

Evaluation of Antibiotic Prescription in Community-Acquired Pneumonia Patients with Gyssens Method

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Submitted: 15-08-2023

Accepted: 25-08-2023

ABSTRACT: Pneumonia is inflammation of the lung parenchyma caused by microorganisms with a high mortality rate. The key therapy for pneumonia is the administration of antibiotics. Improper use of antibiotics can lead to less effective treatment, decreased drug safety, high resistance, and high treatment costs. This study aims to qualitatively evaluate the use of antibiotics in community-acquired pneumonia patients at Dr. M. Djamil Padang for the January-December 2021 period based on the Gyssens method. This non-experimental, cross-sectional study uses retrospective data from patient medical records. Of 26 patients who met the inclusion criteria, 12 (61.54 %) demonstrated appropriate and rational use of antibiotics. Irrational use of antibiotics was found in categories IVA, IIIB, and IIIA (15.38 %), 3 (11.54 %), and 2 patients (11.54 %) respectively.

Keywords: antibiotic, gyssens, community-acquired pneumonia

I. INTRODUCTION

One of the modern health problems is antimicrobial resistance (AMR) caused by inappropriate use of antibiotics. AMR is associated with high mortality in Europe and worldwide (1,2). Infection of the lower respiratory tract is a disease with the highest mortality rate associated with antimicrobial resistance, with a mortality rate of 1.5 million people (2).

Community-Acquired Pneumonia (CAP) is a lower respiratory tract infection disease with a high number of sufferers and mortality rates (3–5). In Indonesia, the number of pneumonia sufferers continues to increase, with the number of geriatric sufferers as much as 15.5%. Padang is one of the top five cities in West Sumatra with pneumonia sufferers(6). In 2019, the number of cases of pneumonia sufferers in Padang City was 2.723 cases

(7). Pneumonia is the most common reason for prescribing antibiotics in hospitalized patients(8).

Improper prescribing of antibiotics can increase the incidence of AMR. In general, Indonesia is one of the countries with poor quality antibiotic prescribing. Research by Fakhrunnisa et al., 2020 shows that 98.3% of inappropriate antibiotic prescribing in health facilities(9). In two out of three visits to drug outlets, at least one type of antibiotic is given to patients without a prescription (10). In a multicenter study, the use of antibiotics was very high. However, documentation and adherence to the guidelines are still poor (8).

There is a significant relationship between the rationality of antibiotic prescription and patient outcomes, making it essential to evaluate the use of antibiotics(11,12). One of the methods used to assess the accuracy of the use of antibiotics is the Gyssens flowchart. This method has been approved by the Ministry of Health of the Republic of Indonesia and is one of the indicators for assessing the quality of antibiotic use in hospitals. The Gyssens flowchart was introduced in 1992 and used to evaluate all aspects of antimicrobial prescribing (13). This study aims to evaluate the empirical use of antibiotics, as an effort to update and improve the quality of care in hospitals. This method is specific and comprehensive and includes timeliness, route, administration interval, dose, duration, spectrum, toxicity, effectiveness, and indications for the use of antibiotics (14).

II. MATERIALS AND METHODS

This is non-experimental, descriptive research with a cross-sectional method. The data were taken from medical records of inpatient community pneumonia patients at RSUP DR. M. Djamil Padang in the January-December 2021 period. The sample in this study were all CAP

inpatients with or without comorbidities who received empirical antibiotic therapy in the Internal Medicine Ward of RSUP Dr. M. Djamil Padang in January-December 2021; with age ≥ 18 years old, and patients with complete and legible medical records. Patients who were diagnosed with other infectious diseases were excluded from this study.

Data collection using the consecutive sampling method based on inclusion criteria in the medical records room of RSUP Dr. M. Djamil

Padang. The initial data includes patient data (name, age) and the indication for antibiotics (diagnosis). Furthermore, patient laboratory data, antibiotic dose, length of time given, and route of administration were also needed. An assessment of the suitability of giving antibiotics was carried out. The evaluation of the use of antibiotics was carried out using the Gyssen method based on the guidelines for CAP patients.

