrow-spectrum bacteria, are typically advised for most surgical procedures (Sartelli et al., 2023). Cefazolin is the predominant antibiotic utilized for surgical prophylaxis in patients without a history of beta-lactam allergy or MRSA (Methicillin-Resistant Staphylococcus aureus) (Crader & Varacallo, 2023). Cefazolin, a first-generation cephalosporin antibiotic, is considered the most effective against methicillin-sensitive Staphylococcus,

exhibiting reduced efficacy against gram-negative bacteria relative to higher-generation cephalosporins (Surat et al., 2022).

This study identified 48 patients receiving 1 gram of ceftriaxone as prophylactic antibiotics. Ceftriaxone is classified as a broad-spectrum therapeutic antibiotic. The use of ceftriaxone as a prophylactic antibiotic complicates the selection of therapeutic drugs in the case of a postoperative infection. Consequently, physicians exhibit increased selectivity in selecting antibiotics for prophylactic purposes (Sumiwi, 2014). Zunnita's study in 2018 reported that among 355 surgical cases, 7 patients (1.97%) had infections at the surgical site. The Fisher exact analysis revealed a substantial correlation between the type of surgery, the antibiotic administered, and the timing of administration with the occurrence of surgical site infections, with a p value < 0.05. This study found ceftriaxone injection, a third-generation cephalosporin, as the most often utilized antibiotic (Zunnita et al., 2019).

Several studies have shown that ceftriaxone can prevent post-surgical infections, although the use of broad-spectrum antibiotics for prophylaxis raises concerns about antimicrobial resistance. A meta-analysis found that prophylactic antibiotics do reduce the incidence of surgical site infections (SSIs), but also increase the proportion of infections caused by resistant bacteria, including those resistant to ceftriaxone. This confirmed a "trade-off" effect: a decrease in initial infections but an increase in selection pressure that promotes resistance (Rink et al., 2025). Other reviews (Sefah et al., 2024) emphasize that antimicrobial stewardship interventions (e.g., guideline use, antibiotic spectrum restrictions, and audits) can reduce noncompliance with prophylaxis protocols. When ceftriaxone is replaced by narrow-spectrum antibiotics (e.g., cefazolin), resistance trends decline. A comparative study on the safety of prophylactic antibiotic use showed that cefazolin was superior to ceftriaxone, with an incidence of 9.8% versus 29.3% (RR= 0.33; p=0.003; 95% CI: 0.076-0.895) (Rahayu et al., 2021).

The subsequent review indicated that 17 patients were excluded from categories IV b, IV c, or IV d, with all antibiotic treatment comprising exclusively cefazolin. The selection of the first-generation prophylactic antibiotic, cefazolin injection 1 gram, is deemed safer, more cost-effective, and has a narrow spectrum of antibacterial activity (Ahmed et al., 2022). This study did not conduct bacterial cultures to determine antibiotic selection.

Category III assessments were analyzed according to the length of antibiotic administration, particularly if it is excessively prolonged (IIIa) or unduly rapid (IIIb). Seventeen data points were excluded from this category as prophylactic antibiotics were administered solely once, namely 30-60 minutes prior to surgery and/or within a maximum of 24 hours after surgery. Prophylactic antibiotics are not advised for repeated use, save in particular situations such as specific cardiac and vascular procedures and lower limb amputations. Administering prophylactic antibiotics for more than 24 hours provides no therapeutic benefit (Ierano et al., 2017). The regulation of prophylactic antibiotic treatment seeks to ensure distribution to the target tissue at an effective dosage at the moment of incision (Bratzler et al., 2013).

Prophylactic antibiotics may be frequently administered if the surgery exceeds 24 hours and there is a hemorrhage over 1.5 liters during the procedure. This is due to the brief half-life of most prophylactic antibiotics, which spans from 1 to 2 hours. The administration of prophylactic antibiotics for periods longer than 24 hours is not advisable (Sartelli et al., 2021). A meta-analysis was performed to assess prophylactic antibiotic dose, using data collected at various time points from 14 trials with 54,552 individuals who met the inclusion criteria. The study's findings revealed no significant difference in the administration of prophylactic antibiotics when given 60-120 minutes compared to 0-60 minutes prior to the incision. Nonetheless, the pharmacokinetic properties of the given antibiotics must still be taken into account (De Jonge et al., 2017).

