

Characteristics of patients associated with antibiotic use among gastrointestinal surgery at the Academic Hospital, Universitas Gadjah Mada

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<https://doi.org/10.22146/inajbcs.v56i01.12181>

ABSTRACT

Submitted: 2023-11-23

Accepted : 2024-02-05

Digestive surgery is a treatment for diseases of the parts of the body involved in digestion, which has a fairly high risk of infection. The study aimed to obtain a description of the types and specific characteristics of patients and the rationality of antibiotic use among digestive surgery patients. This study was conducted using observational analysis. Data on antibiotic use was collected prospectively from medical records of digestive surgery inpatients at the Academic Hospital Universitas Gadjah Mada (UGM) from January to March 2023. The Gyssens method was used to evaluate qualitatively the use of antibiotics. A total of 76 patients met the inclusion and exclusion criteria. No significant difference between the number of male and female patients was identified. The results showed that 24 (31.58%) acute appendicitis patients are the primary diagnosis most often encountered in patients undergoing digestive surgery. The most frequently used prophylactic antibiotics for digestive surgery patients were ceftriaxone (53.85%) and cefazolin (41.03%). Meanwhile, the most frequently used therapeutic antibiotics were ceftriaxone (41.94%) and levofloxacin (29.03%). The Gyssens analysis shows that large irrational use of antibiotics is still observed.

ABSTRAK

Bedah digestif merupakan pengobatan penyakit pada bagian tubuh yang berhubungan dengan pencernaan yang memiliki risiko infeksi cukup tinggi. Penelitian ini bertujuan untuk memperoleh gambaran tentang jenis dan karakteristik spesifik pasien serta rasionalitas penggunaan antibiotik pada pasien bedah digestif. Penelitian ini dilakukan dengan menggunakan analisis observasional. Data penggunaan antibiotik dikumpulkan secara prospektif dari rekam medis pasien rawat inap bedah digestif di Rumah Sakit Akademik Universitas Gadjah Mada (UGM) pada Januari hingga Maret 2023. Metode Gyssens digunakan untuk mengevaluasi penggunaan antibiotik secara kualitatif. Sebanyak 76 pasien memenuhi kriteria inklusi dan eksklusi. Tidak ada perbedaan yang signifikan antara jumlah pasien laki-laki dan perempuan. Hasil penelitian menunjukkan bahwa 24 (31,58%) pasien apendisitis akut merupakan diagnosis utama yang paling sering ditemui pada pasien yang menjalani bedah digestif. Antibiotik profilaksis yang paling banyak digunakan pada pasien bedah digestif adalah seftriakson (53,85%) dan sefazolin (41,03%). Sedangkan antibiotik terapeutik yang paling banyak digunakan adalah seftriakson (41,94%) dan levofloksasin (29,03%). Analisis dengan metode Gyssens menunjukkan masih banyak dijumpai penggunaan antibiotik yang tidak rasional.

Keywords:

digestive surgery;
antibiotic;
gyssens;
drug use;
rationality

INTRODUCTION

Millions of surgical are performed

in the world annually. Sometimes, complications can occur following surgery.¹ combined general surgery

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and trauma, vascular surgery, and cardiothoracic surgery. Main Outcome Measures: Total complication rate (number of complications divided by the number of patients)² Surgical site infection is one of the most common complications of abdominal surgery.³ Surgical site infections are caused by bacteria that enter through incisions made during surgery.⁴ Approximately 0.5 to 3% of patients undergoing surgery will experience infection, associated with length of stay (LoS).⁵ Gillespie *et al.*⁶ reported that 11 out of 100 general surgery patients will likely experience an infection 30 d after surgery.

Surgical care is an essential component of health care. They are threaten the lives of millions of patients each year and contribute to the spread of antibiotic resistance.⁴ Surgical site infection estimates varied among the World Health Organization (WHO) regions.⁷ Surgical site infections are preventable, and various interventions have been proposed over the past years.⁸ Syaiful *et al.*⁹ reported that of 4,893 abdominal operations during the study period, 135 subjects (2.8%) experienced surgical site infection, with 42.2% of cases being the clean contamination type. Even though the surgical site infection at Dr. Cipto Mangunkusumo General Hospital is low, attention is still needed to address this problem.⁹ The incidence of surgical wound infections can be reduced by administering prophylactic antibiotics before surgery.

