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## Evaluation of antibiotic prophylaxis administration at the orthopedic surgery clinic of tertiary hospital in Jakarta, Indonesia

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## PEER REVIEW

## Peer reviewer

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## Comments

This study is a good study, in which the authors not only showed the incidence of surgical site infections despite prophylactic antibiotics has been done, but also expressed that the adherence to antibiotic prophylaxis guidelines are still very low. This article is a good input for the management of hospitals and surgeons. Details on Page 192

## ABSTRACT

**Objective:** To evaluate the effectiveness of the use of antibiotic prophylaxis in preventing surgical site infections, at orthopedic surgery unit in tertiary hospital, Dr. Mintohardjo Navy Hospital, Jakarta, Indonesia.

**Methods:** This study was a cross-sectional study conducted retrospectively on the orthopedic unit of the Dr. Mintohardjo Navy Hospital, Jakarta, Indonesia between January to December 2012. Assessment of appropriateness of antibiotic prophylaxis was carried out based on the Scottish Intercollegiate Guidelines and The National Guidelines of Antibiotic Usage in Indonesia.

**Results:** A total of 163 samples consisted of men (73%) and women (27%) with an age range less than 12 years (9.8%), 12–25 years (23.3%), 26–65 years (58.9%) and over 65 years (8.0%). The most commonly antibiotic prophylaxis used in this study was ceftriaxone (87.8%), followed by gentamycin (3.7%), cefotaxime (3.7%), cefopodoxone (1.2%), siprofloksasin (1.2%), fosfomycin (0.6%), meropenem (0.6%), and vancomycin (0.6%). Of the 163 patients 8 (4.9%) patients developed a surgical site infection of all orthopedic surgical patients who received antibiotic prophylaxis. The pathogens isolated from surgical site infection were *Escherichia coli* (23.08%), coliform (18.62%), *Staphylococcus aureus* (18.00%), *Pseudomonas aeruginosa* (12.15%), and *Alkaligenes* sp. (9.31%).

**Conclusions:** The Compliance of antibiotics prophylaxis administration at orthopedic surgery unit in Dr. Mintohardjo Naval Hospital has not been in accordance with the guidelines of the national or international standards. Therefore it is necessary to do some improvements to ensure better compliance with standard guidelines.

## KEYWORDS

Antibiotic prophylaxis, Surgical site infections, Orthopedic surgery

### 1. Introduction

The use of prophylactic antibiotic is one of the important factors in surgery and has been regularly used to eradicate endogenous microorganisms and to prevent postoperative infectious complications[1,2].

Surgical site infections (SSI) or infection of the incised tissue is an infection that occurs within 30 d after surgery. It remains a major cause of postoperative morbidity and mortality, prolong hospitalization and cost increase of

medical care in the surgical unit. Appropriate prophylactic antibiotics administration before surgery can reduce the incidence of SSI. However, inappropriateness of antibiotic prophylaxis administration is still commonly found in various surgical procedures, including orthopedic surgery[3–6].

Various international guidelines and national guideline are available for the use of antibiotic prophylaxis in surgery[7–9]. However, adherence to the guidelines in choosing the type and timing of antibiotic prophylaxis

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administration is not always followed [1,5,6,10–13]. This situation has led to high incidence of antibiotic resistance worldwide, which has a significant impact on public health issues, especially on treatment outcomes. Development of guidelines for the use of prophylactic antibiotics based on local microbial resistance patterns can improve the effectiveness of the use of prophylactic antibiotics [14]. Surgeons often use a broad-spectrum antibiotic prophylaxis prior to surgery or that does not comply with the guidelines that have been recommended [15].

In Indonesia, research on the use of prophylactic antibiotics in surgery, is still rare, therefore the aim of this study was to evaluate the pattern and rationality of antibiotic prophylaxis of surgical patients undergoing orthopedic surgery and its impact on the rate of SSI in national referral Dr. Mintohardjo Navy Hospital, Jakarta, Indonesia.

## 2. Materials and methods

A cross sectional study was conducted in the orthopedic unit of the Dr. Mintohardjo Navy Hospital, Jakarta, Indonesia between January to December 2012. All surgical orthopedic patients were included in this study. Orthopedic surgery patients who did not meet the inclusion criteria were excluded from the study: (i) they have received antibiotic therapy prior to surgery, (ii) postoperative condition cannot be followed, or (iii) there is no information about the intra-operative use of antibiotics.