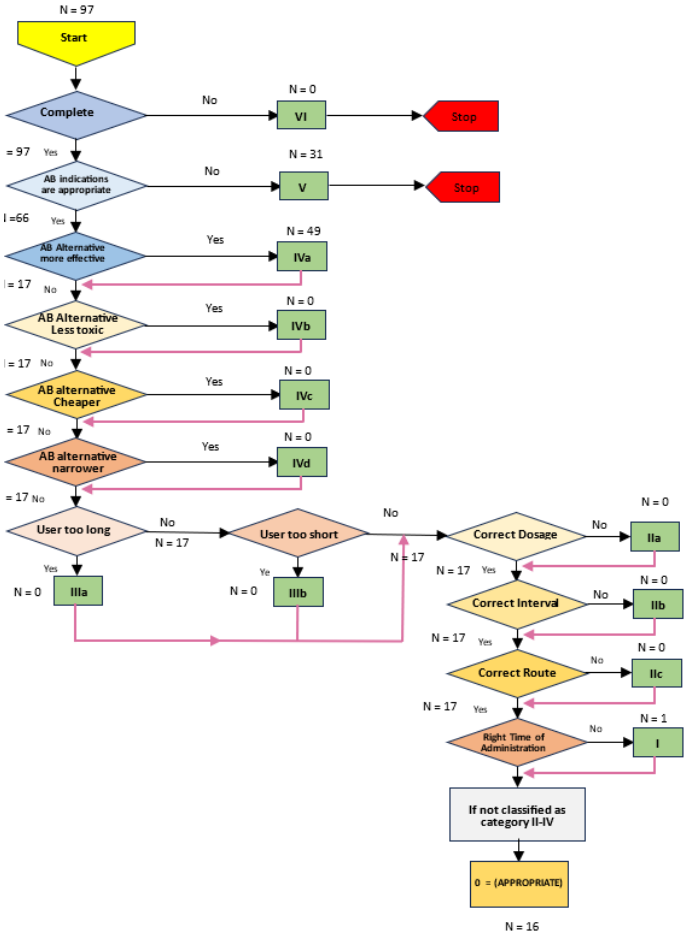


Figure 1. Flowchart for Assessing Antibiotic Use with the Gyssens Method

In category II, the Gyssens method evaluation was divided into three subcategories: incorrect dosage (IIa), unsuitable administration interval (IIb), and inappropriate route of administration (IIc). Among the 17 patients assessed, none were classified in category II, as each patient received merely a single dose of prophylactic antibiotics at 1 gram. The mean patient weight was 71.5 kg, accompanied by a mean BMI of 28.5 kg/m². The guideline suggests administering 3 grams of cefazolin for patients weighing 120 kg or with a BMI more than 50 kg/m² (Coates et al., 2022). The evaluation of category I antibiotics aims to measure the promptness of prophylactic antibiotic administration. The guidelines specify that prophylactic antibiotics should be administered 30-60 minutes prior to the incision (Seidelman et al., 2023). This study involved one patient diagnosed during a cesarean section who received antibiotics for over 60 minutes. The medical records indicated that prophylactic antibiotics were administered at 07:30 WIB, while the incision commenced at 09:00 WIB. This was due to actions classified as CITO, leading to a postponement in operational scheduling.

In the final stage of the Gyssens method review process, 16 patients were classified in category 0, indicating sensible antibiotic usage. Antibiotics that have successfully passed evaluation in categories I to VI are deemed to satisfy the requirements for proper antibiotic use, including correct indications, appropriate medicines, accurate dosages, suitable modes of administration, and appropriate intervals of administration. In these 16 patients, the physician prescribed cefazolin, a first-generation cephalosporin antibiotic, at a dosage of 2 grams, to be given 30-60 minutes before to the incision. This aligns with the 2021 guidelines for antibiotic use set forth by ASHP and WHO. Sixteen individuals received the identical surgical diagnosis of cesarean section. Cefazolin is a narrow-spectrum antibiotic effective against pathogens responsible for surgical site infections, including Staphylococcus aureus, Staphylococcus epidermidis, aerobic Streptococci, and anaerobic Cocci (Bratzler et al., 2013). A study assessing

the pharmacodynamics of single-dose cefazolin vs repeated doses, finding that both dosing regimens achieved comparable peak bacterial eradication. A single administration of prophylactic antibiotics is deemed sufficient when the bacterial load is minimal (Heffernan et al., 2021).

The repeated use of antibiotics may elevate the likelihood of adverse effects. Retrospective cohort research involving 1488 patients administered parenteral or oral antibiotics for 24 hours indicated that 20% (n = 298) experienced one adverse effect, with 20% (n = 56) of those with side effects were attributed to antibiotic regimens deemed clinically unnecessary (Tamma et al., 2017).