The antibiotic prophylaxis is a very brief course of antibiotics initiated closely before,¹⁰ during and after the operative procedures to prevent infectious complications or surgical site infections,^{11,12} while it was considered therapeutic when it was prescribed to treat existing disease.¹² However, using prophylactic antibiotics in clinical practice must follow the existing guide. The government has issued the

regulation of the Minister of Health of Republic of Indonesia number 28/2021 concerning General Guidelines for the Purposeful Use of Antibiotics as a reference in optimizing the wise use of antibiotics. Inappropriate use of surgical prophylactic antibiotics has been widely reported.^{10,12-15} If the antibiotics used in surgical patients are inappropriate, there will be a risk of resistance. Therefore, monitoring the use of prophylactic and empiric antibiotics in surgical patients is necessary.

MATERIAL AND METHODS

Study design

An observational analysis method was used in this study. The use of prophylactic antibiotics and patient clinical outcomes were collected prospectively from medical records in the inpatient ward of the Academic Hospital, Universitas Gadjah Mada (UGM), from January to March 2023. The medical record data was also used to collect demographic patients and management of digestive surgery patients. This study's inclusion and exclusion criteria were inpatients undergoing digestive surgery who received antibiotics before surgery and/or during hospitalizations and age ≥ 5 yr. Exclusion criteria included incomplete data such as not recording the operation time, antibiotic use, and timing of antibiotic administration; paralyzed/coma patients, diabetics, immunocompromised patients, and patients undergoing treatment chemotherapy. The sample used in this research was determined using the Slovin formula.¹⁶ It was known that the population of digestive surgery patients at the Academic Hospital, UGM during the last three months was 305. The level of precision set was 10%. The minimum number of samples that meet the criteria was 76.

Data analysis

The types and specific characteristics of patients and the antibiotic use was analyzed descriptively. Analysis of the rationality of antibiotic use was carried out using the flow diagram Gyssens method.¹⁷ The main antibiotic guideline based on the Regulation of the Minister of Health of the Republic of Indonesia number 28/2021 about Guidelines for Use of Antibiotics. The American Society of Health System Pharmacists (ASHP) Therapeutic and some other guidelines were also used to support the evaluation. If the antibiotic administered was not listed in the main guideline, then the search was continued in the Guidelines for Use of Antibiotics. The ASHP or related journals. Antibiotics were called prophylaxis if they were given before, during and after a surgical procedure or a maximum of 24 hr from the first administration. If antibiotics were given from the time the patient first arrives and was treated at the hospital until the patient goes home, then the antibiotic was classified as a therapeutic antibiotic. The quality evaluation of the use of antibiotics was carried out by the researcher together with pharmacist and surgeon. This was intended to reduce subjectivity in the evaluation process. The results are presented descriptively and supported by tables.

Ethics approval

This research has been approved by the Health Research Ethics Committee, Faculty of Medicine, Public Health and Nursing, UGM with ref. no. KE/FK/1584/EC/2022. This research has also received

a permit from the Academic Hospital, UGM with number-1380/UN1/RSA.2/AR/SB/2023.

RESULTS

A total 105 digestive surgery patients' data were taken from medical records. Of the samples taken, 76 patients met the inclusion criteria, and 29 met the exclusion criteria. Patients who did not meet the inclusion criteria were patients aged under five. Meanwhile, 17 patients included in the exclusion criteria due to incomplete data included patients who underwent surgery in the final week of data retrieval. The other eight patients who met other exclusion criteria were patients with comorbid diabetes. TABLE 1 shows an overview of the demographic characteristics of digestive surgery inpatients at the Academic Hospital UGM, January-March 2023. No significant difference between the number of male and female patients was observed. Of the 76 digestive surgery patients, 39 (51.32%) were males, and 37 (48.68%) were females. The study showed that patients aged 19 – 44 yr 34 (44.74%) were the most patients undergoing digestive surgery.

TABLE 2 shows the disease characteristics of inpatients undergoing digestive surgery at the Academic Hospital UGM from January to March 2023, including primary diagnoses and comorbidity. The study shows that 24 (31.58%) patients underwent digestive surgery, with the primary diagnosis being acute appendicitis (K35.9), while the most common comorbidity was hypertension, 8 (22.86%) patients.