Data from the medical records of patients treated in the orthopedic surgery unit, including patient demographics, type of surgical procedure, drug history, choice of antibiotic regimens, dose, time of administration, and dosage were collected retrospectively. The incidence of SSI is recorded based on the criteria of the U.S. Centers for Disease Control and Prevention [16]. Assessment of the appropriateness of antibiotic prophylaxis is based on the Inter Scottish Guidelines and the National Guidelines for Use of Antibiotics [7]. Aspects assessed were: indication of using prophylactic antibiotics, antibiotic selection for patients, a dose of antibiotics, administration time (within 30 min before skin incision), repeated dose during the procedure, duration of use, and sensitivity patterns of local microorganisms.

## 3. Results

The characteristics of 163 patients enrolled in this study consisted of men (73%) and women (27%) with an age range less than 12 years (9.8%), 12–25 years (23.3%), 26–65 years (58.9%) and over 65 years (8.0%). The third generation cephalosporins (ceftriaxone) was prescribed most frequently (87.8%) as antibiotic prophylaxis, followed by gentamycin and cefotaxime.

The antibiotic was administered within 30 min before the skin incision in only 91 (55.8%) of the 163 patients who

received antibiotics, the antibiotic was administered more than 30 min before the skin incision in 45 patients (27.6%), and during or after skin incision in 27 (16.6%), as shown in Table 1.

**Table 1**

Characteristic of the patients and antibiotic prophylaxis in orthopedic surgery ( $n=163$ ).

Characteristics		No. (%)
Sex (%)	Male	119 (73.0)
	Female	44 (27.0)
Age (years)	<12 years	16 (9.8)
	12–25 years	13 (23.3)
	26–65 yeras	96 (58.9)
	>65 years	13 (8.0)
Timing of antibiotic administration	Single dose more than a half hour before surgery	45 (27.6)
	Single dose a half hour before surgery	91 (55.8)
	During or after incision	27 (16.6)
Antibiotic type	Ceftriaxone	143 (87.8)
	Gentamycin	6 (3.7)
	Cefotaxime	6 (3.7)
	Fosfomycin	1 (0.6)
	Cefoporozone	2 (1.2)
	Ciprofloxacin	2 (1.2)
	Cefradine	1 (0.6)
	Meropenem	1 (0.6)
	Vancomycin	1 (0.6)
	Duration of surgery	Less than 1 h
1 – 3 h		73 (44.8)
More than 3 h		29 (17.8)

Total of 8 (4.9%) patients developed SSI who received antibiotic prophylaxis. The appropriateness of prescribing antibiotic prophylaxis in regard to the choice of antibiotics and sensitivity pattern of local microorganism was 6.1%. The most frequent microorganisms isolated from SSI was *Escherichia coli* (23.08%), followed by coliform (18.62%), *Staphylococcus aureus* (18%), *Pseudomonas* sp. (12.15%) and *Alkaligenes* sp. (9.31%).

Out of 163 surgeries, open reduction and internal fixation was done in 76 (46.6%), external fixation in 50 (30.6%), reposition in 16 (0.98%), surgical debridement in 13 (0.8%), and amputation in 8 (0.49%) cases.

## 4. Discussion

Giving antibiotic prophylaxis in surgery is important to prevent SSI. Several studies have reported that the rate of SSI occurred in at least 2% of patients undergoing surgery. Mortality rate of patients with SSI was about 3% [17]. The use of prophylactic antibiotics to prevent the incidence of SSI in orthopedic surgery is given when the prosthesis is implanted, or when any osteosynthetic materials, such as plates, nails, wire, and screws, are used. According to national and international guidelines the prophylactics use of antibiotics, in the case of orthopedic surgery cefazoline, a first-generation of cephalosporin, is an antibiotic of choice as prophylaxis for SSI. The third generation of cephalosporin should not be used for SSI prophylaxis [7].

However, in this study we found that ceftriaxone, a third-generation cephalosporin, was most commonly prescribed (87.8%) as antibiotic prophylaxis in orthopedic surgery. Although the third-generation cephalosporin are not recommended as antibiotics for prophylaxis in orthopedic surgery, interestingly, these results consistent with other similar studies in a large teaching hospital in East Africa, that ceftriaxone, is the only antibiotic used in orthopedic surgery<sup>[18]</sup>. The other study reported that the use of prophylactic antibiotics in surgery of proximal femoral and other closed long bone fractures, single-dose of ceftriaxone as antibiotic prophylaxis can significantly reduce the risk of SSIs and its use has been shown to have lower medical costs<sup>[19]</sup>.