As a pharmacist, it is imperative to oversee the administration of medications, particularly antibiotics. Antimicrobial resistance poses a substantial threat to global health and development. The WHO reported that in 2019, approximately 1.27 million of the 4.95 million fatalities were due to antibiotic resistance (WHO, 2023). Increased collaboration beetween of pharmacists, physicians, and other healthcare professionals is essential for improving the prudent application of antibiotics in accordance with established guidelines and reduce the use of broad-spectrum antibiotics, which is an important mitigating factor in the emergence of drug resistance (Pardo et al., 2022). Pharmacist also play another equally important role in monitoring resistance patterns through antibiogram data, thereby providing a scientific basis for decision-making in empirical and prophylactic therapy. Thus, pharmacist function not only in providing drugs but also as controllers of rational antibiotic therapy.

This study has limitation not conducting interviews with patients regarding their experience in getting antibiotics before prophylactic antibiotic for surgery. This situation causes researchers to be less comprehensive in conducting discussions. Suggestions for future research to be able to consider this.

4. CONCLUSION

A study conducted at a Private Hospital in Yogyakarta in August 2024 identified a profile of 97 surgical patients who predominantly received ceftriaxone (79.38%) as prophylactic antibiotics. The evaluation results utilizing the Gyssens approach indicated that only 16,49% (16 patient) in category 0 who received rational antibiotics. Therefore, the collaboration between physicians and pharmacists is crucial for improving the prudent application of antibiotics in accordance with established guidelines.

5. CONFLICT OF INTEREST

Author was no conflict of interest in the manuscript.

6. REFERENCES

Agustina, E., & Syahrul, F. (2017). The Effect of Operating Procedure with Infection Incidence on Contaminated Cleaning Operating Patients (Case Control Study in RSU Haji Surabaya). *Jurnal Berkala Epidemiologi*, *5*(3), 351–360. https://doi.org/10.20473/jbe.v5i3.2017

Ahmed, N. J., Haseeb, A., Alamer, A., Almalki, Z. S., Alahmari, A. K., & Khan, A. H. (2022). Meta-Analysis of Clinical Trials Comparing Cefazolin to Cefuroxime, Ceftriaxone, and Cefamandole for Surgical Site Infection Prevention. *Antibiotics*, *11*(11). https://doi.org/10.3390/antibiotics11111543

Arteaga-Livias, K., Panduro-Correa, V., Maguiña, J. L., Osada, J., Rabaan, A. A., Lijarza-Ushinahua, K., Barboza, J. J., Gomez-Gonzales, W., & Rodriguez-Morales, A. J. (2023). Compliance with Antibiotic Prophylaxis in Obstetric and Gynecological Surgeries in Two Peruvian Hospitals. *Antibiotics*, *12*(5). https://doi.org/10.3390/antibiotics12050808

Berriós-Torres, S. I., Umscheid, C. A., Bratzler, D. W., Leas, B., Stone, E. C., Kelz, R. R., Reinke, C. E., Morgan, S., Solomkin, J. S., Mazuski, J. E., Dellinger, E. P., Itani, K. M. F.,

Berbari, E. F., Segreti, J., Parvizi, J., Blanchard, J., Allen, G., Kluytmans, J. A. J. W., Donlan, R., & Schecter, W. P. (2017). Centers for disease control and prevention guideline for the prevention of surgical site infection, 2017. In *JAMA Surgery* (Vol. 152, Issue 8, pp. 784–791). American Medical Association. https://doi.org/10.1001/jamasurg.2017.0904

Bratzler, D. W., Dellinger, E. P., Olsen, K. M., Perl, T. M., Auwaerter, P. G., Bolon, M. K., Fish, D. N., Napolitano, L. M., Sawyer, R. G., Slain, D., Steinberg, J. P., & Weinstein, R. A. (2013). Clinical practice guidelines for antimicrobial prophylaxis in surgery. *American Journal of Health-System Pharmacy*, *70*(3), 195–283. https://doi.org/10.2146/ajhp120568

Bui, T., Patel, P., & Preuss, C. V. (2024, February 17). *Cephalosporins: STATPEARLS*. National Library of Medicine. https://www.ncbi.nlm.nih.gov/books/NBK551517/

CDC, Ncezid, & DHQP. (2024). *Surgical Site Infection Event (SSI)*. https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/ImportingProcedureData.pdf.

