

# Correlation of pre-operating antibiotic types with surgical site infection in post-appendectomy patients

Correlación de tipos de antibióticos previos a la operación con infección en el lugar quirúrgico en pacientes pos-apendectomía

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## SUMMARY

**Introduction:** Prophylactic antibiotics are antibiotics given to patients undergoing surgery to prevent infection due to surgery. Surgical site infection (SSI) is an infection that occurs when microorganisms from the skin, other body parts, or the environment enter the postoperative incision. This study aimed to analyze the relationship between preoperative antibiotics and the occurrence of SSI.

**Methods:** This study used cross-sectional and analytical observational research design. Secondary data collection from medical records of appendectomy

surgery patients with a history of antibiotic use at Jemursari Islamic Hospital, Surabaya, Indonesia in 2017-2019 was used.

**Results:** Of the 138 subjects, the antibiotics used were 128 (93%) cephalosporins and 10 (7%) metronidazole. In the cephalosporin type, ceftriaxone was the most widely used antibiotic (95/128, 74.2%). The incidence of SSI in patients after appendectomy was six patients (8%), while 132 patients (92%) did not experience SSI. Of 128 patients given cephalosporin prophylactic antibiotics, 122 patients (95.3%) did not experience SSI, and six patients (4.7%) experienced SSI after appendectomy. Meanwhile, in 10 patients who were given metronidazole prophylactic antibiotics, it was found that all (100%) did not have SSI. Statistical analysis showed no relationship between the type of pre-operative antibiotics and the occurrence of SSI ( $p=1$ ).

**Conclusion:** Pre-operative administration of antibiotics can prevent the occurrence of SSI in patients after appendectomy.

**Keywords:** Prophylactic antibiotics, surgical site infection, appendicitis, appendectomy.

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## RESUMEN

**Introducción:** Los antibióticos profilácticos son antibióticos que se administran a pacientes sometidos a cirugía para prevenir la infección debido a la cirugía. La infección del sitio quirúrgico (ISQ) es una infección que se produce cuando los microorganismos de la piel,

*otras partes del cuerpo o el medio ambiente ingresan a la incisión posoperatoria. Este estudio tuvo como objetivo analizar la relación entre los antibióticos preoperatorios y la aparición de ISQ.*

**Métodos:** *Este estudio utilizó un diseño de investigación observacional transversal y analítico. Se utilizó la recopilación de datos secundarios de los registros médicos de pacientes sometidos a cirugía de apendicectomía con antecedentes de uso de antibióticos en el Hospital Islámico Jemursari, Surabaya, Indonesia, en 2017-2019.*

**Resultados:** *De los 138 sujetos, los antibióticos utilizados fueron 128 (93 %) cefalosporinas y 10 (7 %) metronidazol. En el tipo de cefalosporina, la ceftriaxona fue el antibiótico más utilizado (95/128, 74,2 %). La incidencia de ISQ en pacientes después de la apendicectomía fue de seis pacientes (8 %), mientras que 132 pacientes (92 %) no experimentaron ISQ. De 128 pacientes que recibieron antibióticos profilácticos con cefalosporinas, 122 pacientes (95,3 %) no experimentaron ISQ y seis pacientes (4,7 %) experimentaron ISQ después de la apendicectomía. Mientras tanto, en 10 pacientes que recibieron antibióticos profilácticos con metronidazol, se encontró que todos (100 %) no tenían ISQ. El análisis estadístico no mostró relación entre el tipo de antibióticos preoperatorios y la aparición de ISQ ( $p=1$ ).*

**Conclusión:** *La administración preoperatoria de antibióticos puede prevenir la aparición de ISQ en pacientes después de una apendicectomía.*

**Palabras clave:** *Antibióticos profilácticos, infección del sitio quirúrgico, apendicitis, apendicectomía.*

## INTRODUCTION

Appendicitis is the most common significant surgical disease. Although appendicitis can occur at any age, it is most common in adolescents and young adults. The mortality rate of this disease was high before the era of antibiotics. For the management of appendicitis, the most appropriate action and the only best option is surgery (appendectomy) (1,2). According to data released by the Indonesian Ministry of Health in 2010, the incidence of appendicitis in Indonesia was 621 435 people, with a percentage of 3.53 % (3). Appendicitis is the second-highest non-communicable disease in Indonesia in hospitalization in 2009 and 2010 (4). Based on initial data on patients with appendicitis surgery (appendectomy) at the Jemursari Islamic Hospital, Surabaya, Indonesia, in 2017-2019,

there were 240 cases of patients with all patients undergoing preoperative antibiotics.