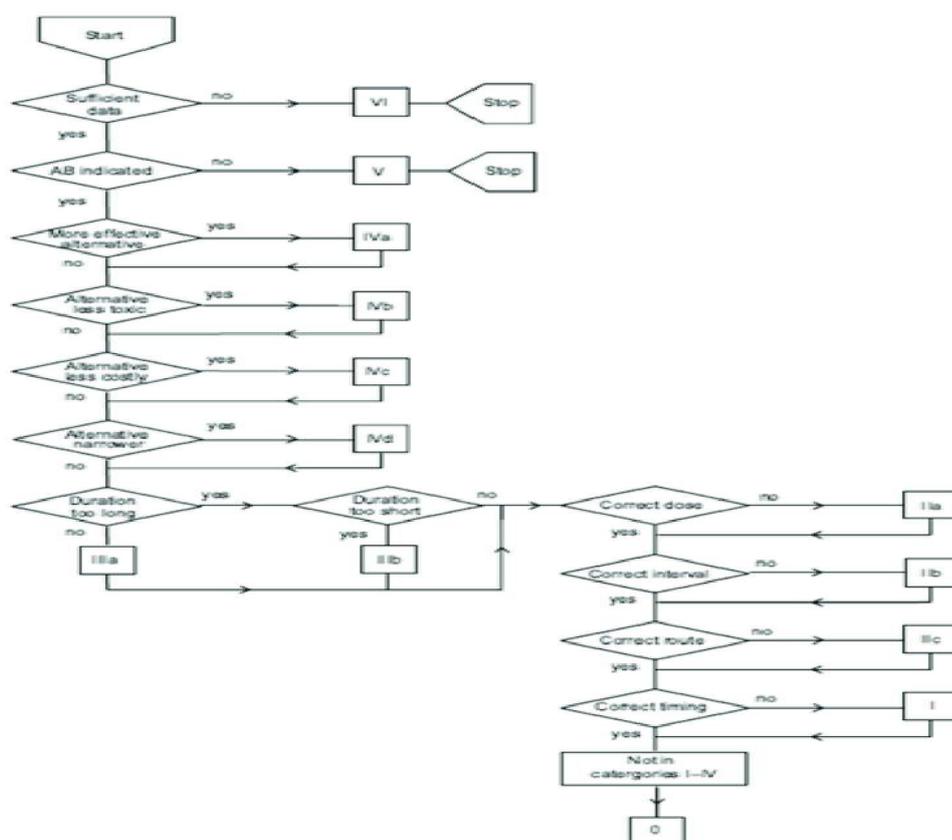


Figure 1. Figure 1 Flow Chart for Evaluation of Antibiotic Prescription(13)

III. RESULT AND DISCUSSION

This study evaluated the quality of antibiotic use in community-acquired pneumonia patients. The evaluation was carried out using the Gyssens method which assessed the accuracy of indications, the accuracy of selecting antibiotics based on effectiveness, toxicity, price, antibiotic spectrum, duration of administration, doses, intervals, routes, and time of administration. This research has passed an ethical review with letter number LB.02.02/5.7/67/2022 by the Health Research Ethics Committee of RSUP Dr. M. Djamil Padang. Based on the research conducted, there

were 65 patients with community-acquired pneumonia and 26 patients who met the inclusion and exclusion criteria. Patient demographic data can be seen in Table 1.

Patient characteristics data include gender, age, and length of patient stay in the hospital. From the total of 26 patients, the number of male patients was more than female. Based on age category, most patients were in the age range >65 years, with the average age of patients in the study being 64.65 years. Several studies have shown that the incidence of CAP is more in males (15,16). In terms of age, CAP is more common in older patients aged ≥ 65

years (16). In a study in three hospitals in Indonesia with a sample size of 151, the number of male

patients was higher (64.2%) (17).

Table 1. Patient characteristic

Characteristic		Total (n=26)	Percentage(%)	Mean ± SD
Gender	Man	14	53.85	-
	Woman	12	46.15	
Age (years)	12-25	1	3.85	64,65 ± 15,68
	26-45	2	7.69	
	46-65	11	42.31	
	>65	12	46.15	
Co-morbidity	Yes	26	100%	-
	No	0	0%	
Length of stay	<5 days	5	19.23	9,54 ± 5,74
	6-10 days	13	50	
	11-15 days	6	23.08	
	>16 days	2	7.69	

The high number of CAP in male patients can be associated with lifestyle, namely smoking and alcohol use. Pathophysiologically, CAP is supposedly caused by the transfer of germs from the oro and nasopharynx to the lower respiratory tract. Cigarettes can damage the epithelium of the upper respiratory tract, making it easier for pathogens to enter and infect the lungs (15).

CAP is a problem commonly found in elderly patients (18). The incidence of CAP increases with age (19). The increase in the incidence of CAP is caused by a decrease in body functions in elderly patients, including the ability of immunity to disease. The body's defense against lower respiratory tract infections consists of mechanical defenses such as coughing, the barrier function of mucus and epithelium, and mucociliary clearance. It is also strengthened by the presence of an immune response against foreign substances. Decreased lung elasticity and muscle strength cause decreased cough reflex and mucociliary clearance.

This results in the accumulation of germs and foreign bodies that can infect the lungs (20). In elderly patient, an increase in the number of cases of CAP can also be caused by comorbid factors such as chronic respiratory disease (COPD), congestive heart failure, DM, and kidney failure (21).