Charernsuk, M., Tunruttanakul, S., Jamjumrat, L., & Chareonsil, B. (2024). Evaluation of preoperative antibiotic prophylaxis in clean-wound general surgery procedures: a propensity score-matched cohort study at a regional hospital. *BMC Surgery*, *24*(1), 294. https://doi.org/10.1186/s12893-024-02616-8

Chong, J. U., Lim, J. H., Kim, J. Y., Kim, S. H., & Kim, K. S. (2015). The role of prophylactic antibiotics on surgical site infection in elective laparoscopic cholecystectomy. *Korean Journal of Hepato-Biliary-Pancreatic Surgery*, *19*(4), 188. https://doi.org/10.14701/kjhbps.2015.19.4.188

Coates, M., Shield, A., Peterson, G. M., & Hussain, Z. (2022). Prophylactic Cefazolin Dosing in Obesity—a Systematic Review. In *Obesity Surgery* (Vol. 32, Issue 9, pp. 3138–3149). Springer. https://doi.org/10.1007/s11695-022-06196-5

Crader, M., & Varacallo, M. (2023, August 4). *Preoperativee Antibiotic Prophylaxis*. StatPearls.

De Jonge, S. W., Gans, S. L., Atema, J. J., Solomkin, J. S., Dellinger, P. E., & Boermeester, M. A. (2017). Timing of preoperative antibiotic prophylaxis in 54,552 patients and the risk of surgical site infection. In *Medicine (United States)* (Vol. 96, Issue 29). Lippincott Williams and Wilkins. https://doi.org/10.1097/MD.0000000000006903

Erdani, F., Novika, R., Ramadhana, I. F., Ksm, B. /, Fakultas, B., Universitas, K., Kuala, S., Rsud, /, Abidin, D. Z., Aceh, B., Farmasi, B., & Abidin, R. D. Z. (2021). Evaluasi Penggunaan Antibiotik Profilaksis terhadap Kejadian Infeksi Luka Operasi pada Operasi Bersih dan Bersih Terkontaminasi di RSUD dr. Zainoel Abidin. *Journal of Medical Science Jurnal Ilmu Medis Rumah Sakit Umum Dr. Zainoel Abidin*, *2*(1), 21–28.

Gyssens, I. (2006). Audits for Monitoring the Quality of Antimicrobial Prescriptions. In *Antibiotic Policies: Theory and Practice* (pp. 197–226). https://doi.org/10.1007/0-387-22852-7_12

Heffernan, A., Alawie, J., Wallis, S. C., Naicker, S., Adiraju, S., Roberts, J. A., & Sime, F. B. (2021). Pharmacodynamic evaluation of a single dose versus a 24-hour course of multiple doses of cefazolin for surgical prophylaxis. *Antibiotics*, *10*(5). https://doi.org/10.3390/antibiotics10050602

Ierano, C., Manski-Nankervis, J. A., James, R., Rajkhowa, A., Peel, T., & Thursky, K. (2017). Surgical antimicrobial prophylaxis. *Australian Prescriber*, *40*(6), 225–229. https://doi.org/10.18773/austprescr.2017.073

Kemenkes RI. (2021). *Peraturan Menteri Kesehatan RI Tentang Pedoman Penggunaan Antibiotik*.

Lofholm, P. W., & Katzung, B. G. (2024). Rational Prescribing & Prescription Writing. In T. W. Vanderah (Ed.), *Katzung's Basic & Clinical Pharmacology, 16th Edition*. McGraw-Hill. accessmedicine.mhmedical.com/content.aspx?aid=1204147446

Megawati, S., Rahmawati, F., & Wahyono, D. (2015). Evaluasi penggunaan antibiotik profilaksis pada pasien bedah. *Jurnal Manajemen dan Pelayanan Farmasi (Journal of Management and Pharmacy Practice)*, *5*(2), 127-134.

Pardo, A., Ntabaza, V., Rivolta, M., Goulard, A., Sténuit, S., Demeester, R., Milas, S., Duez, P., Patris, S., Joris, M., Dony, P., & Cherifi, S. (2022). Impact of collaborative physician-pharmacist stewardship strategies on prophylactic antibiotic practices: a quasi-experimental study. *Antimicrobial Resistance and Infection Control*, *11*(1). https://doi.org/10.1186/s13756-022-01138-3

Rahayu, A., Rahmawati, F., Andayani, T. M., & Siradjuddin, A. (2021). Uji Perbandingan Antibiotik Profilaksis Ceftriaxone versus Cefazolin pada Bedah Obstetri dan Ginekologi. *Jurnal Manajemen Dan Pelayanan Farmasi (Journal of Management and Pharmacy Practice)*, *10*(4). https://doi.org/10.22146/jmpf.59779

