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The Rationality of Antibiotics Use on Inpatient Department of Pediatric in One of the Hospital in Cimahi

Vina Septiani* [1]
Pudjiastuti Kartidjo [2]
Fenny Asri Nurdiani [2]

[1]Department of Pharmacy, Universitas Jenderal Achmad Yani, Cimahi, West Java, Indonesia

[2]Pharmacist Profession Study Program, Universitas Jenderal Achmad Yani, Cimahi, West Java, Indonesia

*email: vinaseptiani@gmail.com

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Abstract

The purpose of this study is to assess the rationality of the use of antibiotics from inpatients in one hospital in Cimahi, West Java. The research about rationality analysis of antibiotics at pediatric inpatient in one of the hospitals in Cimahi was done retrospectively use descriptive analysis design. The data source was the medical record of a patient who treated at the children's inpatient ward from January through March 2017. The result shows that 39% of infected patients were children under one-year-old. Three significant cases of diseases that occurred in the period were bronchopneumonia, typhoid fever, and typhoid fever+bronchopneumonia. Antibiotics therapy was given as single therapy as well as combination, where cefotaxime (51%) and ceftriaxone (42%) were the most antibiotics widely used as single therapy. Antibiotic use at children inpatient ward during the period January – March 2017 on bronchopneumonia, typhoid fever, and typhoid fever + bronchopneumonia patients was not 100% rational referring to criteria: correct diagnosis, correct indication, the correct drug of choice, correct dosage, correct method, and correct time interval of drug administration.

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INTRODUCTION

According to the World Health Organization, the use of drugs is rational if the patient gets medication as needed, in a sufficient period, and at the lowest price (Ofori-Asenso & Agyeman, 2016). The use of the drug is irrational if the possibility of negative impacts received by patients is more significant than its benefits, such as clinical impact, for example, side effects and bacterial resistance, and economic impacts, such as costs are not affordable (Llor & Bjerrum, 2014).

Antibiotic resistance remains a significant public health concern, and appropriate antibiotic use is an important health care quality goals (Hersh *et al*., 2013). Antibiotic resistance initially occurred at the hospital level, but slowly also developed in the community environment (Davies & Davies, 2010). Antibiotic resistance is also occurring in children in different countries, especially in developing countries (Zaman *et al*., 2017).

Prescribing of antibiotics for children only when benefits are proven scientifically. In practice, antibiotics do not need to be prescribed to children for high fever, inflammation of the throat, and diarrhea caused by viral infections (Levy-Hara *et al*., 2011). The selection of antibiotics depends not only on the spectrum but also the pharmacological properties, the potential for resistance, the safety profile, and the price (Jog, 2016). Appropriate antibiotic use is possible if health workers and the public have access to reliable and unbiased drug information. Universal access to reliable information about medicines can be achieved and must be the basis of efforts to promote rational prescriptions (Maiti *et al*., 2015).

To ensure that patients get a rational treatment, especially the use of antibiotics in children, it is necessary to analyze the rationality of antibiotics usage in one of the hospitals in Cimahi, West Java. The purpose of this study is to assess the rationality of the use of antibiotics from inpatients in one hospital in Cimahi.

MATERIALS AND METHODS

The study was conducted using descriptive analysis design, which was carried out retrospectively. The source of research data is the medical record of the patient treated at the children's inpatient ward in one of the general hospitals in Cimahi. The research was conducted from June until August 2017. The population is a pediatric patient who treated in the children Inpatient ward. Inclusive criteria are pediatric patient aged ≤ 14 years both male and female treated in children inpatient ward during the period from January to March 2017 and get antibiotic therapy, while the exclusive criteria are patients of children aged ≤ 14 years both male and female treated in children inpatient ward during the period from January to March 2017 which did not get antibiotic.