The average length of stay of patients in the hospital was 9.54 days. Age and comorbidities will affect the outcome of CAP patients (18,19). In another study by Suted-Wimer et al., (2012) at several hospitals in Switzerland, the average length of patient care was 9.8 days. Several independent factors that affect the patient's length of stay are age, respiratory rate >20 pm, nursing home residence, chronic pulmonary disease, diabetes, multilobar CAP, and the pneumonia severity index class(22). In another study, clinical factors that affected patient length of stay were hypoxemia, anemia, neoplastic disease, and complications (23). The patient's length of stay will be directly related to the medical costs incurred for patient care (22,23)

Table 2. Distribution of antibiotics used in CAP patients

No	Classification	Antibiotic	No. of antibiotics administered	(%)
1	Cephalosporins	Ceftriaxone	10	21,74%
		Cefoperazone	1	2,17%
		Cefepime	2	4,35%
2	Macrolides	Azithromycin	7	15,22%
3	Flouroquinolones	Levofloxacin	16	34,78%
		Moxifloxacin	2	4,35%
4	Carbapenems	Meropenem	5	10,87%
5	Penicillins	Ampicillin-sulbaktam	2	4,35%

6	Aminoglycosides	Amikacin	1	2,17%
Total			46	100%

Based on antibiotic classification, the most widely used antibiotics were fluoroquinolones (39.13%), followed by cephalosporins (28.26%) and macrolides (15.22%). Based on the type, the most widely used antibiotic was levofloxacin (34.78%) (table II). Levofloxacin works by inhibiting DNA gyrase and topoisomerase IV enzymes in bacteria. Inhibition of these enzymes will cause disturbances in bacterial DNA replication, transcription, repair, and recombination. Levofloxacin is one of the antibiotics used in respiratory tract infections because the drug can penetrate well into the extracellular and intracellular compartments of the lungs (24).

The results of the Gyssens analysis showed 61.54% rational (category 0) and 38.46% irrational use of antibiotics (category I-IV). The problem of antibiotic therapy found in category IVA (more effective alternative) at 15.38%, category IIIB (duration too short) and IIIA (duration too long), both at 11.54%. In this study, the evaluation was carried out based on the Guidelines Perhimpunan Dokter Paru Indonesia (PDPI)(24,25), The American Thoracic Society (ATS) Guidelines (2019)(26), Guidelines of Antibiotics Use in Dr. M. Djamil Padang and other supporting guidelines. Medication-related information was obtained from the Drug Information Handbook and websites (drugs.com and medscape.com).

Table III. Evaluation of antibiotic used in CAP patients based on Gyssens Criteria

Gyssens criteria	Amount (n)	Percentage (%)
Category 0	16	61,54%
Category I	-	-
Category IIA	-	-
Category IIB	-	-
Category IIC	-	-
Category IIIA	3	11,54%
Category IIIB	3	11,54%
Category IVA	4	15,38%
Category IVD	-	-
Category V	-	-
Total	26	100%

The patient's medical record data were considered complete (category VI), and the selection of antibiotics for empiric therapy in CAP patients is appropriate (category V, category IVD). There are no problems related to price (category IV) and dosage regimens (category I-, category IIA-C). The dosage regimen was evaluated by tailoring the dose, regimen, interval, and time of administration according to the clinical conditions of each patient.

Four patients stopped in the IVA category. Based on the guidelines, the choice of antibiotics for inpatients with CAP is a respiratory fluoroquinolone (levofloxacin 750 mg, moxifloxacin) or β -lactam plus a macrolide. For intensive inpatients, the choice of antibiotics is β -lactam (cefotaxime, ceftriaxone, or ampicillin-sulbactam) plus a new macrolide or intravenous respiratory fluoroquinolone (25,26). Factors that

influence the selection of empirical antibiotics include causative bacteria, the pattern of bacterial germs, medication effectiveness, risk factors for antibiotic resistance, and comorbid factors (25).

Another problem is the duration of antibiotic therapy. For CAP patients, antibiotic therapy is given for at least five days. Generally, the patient received antibiotics for 7-10 days and extended in patients with ineffective initial therapy, extrapulmonary infections, unusual germs, necrotizing pneumonia, emphysema, or abscess (26). Three patients received antibiotic therapy for less than ≤ 2 days and more than ≥ 11 days each. A bacterial culture is necessary to determine definitive antibiotics for patients with prolonged empirical antibiotics therapy or ineffective therapy (25,26).

The results of other studies show that there are still many inaccuracies in antibiotic use in

CAP patients. Research by Hardiana et al., (2021) stated that 28 out of 43 patients received rational antibiotics (27). Another study conducted by Rumende et al., (2019) in three hospitals found that only 25.2% of antibiotics used were included in category 0 while the rest were inappropriate (categories I-IV) (17). Improper use of antibiotics will cause disadvantages to the patients in terms of cost, medication side effects, and the risk of antibiotic resistance. It will also impact the morbidity and failure of therapy. The accuracy of giving antibiotics is also closely related to patient outcomes (27).

There are several limitations in this research. The study was retrospective and based on medical record data only. Researchers cannot confirm, intervene, and recommend antibiotic selection.

IV. CONCLUSION

In this study, health workers played a supervisory role regarding the use of antibiotics in CAP patients at the hospital. Appropriate administration of antibiotics can affect patient outcomes and also reduce the likelihood of the incidence of antibiotic resistance.

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