Rink, M., Gladstone, B. P., Nikolai, L. A., Bitzer, M., Tacconelli, E., & Göpel, S. (2025). The Impact of Antibiotic Prophylaxis on Antibiotic Resistance, Clinical Outcomes, and Costs in Adult Hemato-Oncological and Surgical Patients: A Systematic Review and Meta-Analysis. *Antibiotics*, *14*(9), 853. https://doi.org/10.3390/antibiotics14090853

Sartelli, M., Boermeester, M. A., Cainzos, M., Coccolini, F., de Jonge, S. W., Rasa, K., Dellinger, E. P., McNamara, D. A., Fry, D. E., Cui, Y., Delibegovic, S., Demetrashvili, Z., De Simone, B., Gkiokas, G., Hardcastle, T. C., Itani, K. M. F., Isik, A., Labricciosa, F. M., Lohsiriwat, V., … Barie, P. S. (2023). Six Long-Standing Questions about Antibiotic Prophylaxis in Surgery. In *Antibiotics* (Vol. 12, Issue 5). MDPI. https://doi.org/10.3390/antibiotics12050908

Sartelli, M., Coccolini, F., Carrieri, A., Labricciosa, F. M., Cicuttin, E., & Catena, F. (2021). The "torment" of surgical antibiotic prophylaxis among surgeons. *Antibiotics*, *10*(11). https://doi.org/10.3390/antibiotics10111357

Sefah, I. A., Chetty, S., Yamoah, P., & Bangalee, V. (2024). The impact of antimicrobial stewardship interventions on appropriate use of surgical antimicrobial prophylaxis in low- and middle-income countries: a systematic review. *Systematic Reviews*, *13*(1). https://doi.org/10.1186/s13643-024-02731-w

Seidelman, J. L., Mantyh, C. R., & Anderson, D. J. (2023). Surgical Site Infection Prevention: A Review. In *JAMA* (Vol. 329, Issue 3, pp. 244–252). American Medical Association. https://doi.org/10.1001/jama.2022.24075

SHC. (2017). *SHC Surgical Antimicrobial Prophylaxis Guidelines*. https://med.stanford.edu/content/dam/sm/bugsanddrugs/documents/clinicalpathways/SHC-Surgical-Prophylaxis-ABX-Guideline.pdf

Sihite, E. N., Ramadhan, A. M., & Samsul, E. (2021). Evaluasi Penggunaan Antibiotik Secara Kuantitatif dan Kualitatif Pada Pasien Bedah Digestif di RSUD Abdul Wahab Sjahranie Samarinda. *Proceeding of Mulawarman Pharmaceuticals Conferences*, *14*, 214–221. https://doi.org/10.25026/mpc.v14i1.552

Sumiwi, S. (2014). Quality of Antibiotics Use in Patients with Digestive Surgery in Hospital in Bandung City. *Indonesian Journal of Clinical Pharmacy*, *3*(4), 135–140. https://doi.org/10.15416/ijcp.2014.3.4.135

Surat, G., Meyer-Sautter, P., Rüsch, J., Braun-Feldweg, J., Markus, C. K., Germer, C. T., & Lock, J. F. (2022). Cefazolin Might Be Adequate for Perioperative Antibiotic Prophylaxis in Intra-Abdominal Infections without Sepsis: A Quality Improvement Study. *Antibiotics*, *11*(4). https://doi.org/10.3390/antibiotics11040501

Tamma, P. D., Avdic, E., Li, D. X., Dzintars, K., & Cosgrove, S. E. (2017). Association of adverse events with antibiotic use in hospitalized patients. *JAMA Internal Medicine*, *177*(9), 1308–1315. https://doi.org/10.1001/jamainternmed.2017.1938

WHO. (2018). *Global guidelines for the prevention of surgical site infection*. World Health Organization.

WHO. (2023). *People-centred approach to addressing antimicrobial resistance in human health- WHO core package of intervensions to support national action plan*. https://www.who.int/publications/i/item/9789240082496

Zazuli, Z., Sukandar, E. Y., & Lisni, I. (2015). Antibiotic Use Evaluation in Surgery Patients at a Private Hospital in Bandung. *Indonesian Journal of Clinical Pharmacy*, *4*(2), 87–97. https://doi.org/10.15416/ijcp.2015.4.2.87

Zunnita, O., Sumarny, R., & Kumalawati, J. (2019). Pengaruh Antibiotik Profilaksis Terhadap Kejadian Infeksi Luka Operasi. *FITOFARMAKA: Jurnal Ilmiah Farmasi*, *8*(1), 39–44. https://doi.org/10.33751/jf.v8i1.1170