The collected data is analyzed to get the results of the rationality analysis of antibiotics to use in one of the hospitals in Cimahi, including:

1. Patient and drug characteristics

   Patient characteristics include the number of patients, age, gender, payment status, diagnosis, and discharge status. The characteristics of the drug include the type and amount of antibiotic use.
2. The rationality of the use of antibiotic

   Analysis of the rational use of antibiotics includes the following criteria:

   a. Appropriate diagnosis

      The drug is given based on the right diagnosis. The diagnosis is made by a physician who treats the patient.

   b. Appropriate indication

      It is said to be an accurate indication when antibiotics are given to patients with symptoms of a bacterial infection.

   c. Appropriate drug of choice

      Selection of drugs based on therapeutic effect according to the patient's disease.

   d. Appropriate dosage regimen

      The administered dose is not excessive or subdosage.

   e. Appropriate route of administration

      The chosen method of drug administration must be following the prescribed medication and the patient's condition.

   f. Appropriate time interval of administration

      The time interval of drug administration must be adjusted to the prescribed medication and the patient's condition.

Reference used in the analysis of rational antibiotics use is Basic and Clinical Pharmacology 12th edition (Katzung *et al*., 2011).

RESULTS AND DISCUSSION

Patient characteristics and medication

Based on the results of the study, there were 165 patients included in the inclusion criteria. Patient characteristics are presented in **Table I**. **Table I** shows the patient's demographic data in the children's inpatient ward in one of the public hospitals in Cimahi during the period from January to March 2017. A total of 54% of patients were males, whereas female patients were 46%. Based on payment status, 61.8% is Badan Penyelenggara Jaminan Sosial Kesehatan (BPJS Kesehatan, National Health Insurance) patient because of the hospital as a regional general hospital is one of the health service facilities that accept BPJS Kesehatan patients. However, there are also 31.5% of patients with public payment status, and the

remaining 6.7% are Keluarga Miskin Daerah (Gakinda, Regional Health Insurance) patients.

By age, 39% of children hospitalized from January to March 2017 were patients aged 0-1 years. The perfect immune system can cause a high incidence of infections in the age range is not yet developed. This is supported by data showing that the higher the age, the lower the incidence of infection, as shown in **Table I**.

Patient discharge data is quite diverse, 48% cured, 46% improvement, 4% not cured, while each as much as 1% died and no information discharge status. Infection is a diagnosis that can be cured. Therefore, an appropriate antibiotic therapy can eradicate the bacteria that cause infection and can cure the patient. However, there are also patients with improvement discharge status. Patients with improvement discharge status are given antibiotic therapy upon discharge. Patients with not cured discharge status are patients who discharge by their request, or the term patient wants to go home forcefully. These patients generally are patients with public payment status, who ask to go home from the hospital before being allowed by the doctor due to costs related constraints. Some patients discharged from the dead condition. The patient who dies is patient with complications. Patient with no information in discharge status is known from the absence of information on discharge status in the patient's medical record. This indicates that some medical records do not contain complete data.

Table I. Patient characteristics

Variable	Category	Frequency %)
Gender	Male	54
	Women	46
Age	0-1 years old	39
	2-3 years old	17
	4-5 years old	13
	6-7 years old	12
	8-9 years old	7
	10-11 years old	7
	12-13 years old	5
	14-15 years old	1
Payment Status	BPJS Kesehatan	61.8
	Public	31.5
	Gakinda	6.7
Discharge Status	Cured	48
	Improvement	46
	Not cured	4
	Died	1
	No information	1

Cases of infectious diseases in the pediatric inpatient during the period of January to March 2017 are quite diverse, however there are three diagnoses with the highest prevalence compared to other diagnoses, namely bronchopneumonia as many as 56 cases, typhoid fever as many as 25 cases, and typhoid fever+bronchopneumonia as many as 17 cases, as shown in **Figure 1**.

Antibiotics for therapy in the children inpatient ward during the period of January to March 2017 are given in a single or a combination. The most antibiotics given singly are cefotaxime by 51%, and ceftriaxone by 42%. Both are third-generation cephalosporin antibiotics. Cephalosporin is a beta-lactam antibiotic with broad-spectrum activity. Compared to the previous class of antibiotics, cephalosporins have an excellent pharmacokinetic profile and low toxicity (Jum'a & Karaman, 2015). Cephalosporins work by influencing proteins that are important for the synthesis of bacterial cell walls. Cephalosporins are divided into several generations based on target organisms (Kohanski *et al.*, 2010). A study showed that antibiotics that were widely prescribed for children aged < 12 years were penicillins, cephalosporins, and macrolides (Vaz *et al.*, 2014).