Surgical site infection (SSI) is one of the post-abdominal surgery complications and nosocomial infections in surgical patients. A survey by the World Health Organization shows that 5 %-34 % of the total nosocomial infections are SSI (5). Factors for the incidence of SSI from patients, for example, are diabetes mellitus (DM), obesity, severe malnutrition, and the wound's location. While the operating factor, for example, is the length of the operation and the operating procedure. Gram-negative bacteria are the dominant cause of SSI, especially in general surgery, neurosurgery, bone surgery, and others (6). The surgical wound is said to be infected if the wound oozes pus and signs inflammation. SSI found the fastest is on the third day and the most found on the fifth day, and the longest is the seventh day (7).

Appendectomy is the most efficient way of treating appendicitis, with a success rate of >95 % and a low overall morbidity and mortality rate (8). Factors that play an essential role in influencing the incidence of SSI are endogenous and exogenous. In terms of age, old age is associated with many structural and functional changes that make the skin and subcutaneous tissue more susceptible to infection (9).

Prophylactic antibiotics are antibiotics used for patients who have not been infected with an infection but are suspected of having a high chance of getting it, or if they are exposed to infection, it can harm the patient. The most widely used prophylactic antibiotics are cefazolin and ceftriaxone (10). Previous research showed that the type of antibiotic therapy and prophylaxis most widely used in surgical cases of appendicitis was ceftriaxone by 65.28 % (11,12).

In a study at Dr. Kariadi General Hospital, Semarang, Indonesia, six samples (35.2 %) of appendectomy laparotomy patients with SSI signs were given the antibiotic ceftriaxone. In appendectomy laparotomy, patients with SSI signs were given non-ceftriaxone antibiotics, 1 sample (5.8 %). Meanwhile, in patients with laparoscopic appendectomy with SSI signs who were given ceftriaxone antibiotics, two samples (14.2 %) did not find any signs of SSI in laparoscopic appendectomy patients who were

given non-ceftriaxone antibiotics. The treatment for the SSI is that the wound must be cleaned and treated so that it does not spread and the wound can recover (7,13). The purpose of this study was to analyze the relationship between preoperative antibiotics and the occurrence of SSI in patients after an appendectomy at Jemursari Hospital Surabaya, Indonesia.

## METHODS

This type of research is analytic observational with a cross-sectional design. The population in this study was the medical records of inpatient appendectomy at Jemursari Islamic Hospital, Surabaya, Indonesia, in 2017-2019, amounting to 240 patients. The number of samples was calculated using simple random sampling and obtained as many as 150 subjects. However, due to research limitations, the sample became 138 subjects.

The sample of this study was medical records of appendectomy patients with a history of pre-operative antibiotic use in January 2017 - December 2019 with inclusion and exclusion criteria. The inclusion criteria in this study were a diagnosis of acute appendicitis, post-appendectomy patients aged 17-45 years, a history of pre-operative antibiotic use, and the patient was a control patient. At the same time, the exclusion criteria for this study were patients with appendicitis without surgery and patients who died after appendectomy.

This research was conducted at Jemursari Islamic Hospital, Surabaya, Indonesia. The time of the study started from September 2019 to August 2020. The independent variable in this study was the use of preoperative antibiotics for appendectomy. At the same time, the dependent variable was the occurrence of SSI in patients after appendectomy. This research instrument used secondary data: medical record data of appendectomy patients with a history of preoperative (prophylactic) antibiotic use at Jemursari Islamic Hospital, Surabaya, Indonesia, in 2017-2019. The procedure of this research was after getting data from medical records, editing, coding, tabulating, entry, and cleaning are carried out. The data were then analyzed

using Chi-Square. This research had passed the code of ethics test at Jemursari Islamic Hospital Surabaya, Indonesia, with the Ethics number 0148/KEPK-RSI JS/11/2020.

## RESULTS

The sample characteristics in this study were described based on diagnosis, age, type of preoperative antibiotics, SSI occurrence, and control patients. Of the 138 study subjects, almost all (93 %) of appendectomy patients used cephalosporin prophylactic antibiotics. The types of prophylactic antibiotics in appendectomy patients are described in Table 1 as follows.

Table 1  
Types of prophylactic antibiotics used

Types of antibiotics	n	%
Cephalosporins	128	93
Metronidazole	10	7
Total	138	100

As many as 128 types of cephalosporin antibiotics were used, most of them (74.2 %) using ceftriaxone cephalosporins. The types of cephalosporin antibiotics used are described in Table 2. The results showed that six patients (8 %) after appendectomy experienced SSI, and almost all 132 patients (92 %) did not experience SSI.