Timing of antibiotic prophylaxis for surgery is an important issue because it is related to the rate of SSI. Current guidelines suggest the timing of prophylactic administration of antibiotics within 30 min before incision<sup>[7]</sup>. In this study with respect to the timing of antibiotics administration, we found that 91 (55.8%) in 163 patients received prophylactic antibiotics appropriately, and the SSI rate was 4.9%. This rate is higher than it has been estimated that SSI growing at 0.3%–1.3% of patients undergoing orthopedic surgery and given prophylactic antibiotics<sup>[17,20,21]</sup>. A previous study involving 4472 patients undergoing cardiac surgery, hysterectomy, or hip or knee arthroplasty reported that the infection rate was 1.6% when antibiotics were given within 30 min before incision<sup>[22]</sup>. Another study reported that out of 32459 patients, where antibiotic prophylaxis is given by an average of 28 min (inter-quartile range, 17–39 min) prior to surgical incision, 1497 patients (4.6%) developed SSI<sup>[23]</sup>.

In this study we found that of the 163 patients, 8 (4.9%) patients who received prophylactic antibiotics had SSIs. For the timing of prophylactic antibiotics, antibiotics were given within 30 min before incision in 91 patients (55.8%), which is appropriate. However, adherence to national and international guidelines for antimicrobial prophylaxis in Dr. Mintohardjo Navy Hospital was still not optimal. Regarding the choice of antibiotics and sensitivity patterns of bacteria in local hospital, we found that only 6.1% of the antibiotic prophylaxis prescription was in accordance with the guidelines for prophylactic antibiotics. This result was comparable with the other study conducted in Iran that the appropriateness of choosing antibiotic prophylaxis for general surgery was about 7.5%<sup>[6]</sup>. Another previous study reported that the appropriateness of the selection of antibiotic prophylaxis in 3 hospitals (a government hospital, a medical college teaching hospital, and a corporate hospital) in Mangalore, India were 14.1%, 23.3% and 32.9% respectively<sup>[24]</sup>. The rate of compliance with prophylactic antibiotic treatment guidelines for various types of surgical procedures which were conducted in several countries ranged from 0% to 71.9%<sup>[25]</sup>.

In general, prophylactic antibiotics should be in accordance with national and international guidelines

and should also be based on local resistance patterns, the availability of antibiotics, and the spectrum of microbial pathogens in hospitals, collaborative inter-professional medical staff, and socio-economic background of the population. Therefore, it is necessary to develop guideline for surgical prophylaxis in Dr. Mintohardjo Navy Hospital, especially in orthopedic surgery.

### Conflict of interest statement

We declare that we have no conflict of interest.

### Acknowledgements

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### Comments

#### Background

SSIs remain a major problem of postoperative morbidity and mortality. Appropriate prophylactic antibiotics administration before surgery can reduce the incidence of SSI. However, inappropriateness of antibiotic prophylaxis administration is still commonly found in various surgical procedures, including orthopedic surgery. Various guidelines are available for the use of antibiotic prophylaxis in surgery. However, the adherence to the guidelines is still very low. The purpose of this study was to evaluate the pattern of antibiotic prophylaxis of surgical patients undergoing orthopedic surgery in a tertiary hospital in Jakarta, Indonesia.

#### Research frontiers

The study showed that the incidence of SSIs was 4.9%, while the rate of compliance with the guidelines is very low. This case shows that the use of antibiotic prophylaxis in orthopedic surgery in Indonesia still needs attention.

#### Related reports

Some study related to this report have been done by several other researchers in various countries, but to my knowledge the study of the appropriateness of prophylactic antibiotics administration especially in orthopedic surgery is a new research conducted in Indonesia.

#### Innovations & breakthroughs

Data on the use of surgical antibiotic prophylaxis in Indonesia is still very rare. This research is important information for hospitals and surgeons.

### Applications

This study emphasizes the importance of the use of surgical antibiotic prophylaxis in Indonesia, to reduce the incidence of SSIs.

### Peer review

This study is a good study, in which the authors not only showed the incidence of SSIs despite prophylactic antibiotics has been done, but also expressed that the adherence to antibiotic prophylaxis guidelines are still very low. This article is a good input for the management of hospitals and surgeons.

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