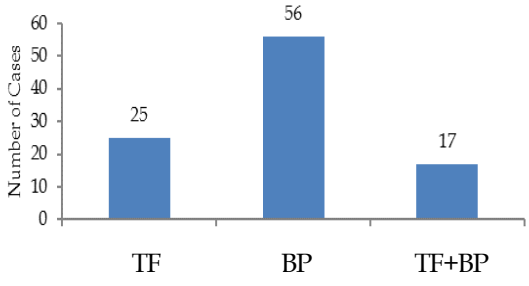

Figure 1. The three most diagnoses with the highest prevalence

In the hospital, cefotaxime is used in bronchopneumonia patients, whereas ceftriaxone is given for patients with a diagnose of typhoid fever. Bronchopneumonia and typhoid fever are the two most diagnoses obtained, as seen in **Figure 2**. Bronchopneumonia is the clinical manifestation of pneumonia that is most common in children. Bronchopneumonia is an infectious disease that causes death in children under five years (Zec *et al*., 2016). Cefotaxime is a third-generation cephalosporin that has broad-spectrum activity and is widely used in the treatment of pneumonia (Yayan *et al*., 2015). The results of other studies show that the most widely used therapy for pneumonia is antibiotics of penicillin and first and third-generation cephalosporins (Zec *et al*., 2016). Ceftriaxone is a third-generation cephalosporin that has high effectiveness against *Salmonella typhi* and becomes the therapeutic standard of typhoid fever in various countries of the world, but this drug requires parenteral administration, therefore, it is considered less than ideal (Frenck *et al*., 2000).

The results of the study showed that several patients received combination antibiotic therapy. In general, the use of antibiotic combination aims to increase the effectiveness of antibiotics in eradicating bacteria. Also, the results of the study showed that there was an antibiotics replacement, which was generally due to the previous antibiotics that did not achieve the expected effect. This can be seen from the improvement of the patient's symptoms as well as from the results of examinations such as vital signs, laboratory tests, and others. Replacement antibiotics come from the same group of antibiotics or different groups of antibiotics.

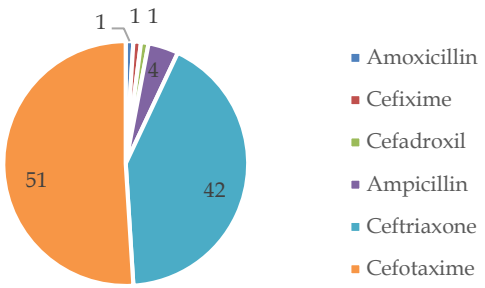

Figure 2. Type and percentage of antibiotics used

Overview of the rationality of antibiotics use

Rationality analysis of antibiotic use was carried out on the antibiotics used in the three most cases of the disease, namely bronchopneumonia (BP), typhoid fever (TF), and typhoid fever+bronchopneumonia (TF+BP). **Table II** shows the results for the accuracy of the diagnosis. Diagnosis data is based on the diagnosis that has been established by the doctor. Diagnosis of bronchopneumonia is carried out by conducting the thorax Postero-Anterior (PA), while typhoid fever is diagnosed with immunoserology, using the Widal test.

Table II. Review of the accuracy diagnosis

Diagnosis	Results Thorax PA (+)	Results Immunoserology (+)	Immunoserology Results & Thorax PA (+)	No description/Results (-)
BP	55	-	-	1
TF	-	25	-	0
TF+BP	-	-	16	1

BP: bronchopneumonia; TF: typhoid fever

Table III shows the results for the accuracy of the indication, drug of choice, and dosage. The selection of antibiotics is based on whether there is an indication for antimicrobial use (Slama *et al*., 2005). The analysis showed that all antibiotics used inpatient BP, TF, and BP+TF are 100% correct, which means that antibiotics were used in cases of infection with diagnosis result that has been established, and 100% correct drug of choice where the drug selected in accordance with the spectrum

of action against microorganisms causing infectious cases and is a drug that complies with therapeutic guidelines and has an affordable price. Analysis of drug dosage showed as many as 11.22% subdosage and as many as 23.47% excessive dosages (Katzung *et al*., 2011; Hilal-Dandan & Brunton, 2008). It may indicate the lack of rationality in giving antibiotics. However, this can also be caused by the patient having less or more bodyweight, thus affecting the administered dose, because generally the dose in child patients is calculated based on body weight.