TABLE 1. Characteristics of inpatient digestive surgery at the Academic Hospital UGM for the period January-March 2023

Patient characteristics	Number of patients [n (%)]
Gender	
• Male	39
• Female	37
Subtotal	76 (100)
Age	
• >5 – 18 yr	9
• 19 – 44 yr	34
• 45 – 59 yr	15
• >60 yr	18
Subtotal	76 (100)

TABLE 2. Disease characteristics of digestive surgery inpatient at Academic Hospitals UGM period January-March 2023

Disease characteristics	ICD X code	Number of patients [n (%)]
Primary diagnosis		
• Appendicitis acute	K35.9	24 (31.58)
• Cholecystitis	K81.0	11 (14.47)
• Inguinal hernia	K40.90	7 (9.21)
• Ileus obstructive	K56.7	6 (7.89)
• Cholelithiasis	K80	5 (6.58)
• Tumor	C80.1	4 (5.26)
• Chronic appendicitis	K36	3 (3.95)
• Peritonitis ec perforation	K65	3 (3.95)
• Haemorrhoids	K64.9	2 (2.63)
• Prolapse recti	K62.3	2 (2.63)
• Cholelithiasis + cholecystitis	K80.63	1 (1.32)
• Others		8 (10.53)
Subtotal		76 (100)
Comorbidity		
• Hypertension	I10	8 (22.86)
• Hyponatremia	E87	6 (17.14)
• Hypokalaemia	E87.6	4 (11.43)
• Anaemia	D64.9	4 (11.43)
• Diarrhoea	R19.7	3 (8.57)
• AKI	N17	2 (5.71)
• Febris/hyperpyrexia	R50	2 (5.71)
• Gastroenteritis	K52.9	1 (2.86)
• Hydronephrosis	N13.2	1 (2.86)
• Urinary tract infection	N12	1 (2.86)
• Pelvic inflammatory disease	N73.9	1 (2.86)
• Tuberculosis	A15	1 (2.86)
• Thrombocytopenia	D69.6	1 (2.86)

Noted: Not all patients have comorbidities, and one patient can have more than one comorbidity

Data related to the description of the surgical management of digestive inpatients at the Academic Hospital UGM period January – March 2023 is presented in TABLE 3. Surgical reports listed in the medical records of inpatients undergoing digestive surgery included surgical procedures, operation plan, duration of operation, and length of stay before surgery. The most common surgical procedure performed was appendectomy in 29 (38.16%) cases.

The study shows that 65 (85.53%) cases of surgical procedures were carried out electively, and the time from incision to the closing of the surgical wound was generally less than 1 hr in 34 (44.74%) patients. There were 62 (81.58%) patients with a more extended stay before surgery of < 3 d. The present study shows that emergency surgery was performed on appendectomy in 9 cases, hernia repair in 1 case, and recti prolapse in 1 patient.

TABLE 3. The management of digestive surgery inpatients at Academic Hospital UGM period January-March 2023

Surgical characteristics	Number of patients [n (%)]
Surgical action	
• Appendectomy	29 (38.16)
• Cholecystectomy	18 (23.68)
• Herniorepair	8 (10.53)
• Operative laparoscopy	8 (10.53)
• Exploratory laparotomy	4 (5.26)
• Low resection	2 (2.63)
• Haemorrhoidectomy	2 (2.63)
• Recti prolapse	2 (2.63)
• Perianal fistulectomy	1 (1.32)
• Gastrostomy, ileostomy, colostomy	1 (1.32)
• Gastric anatomy resection	1 (1.32)
Sub total	76 (100)
Operation Plan	
• Elective	65 (85.53)
• Cito	11 (14.47)
Sub total	76 (100)
Duration of surgery	
• <1 hr	34 (44.74)
• 1 – 2 hr	35 (46.05)
• >2 hr	7 (9.21)
Sub total	76 (100)
LoS before surgery	
• <3 d	62 (81.58)
• ≥3 d	14 (18.42)
Sub total	76 (100)

The use of antibiotics for inpatients with digestive surgery was grouped into prophylactic antibiotics, therapeutic antibiotics, and both of them. The results showed that 14 (17.11%) patients received prophylactic antibiotics, 37 (50%) received therapeutic antibiotics, and 25 (32.89%) patients received both of them. The study shows that all gastrointestinal surgical patients on prophylactic antibiotic therapy received single antibiotic therapy. The type of prophylactic antibiotic most frequently used for digestive surgery patients was ceftriaxone in a total of 21 (53.85%) patients, followed by cefazolin in 16 (41.03%) patients and levofloxacin in 2 (5.13%) patients. The therapeutic antibiotics given are categorized as empirical antibiotics because the bacterial culture was usually not performed on digestive surgery patients; the study shows that patients undergoing digestive surgery were given single or combination therapeutic antibiotics. The single type of therapeutic antibiotic most frequently given to digestive surgery patients was ceftriaxone in 26 (41.94%), followed by levofloxacin in 18 (29.03%) patients. Meanwhile, the type of combination therapeutic antibiotics most frequently given to digestive surgery patients was ceftriaxone + metronidazole for 13 (20.97%) patients, followed by cefotaxime + metronidazole for (8.06%) patients.