Table 2  
Types of cephalosporin antibiotics used

Cephalosporin type	n	%
Cefuroxime	24	18.60
Ceftriaxone	95	74.2
Cefazolin	2	1.6
Cefoperazone	5	4
Cefotaxime	1	0.80
Cefepime	1	0.80
Total	128	100

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Based on Table 3, the Chi-square statistical test results using the SPSS statistical application showed a significant p-value of 1.00 (>0.05), indicating no significant relationship between the antibiotic and the occurrence of SSI in patients after appendectomy. Of the 128 patients given

cephalosporin prophylactic antibiotics, almost all (95.3 %) of patients after appendectomy did not experience SSI, and a small proportion (4.7 %) of patients after appendectomy had SSI. Meanwhile, in 10 patients given metronidazole prophylactic antibiotics, all (100 %) did not experience SSI.

Table 3  
Crosstabulation of types of antibiotics with the occurrence of infection

Types of Prophylactic Antibiotics	Post operation						p
	Infected		Not infected				
	n	%	n	%	n	%	
Cephalosporins	6	4.7	122	95.3	128	100	1.00
Metronidazole	0	0	10	100	10	100	(>0.05)

DISCUSSION

The majority of post-appendectomy patients do not have SSI. The statistical tests showed no significant relationship between the type of pre-operative antibiotics and the occurrence of SSI in post-appendectomy patients. Previous studies have shown no relationship between the type of irrational use of prophylactic antibiotics and the incidence of SSI. Surgical patients with irrational use of antibiotics do not have SSI due to prophylactic antibiotics given with a broader spectrum that can include gram-positive and negative bacteria and the use of antibiotics with a longer duration, which can prevent bacterial contamination in the treatment room (14). In another study, prophylactic antibiotics were given more use to third-generation cephalosporins, especially broad-spectrum Ceftriaxone, because of concerns about first-generation antibiotic resistance, bacterial patterns in the operating room, and treatment. The use of prophylactic antibiotics in the preoperative period aims to tackle infection so that the postoperative risk can be reduced as low as possible so that the provision of prophylactic antibiotics can minimize SSI (15).

The most widely used type of prophylactic antibiotic in patients after appendectomy is Ceftriaxone. The results of this study are following research that has been done that the type of antibiotic therapy and prophylaxis that is most widely used in cases of surgical appendicitis is Ceftriaxone (12,16). In addition to being used in cases of surgical appendicitis, a study showed that prophylactic antibiotics were 98 % effective in cesarean section (17). The reason Ceftriaxone is most widely used is possible because, in addition to the advantages of using cephalosporins in general, it also has a long half-life of up to 8 hours with a dose of 1 gram/injection, so that if the operation lasts a long time, it is not necessary to increase the dose of Ceftriaxone during surgery. Previous research also shows that prophylactic antibiotics in appendectomy surgery with indications of appendicitis used in Surakarta, Indonesia, are third-generation cephalosporins such as Ceftriaxone and cefotaxime (18).

Most of the antibiotics used were third-generation cephalosporins, as many as 235 (66.2 %) patients, carbapenem as many as 54 (15.2 %) patients, and penicillin 41 (11.5 %) patients (19). The 3rd generation cephalosporin that is widely used is ceftriaxone, and there is a relationship and influence between the nature

of the operation, type of antibiotic, time of administration, and duration of operation with SSI with a p-value < 0.05 (20,21). There are differences in the results from previous studies due to the number of samples and the number of different types of antibiotics affecting the p-value of the statistical test results.

This study shows that the incidence of SSI is relatively low. This is in line with previous research that there were 7 (0.55 %) SSI cases out of 1,281 surgical procedures performed at hospitals in Surabaya, Indonesia, in 2012 (22). Emphasis on risk factors is very influential on the incidence of SSI, one of which is cleanliness and type of procedure. Risk factors that influence the incidence of SSI in clean-contaminated surgery patients include preoperative bathing and shaving (23). Following previous studies, the prevalence of SSI in Indonesia is estimated at around 2.3 %-18.3 % and is the most common nosocomial infection. Appendectomy is included in the category of clean surgery contamination. The possibility of SSI in this operation ranges from 5 %-15 % (18,19).

There are limitations to this study. This study uses the simple random sampling technique by taking data from medical records. Much static is included in the exclusion criteria so that the data needed is less so that it needs to be re-stated, and the research time is less efficient. A preliminary diagnosis is written not to be used in research, such as not writing down the type of appendicitis such as perforated appendicitis, acute appendicitis, and chronic appendicitis. Writing a diagnosis after control is also incomplete to determine the presence of infection or not. Then the time of the study coincided with the Coronavirus Disease 2019 (COVID-19) pandemic, so researchers had to postpone the time of data collection.

## CONCLUSION

The types of antibiotics used in appendectomy patients are mostly cephalosporin (Ceftriaxone) prophylactic antibiotics. There was no significant relationship between the type of preoperative antibiotics and the occurrence of SSI in patients after appendectomy. Preoperative antibiotics can prevent the occurrence of SSI.

## Conflicts of Interest

The authors declare no conflict of interest.

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