The dose given can also be influenced by the severity of the infection suffered. Fewer dosages or subdosage can cause bacterial eradiation not to be achieved and potentially lead to resistance, while excessive dosage can increase the risk of adverse effects in patients. Research from Kaparang *et al*. (2014) showed that as many as 8.93% of the use of antibiotics in children, the dosage is improper.

Table III. Review of the accuracy of the indication, drug of choice, and dosage

Antibiotic	Assessment of accuracy indications and drugs of choice			Assessment of dosing accuracy			
	Indications according to literature	Description	n	Standard dosages according to literature	n Appropriate dosage	n Subdosage	n Overdosage
A	BP	Right	2	Penicillin 60-120 mg/kg /day. Every 8 hours; Chloramphenicol 50-100 mg/kg /day; Cefixime: 5-20 mg/kg /day; Ceftriaxone: 50-100 mg/kg /day. Every 12 hours; Cefotaxime: 50-200 mg/kg /day	2	-	-
Cf	BP	Right	23		23	-	-
Cr	BP	Right	1		1	-	-
Cf to Ce	BP	Right	9		8	-	1
Cr to Ce	BP	Right	1		-	1	-
Cd	BP	Right	1		-	1	-
Cf to Ce to Cx	BP	Right	1		1	-	-
Cf & Cx	BP	Right	2		-	-	-
Cf & G	BP	Right	3		2	-	-
A & G	BP	Right	1		-	-	3
Cf & Cx to Ce	BP	Right	1		-	-	1
Cf & G to Cx	BP	Right	2		1	-	-
Cf & G to A	BP	Right	1		-	-	-
Cf & G to Ce	BP	Right	4		-	-	2
A & Cf to M	BP	Right	1		-	-	-
Cf to A & G to Ce	BP	Right	1		-	-	1
Cf to A	BP	Right	1		-	-	-
Cf-M-Ce-Cr–Ce	BP	Right	1		1	-	3
A	TF	Right	1		-	-	-
Cr	TF	Right	11		-	-	1
Cr	TF	Right	1		-	-	-
Cr to Ce	TF	Right	8		-	-	1
Cf to Cr	TF	Right	1		-	-	-
Ce to Ch	TF	Right	1		-	-	-
Ch to Cf	TF	Right	1		1	-	-
Ch & Cr	TF	Right	1		-	1	-
Ce	BP+TF	Right	2		-	-	-
Cr	BP+TF	Right	4		-	-	1
Cf	BP+TF	Right	4		5	-	7
Cf to Cr	BP+TF	Right	3		1	-	-
Cr to Ce	BP+TF	Right	3		4	3	-
T to Cr	BP+TF	Right	1		1	-	-
Total	98	Total	98	Total	64	11	23
%	100	%	100	%	65.31	11.22	23.47

A: Ampicillin; Cd: Cefadroxil; Ce: Cefixime; Cf: Cefotaxime; Ch: Chloramphenicol; Cr: Ceftriaxone; Cx: Cloxacillin; G: Gentamicin; M: Meropenem; T: Thiamphenicol

Table IV shows the review of the accuracy of the method and time interval of drug administration. Results of the analysis showed that the method of antibiotic administration was 100% correct, while as many as 56.12%, the time interval of antibiotic administration was improper (Katzung *et al*., 2011). It may indicate a deficiency in the rationality of antibiotics administration. This can also be caused by nurses administering

medication, not according to the schedule. The method of administering antibiotics should be adjusted to the condition of the patient because there are pediatric patients who cannot use drugs orally. Antibiotic is drugs with a specific time interval of administration, generally expressed as every 6 hours, every 8 hours, every 12 hours, or every 24 hours. The time interval of antibiotic administration should be appropriate because each antibiotic has a different half-life and duration of action, as well as its levels in the blood, should be maintained to achieve the desired therapeutic effect (Levison & Levison, 2009).