The rationality of antibiotics was evaluated using the Gyssens method¹⁷ the pathogens, and the anti-infective agents. The rational use of antimicrobial drugs is based on an understanding of the many aspects of infectious diseases. Factors

relating to host defence, the identity, virulence, and susceptibility of the microorganism and the pharmacokinetics and pharmacodynamics of antimicrobial drugs have to be considered. Antimicrobial use is the major determinant of microbial resistance. To guarantee the long-term efficacy of antimicrobial drugs, the quality-of-use should be maximised and overconsumption (inappropriate use and with the main guidelines of the Minister of Health of Republic of Indonesia No. 28/2021 concerning Antibiotic Use and the Antimicrobial Use Guidelines 2023 of the Academic Hospital UGM. The rationality for the use of prophylactic and therapeutic antibiotics is presented in TABLE 4. From January – March 2023, of 76 digestive surgery patients, 39 were given prophylactic antibiotics. Analysis of antibiotics use through the flow diagram of the Gyssens method resulted in the rational category (category 0) of 2 (5.13%) patients and 37 (94.87%) patients who were irrational. The results also show two patients with prophylactic antibiotics in category IVA (other antibiotics are more effective). Thus, both patients received a cholecystectomy with prophylactic antibiotic levofloxacin. The IVD category is a category that indicates the presence of other antibiotics with a narrower spectrum. The results of the analysis showed that 21 patients underwent digestive surgery (13 appendectomies, three exploratory laparotomies, and one each of cholecystectomy, perianal fistulectomy, gastrostomy, ileostomy, colostomy, low resection, and prolapse recti) given ceftriaxone as a prophylactic antibiotic. Therefore, it was an IVD category.

TABLE 4. Rationality of the use of prophylactic and therapeutic antibiotics inpatients of digestive surgery at the Academic Hospital UGM for the period January-March 2023

Rationalities	Category	Number of patients n (%)
Prophylaxis antibiotics (n =39 patients)		
• Rational (n =2 patients)	0	2 (2.63)
• Irrational (n =37 patients)	IVA	2 (2.63)
	IVD	21 (27.63)
	IIA	27 (35.53)
	I	24 (31.58)
Therapeutic antibiotics (n =62 patients)		
• Rational (n =16 patients)	0	17 (25.37)
• Irrational (n =46 patients)	IVA	27 (40.30)
	IB	4 (5.97)
	IIA	6 (8.96)
	IIB	13 (19.40)

Note: Analyzed based on Gyssens. The use of one antibiotic can result in irrationality >1 category. Therefore, the number of analysis results differs from the number of antibiotics.

The present study also showed 27 adult patients (>19 y.o.) with prophylaxis antibiotic category II A (in appropriate doses). The number of surgery, as well as drugs and doses used, as follows: 13 appendectomies with ceftriaxone (1 g); 3 herniorepair with cefazolin (1 g); 1 cholecystectomy with ceftriaxone (1 g); 3 exploratory laparotomy with ceftriaxone (1 g); low resection with ceftriaxone (1 g); low resection with cefazolin (1 g); prolapse recti with ceftriaxone (1 g); prolapse recti with cefazolin (1 g); perianal fistulectomy with ceftriaxone (1 g); gastrostomy, ileostomy, colostomy with ceftriaxone (1 g); and operative laparoscopy with cefazolin (1 g). Inappropriate time use of prophylactic antibiotics (category I) was administration of antibiotics more than 60 min before the procedure. According to guidelines, prophylactic antibiotics are given within 30-60 min before incision. The results showed that were 13 patients

given prophylactic antibiotics more than 1 hour before the procedure, and 11 were given prophylactic antibiotics > 2 hr before the incision.