Table IV. Review of the accuracy of the route and time interval of drugs administration

Antibiotic name	Accuracy of the route of drug administration			Accuracy of the time interval of drug administration			
	Route of drug administration	Description	n	Standard time interval of drug administration according to literature	n Right time interval administration	n Improper time interval administration	n No description
A	P	Right	3	Every 6 or 8 hours	1	2	-
A & G	P	Right	1	Every 6 hours & per 24 hours	1	-	-
A & Cf to M	P	Right	1	Every 6 hours & 8 hours to every 8 hours	-	1	-
Ce	O	Right	2	Every 12 hours	1	1	-
Ce to Ch	O to O/P	Right	1	Every 12 hours to every 6 hours	-	1	-
Cr	P	Right	16	Every 24 hours	10	4	2
Cr to Ce	P to O	Right	12	Every 24 hours to every 12 hours	6	6	-
Cf	P	Right	28	Every 8 hours	13	13	2
Cf to Ce	P to O	Right	9	Every 8 hours to every 12 hours	-	9	-
Cf to Ce to Cx	P to O to P	Right	1	Every 8 hours to every 12 hours to every 6 or 8 hours	-	1	-
Cf to Cr	P	Right	4	Every 8 hours to every 24 hours	2	2	-
Cf to A	P	Right	1	Every 8 hours to every 6 or 8 hours	-	1	-
Cf & Cx	P	Right	2	Every 8 hours & every 6 or 8 hours	-	2	-
Cf & G	P	Right	3	Per 8 hours & per 24 hours	-	3	-
Cf & Cx to Ce	P & P to O	Right	1	Every 8 hours & every 6 or 8 hours & every 12 hours	-	1	-
Cf & G to Cf & Cx	P	Right	2	Every 8 hours & every 24 hours to every 8 hours & every 6 or 8 hours	-	2	-
Cf & G to A	P & P to P/O	Right	1	Every 8 hours & every 24 hours to every 8 hours	-	1	-
Cf & G to Ce	P to O	Right	4	Every 8 hours & every 24 hours to every 12 hours	1	3	-
Cf to A & G to Ce	P to P & P to O	Right	1	Every 8 hours to every 6 or 8 hours & every 24 hours to every 12 hours	-	1	-
Cf-M-Ce-Cr-Ce	P-P-O-P-O	Right	1	Every 8 hours-every 8 hours-every 12 hours-every 24 hours-every 12 hours	-	1	-

Cd	P/O	Right	1	Every 8 hours	1	-	-
Ch to Cr	O/P to P	Right	1	Every 6 hours to every 24 hours	1	-	-
Ch & Cr	O/P & P	Right	1	Every 6 hours & per 24 hours	1	-	-
T to Cr	P/O to P	Right	1	Every 6 hours to every 24 hours	1	-	-
Total	98	Total	98	Total	39	55	4
%	100	%	100	%	39.80	56.12	4.08

A: Ampicillin; Cd: Cefadroxil; Ce: Cefixime; Cf: Cefotaxime; Ch: Chloramphenicol; Cr: Ceftriaxone; Cx: Cloxacillin; G: Gentamicin; M: Meropenem; T: Thiamphenicol; O: Oral; P: Parenteral

CONCLUSION

The use of antibiotics at children inpatient ward in one of general hospital in Cimahi during the period January to March 2017 in patients with bronchopneumonia, typhoid fever, and typhoid fever + bronchopneumonia is not 100% rational referring to the criteria of right diagnosis, right indication, right drug of choice, right dosage, right method and time interval of drug administration.

APPROVAL OF ETHICS

The Health Research Ethics Committee of the Faculty of Medicine of University of Padjadjaran (Reference number: 624/UN6.C10/PN/2017) has approved this research.

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