Among 76 digestive surgery patients from January to March 2023, 62 patients received therapeutic antibiotics. Rational use of therapeutic antibiotics (category 0) was 16 (25.81%) patients, and irrational was 46 (74.19%) patients. There were 27 patients with therapeutic antibiotics in the category IVA, including (17 acute appendectomies, three inguinal hernias, three obstructive ileuses, two cholecystitis, and one haemorrhoid), each used ceftriaxone, and only 1 for acute appendicitis treatment used levofloxacin as a therapeutic antibiotic. Four patients were in category IIIB (too short in antibiotic use). In the primary diagnosis of acute appendicitis, 2 patients used it for 3 d, and one patient used it for 2 d. Meanwhile, in the main diagnosis of cholelithiasis,

one patient used it for 5 d. Six patients received therapeutic antibiotics in the category of inappropriate use (category IIA), including three patients with the combination antibiotic cefotaxime + metronidazole, two patients with the combination antibiotic ceftriaxone + metronidazole, and one patient with the antibiotic levofloxacin. Thirteen patients received antibiotics at inappropriate intervals (category IIB), consisting of 12 patients diagnosed with cholecystitis and cholelithiasis given therapeutic antibiotics with levofloxacin at a dose of 500 mg at 24 hr intervals and one patient diagnosed with acute appendicitis given ceftriaxone and metronidazole. Simultaneously at 8 hr intervals. Irrational use of antibiotics was more often found in the use of therapeutic antibiotics. The percentage of irrationality for the use of therapeutic antibiotics reached 40.30% with the most common category being the IVA category (there are other antibiotics that are more effective).

DISCUSSION

The present study shows that the most common primary diagnosis in digestive surgery patients is acute appendicitis (31.58%). Acute appendicitis is one of the most common abdominal emergencies worldwide.¹⁸ Appendicitis is the inflammation of the vermiform appendix.¹⁹ It typically presents acutely, within 24 hr of onset, but can also give as a more chronic condition. Even though there was no significant difference, the results show a tendency for the number of males to be greater than females and the 19–44 y.o. group to undergo digestive surgery more often. The results also show that acute appendicitis surgery was the most common cause of digestive surgery patients. Although there is no age exception, appendicitis most often occurs between the ages of 10 and 20 yr.²⁰ In the United States, there were

more males than females, with a ratio of 1.4:1. The overall lifetime risk was 8.6% for males and 6.7% for females.²⁰ Bhangu *et al.*¹⁸ also stated that most studies show a slight male predominance of acute appendicitis. Appendicitis can occur at any age, but it most commonly affects people in their second or third decade of life, and the disease is less common at both extremes of age.¹⁸ The present study shows that most digestive operations were performed electively, whereas emergency procedures were generally performed in acute appendicitis. Appendectomy is usually carried out on an emergency basis to treat appendicitis (inflamed appendix). If appendicitis occurs, the appendix typically needs to be removed immediately. If left untreated, the appendix can burst, and this is a medical emergency.²¹

Patients who underwent digestive surgery at the Academic Hospital UGM during the research period received only prophylactic antibiotics, some other only therapeutic antibiotics, or they were given both. Surgical antibiotic prophylaxis is associated with reduced surgical site infection rates, hospital stay, and mortality.¹¹ Surgical antibiotic prophylaxis is a cornerstone of perioperative care.¹¹ The study shows that ceftriaxone from the cephalosporin group was the single prophylactic antibiotic most often used in digestive surgery. The antibiotic spectrum should be selected according to the local flora of the surgical site.¹¹ The most widely used antibiotics are first- and second-generation cephalosporin.¹¹ Based on a systematic review, it was also stated that those included in the top 15 antibiotics most commonly consumed in Indonesia are β -lactams, especially cephalosporin and penicillins.²² Bacterial culture was not usually performed on digestive surgery patients. The therapeutic antibiotic used in the present study was empirical antibiotics. Similar to the results obtained with prophylactic

antibiotic use, ceftriaxone was the most commonly prescribed therapeutic antibiotic. Meanwhile, the combination therapeutic antibiotic most often given to digestive surgery patients was ceftriaxone + metronidazole. Due to increasing antimicrobial resistance, the correct use of antimicrobials is becoming more complex. The choice of the therapeutic antibiotic should follow current guidelines, take local susceptibility data into account, and reflect the patient's risk factors.²³

The Gyssens method is an instrument that is widely used to evaluate the appropriateness of using antibiotics in the treatment of patients.^{22,24,25} The present study showed various causes of irrational use of antibiotics, either as prophylactic or therapeutic. Both the use of other antibiotics should be more efficient, and the inappropriate doses were the main category that often led to irrational assessments of the use of these antibiotics. The benefits and detriments of each drug should be compared in choosing an antibiotic. Inappropriate use of antibiotics is a reasonably widespread practice worldwide in high-income and low-income nations.^{26,27} Improper use of antibiotics can potentially lead to antimicrobial resistance and increase the necessity to use more expensive antibiotics to treat joint and life-threatening infections. Several studies reported on the use of antibiotics for digestive surgery. Surgery involving the gastrointestinal tract provides a special challenge because of its high, predominantly anaerobic bacterial load.²⁸ The most suitable antibiotic and the optimal duration of prophylaxis are still debated.²⁹ Better ways of post-operative management of infections must be studied such that the recommended use of antibiotics has complete or specific coverage of pathogens and has minimal adverse effects.³⁰ Freitas *et al.*,¹¹ in their study on the use of antibiotics in abdominal surgery, stated that the antibiotic spectrum must be

chosen according to the local flora at the surgical site. In addition, antibacterial prophylaxis should cover all possible pathogens, including aerobic and anaerobic organisms.²⁸ The accepted practice worldwide for preventing surgical site infections is administering single or multiple doses of antimicrobial prophylaxis.²⁹ Although combination antibiotic therapy is appropriate in certain situations, single-agent prophylaxis is appropriate for most patients.²⁸ Cefazolin is the most widely used antibiotic for surgical prophylaxis.¹¹

Antibiotics are some of the most widely, and often injudiciously, used therapeutic drugs worldwide. Perioperative prophylaxis antibiotic is recommended for various surgical procedures to prevent surgical site infections. The use of therapeutic antibiotics requires consideration including obtaining an accurate diagnosis of infection; identify opportunities to shift to narrow, cost-effective spectrum. In this study, the classification of antibiotic as prophylactic or therapeutic antibiotics was based on the type of surgery, the organ being operated on and the risk of infection/contamination. If surgery was performed on a hollow organ and there was a risk of contamination, prophylactic antibiotics were given. If there was no risk of contamination, then only therapeutic antibiotic was used. The most prevalent form of irrational antibiotic use of the present study was often found in the use of therapeutic antibiotic in the IVA category (there are other antibiotics that are more effective), and in patients with acute appendicitis.

The study found that 40.30% of antibiotics were used irrationally, but no SSI diagnosis. The absence of an SSI diagnosis may be caused by the patient did not having post-operative control as recommended by the doctor. The majority of patients did not comply with post-operative follow-up actions until >30 d after discharge, therefore it was difficult to monitor post-operative

progress. Apart from that, the impact of irrational use does not always result in infection, and vice versa. However irrational use of antibiotics is proving to be a major concern to the health systems globally. This results in antibiotics resistance and increases health care costs.

The irrational use of antibiotic therapy will increase the occurrence of resistance, which impacts the increase of morbidity, mortality, and health costs Worldwide, irrational use of antibiotics is escalating, both in developed and developing countries.^{10,13,24,25} Irrational use of antibiotics can take many forms, including the prolonged antibiotics use,¹³ restricted antibiotics use,¹² outside clinical guidelines,^{13,14} inappropriate timing/duration of prophylactic or therapeutic antibiotic administration,^{10,24,25} or with inadequate dosage or inappropriate route of administration.¹² As a direct consequence of irrational antibiotic use, resistance to the commonly available antibiotics has been increasing rapidly. It is almost impossible to reverse resistance to antibiotics once it is present in the pool of bacteria. Therefore, it is important to always evaluate the use of antibiotics in health services. The spread and emergence of resistance can be slowed before it causes further damage to people's health and finances. This finding remains a challenge to encourage healthcare professionals to appropriately follow hospital guidelines and continually evaluate antibiotic use. The role of the clinical pharmacist can facilitate this process across all surgical disciplines.

Research limitations

Most patients only visited for control after digestive surgery 7–14 d and did not by the recommendation for control up to 30 d after digestive surgery. Therefore, the results of the post-operative condition could not be known, and the incidence of wound infection after surgery in patients

could not be observed. Apart from that, researchers also did not always know the actual events when determining antibiotic use, including incomplete data on the patient's medical record.

CONCLUSION

In conclusion, patients with acute appendicitis (24 patients or 31.58%) are the highest number among patients undergoing digestive surgery, where most surgical procedures are performed electively, with the time from incision to surgical wound closure generally < 1 hr. The antibiotics most frequently administered to gastrointestinal surgical patients hospitalized during the 3 mo of the study are the cephalosporin group, of which the most widely used is ceftriaxone for prophylaxis (53.85%) and therapeutic (41.94%). The Gyssens analysis shows that the irrational use of antibiotics is still observed. Efforts to increase the rational use of antibiotics among healthcare providers are needed.

ACKNOWLEDGEMENT

Authors would like to thank the Director of the Academic Hospital, UGM, Yogyakarta for the permission to conduct this study.

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