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Qualitative Analysis of Antibiotic Use in Community Acquired Pneumonia Cases in Inpatients at a Government Hospital Batam City

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A R T I C L E I N F O

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A B S T R A C T

Community Acquired Pneumonia (CAP) is caused by pathogenic infections such as bacteria and fungi acquired outside the hospital, the main therapy given to pneumonia patients is antibiotics. The irrationality of antibiotics will lead to antibiotic resistance. This study aims to determine the description and evaluation of the appropriateness of antibiotic use in CAP patients in inpatient a government hospital Batam period January 2023 to December 2023 using the PPAB 2021, IDSA 2019 and PDPI 2021 therapy guidelines. This research method is cross-sectional with a retrospective data collection technique using medical records, descriptive data analysis. The results of the study of 34 samples of the description of the use of antibiotics that were most often prescribed were Ceftriaxone at 35.28%. The results of the evaluation of accuracy based on the PPAB 2021, IDSA 2019 and PDPI 2021 guidelines obtained the correct type of antibiotic of 85.3%, the correct dose of 91.2%, the correct route and time of administration of 100% and the correct interval of administration of 82.4%.

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INTODUCTION

Inflammation and infection of the lung tissue is a sign of pneumonia. It can occur due to various microorganisms, such as fungi, bacteria, parasites, viruses, chemical exposure or physical damage to the lungs. Fever, dry cough and tightness, weakness or difficulty breathing are common symptoms of pneumonia. (PDPI, 2020). Community Acquired Pneumonia causes very high morbidity and mortality in adults (Welte, T., Torres, A., Nathwani, 2020). According to Our World in Data (2019), Southeast Asia has the highest pneumonia mortality rate. Mortality data in Indonesia reached 2,898 cases in the age range of 15-49 years and 9,531 cases in the age range of 50-69 years, indicating a much larger number of cases in this age range.

Antibiotics are used to treat pneumonia. Often, a major problem in antibiotic therapy is irrational use. In general, irrational treatment has the potential to increase disease-related morbidity and mortality. In particular, drug irrationality can lead to antibiotic resistance, excessively high healthcare expenditure and various adverse effects. (Ministry of Health, 2018b).

Microbial resistance to antibiotics has developed into a significant health problem worldwide, with various negative effects that can threaten the quality of healthcare. Selection pressure caused by antibiotic use and the spread of resistant bacteria correlate with the emergence and development of resistant microorganisms. Effective infection control can stop the spread, and prudent use of antibiotics can reduce the selection pressure of resistance. (Ministry of Health, 2021).

The Indonesian Ministry of Health has reported that a significant percentage of antibiotics, ranging from 40-62%, are used in an inappropriate manner. In addition, around 30-80% of antibiotics are not given according to the recommended indication, potentially leading to bacterial resistance to antibiotics. The use of antibiotics in violation of regulations and non-compliance with health facility requirements in hospitals and health centres may be the cause. (Arrang, S.T., Cokro, F., & Sianipar, 2019)..

Based on 2018 information, the prevalence of pneumonia increased by 2% or more in Indonesia (Ministry of Health, 2018a). Based on information from the 2019 Indonesian Health Profile, there were 468,172 cases of pneumonia in Indonesia (Ministry of Health R1, 2019). In accordance with information from the Ministry of Health of the Republic of Indonesia in 2020, there were 309,838 cases of pneumonia in Indonesia (Ministry of Health RI, 2020). Based on information from 2022, there were 278,261 cases of pneumonia in Indonesia (Ministry of Health, 2022).

According to the 2018 Riau Islands Province Riskesdas Report, the prevalence of pneumonia reached 3.36%, which is 11,698 cases of pneumonia based on diagnosis by health workers (doctors, nurses or midwives) or symptoms that have been experienced by the patient. (Indonesian Ministry of Health, 2019). Based on information from the Batam City Health Office on 18 January 2024, the number of pneumonia cases in Batam City reached 2,536 people in 2023. (Batam, 2024).

Based on this background, the researcher is interested in conducting a study on the Evaluation of Antibiotic Use in Community Acquired Pneumonia (CAP) Patients in the Inpatient Installation of the a government hospital in 2023 based on standard therapy guidelines such as the Guidelines for the Use of Antibiotics (PPAB) 2021, Infectious Diseases Society of America (IDSA) 2019 and the Indonesian Lung Doctors Association (PDPI) 2021.

LITERATURE REVIEW

Acute respiratory tract infection that primarily affects the lungs is called pneumonia. Alveoli are small sacs found in the respiratory system of healthy people, which expand when air is inhaled. The accumulation of pus and fluid in the alveoli, leading to breathing problems and low oxygenation, is a medical condition known as pneumonia (WHO, 2021). Symptoms of this condition can vary in severity and include a variety of manifestations such as fever, chills, cough with or without mucus and difficulty breathing. Age, general health and the source of the infection all affect the severity of pneumonia. Pneumonia is a disease that develops when bacteria and fungi infect the alveoli in the lung tissue and cause swelling and inflammation. Pneumonia is an inflammation of the lungs caused by viruses and bacteria. It is characterized by high fever, cough with phlegm, rapid breathing (more than 50 times per minute), shortness of breath and other symptoms such as headache and decreased appetite. (WHO, 2021)

Etiology Pneumonia can be caused by bacteria, mycoplasma, viruses or fungi. Based on the cause, pneumonia can be classified into four categories, namely fungal pneumonia, viruses, bacteria or typical pneumonia. Pneumonia caused by bacteria includes Streptococcus pneumonia, Hemophilus influenza and Pneumococcus pneumonia. Pneumonia caused by Mycoplasma, such as Pneumocytis, Chlamidia trachomatis and Mycoplasma pneumonia, is commonly known as typical pneumonia. Fungal pneumonia is pneumonia that often develops as a secondary infection, especially in patients with weakened immune systems. Viral pneumonia is pneumonia caused by viruses, such as influenza virus, adenovirus or respiratory syncitial virus. In addition to these etiologies, individuals who smoke, drink alcohol, have diabetes, COPD (Chronic Obstructive Pulmonary Disease) or both, as well as those who experience decreased immune function, are at risk of developing pneumonia (Farasia, 2020). Pathophysiology of Pneumonia bacteria that enter the upper respiratory system and travel through the bronchioles and alveoli are the pathophysiology of pneumonia (Hasan and Arusita M, 2017). Once inside, bacteria have the ability to trigger an infection reaction and produce protein-rich edema fluid. From the alveoli, pneumococcal bacteria can attack every segment and lobe. Leukocytes and erythrocytes also increase, filling the alveoli with edema fluid consisting of fibrin, erythrocytes and leukocytes. Pneumonia can be classified into four, namely Community Acquired Pneumonia (CAP), Hospital Acquired Pneumonia (HAP), Ventilator Associated Pneumonia (VAP) and Health Care Associated Pneumonia (HCAP). Signs and Symptoms of

Pneumonia include fever, chills, nausea and loss of appetite, thick and productive cough, shortness of breath, rhonchi, weakness or fatigue, orthopnea.

Antibiotic Prescribing Patterns : Commonly Used Antibiotics : Ceftriaxone, fluoroquinolones, and azithromycin were frequently prescribed. However, inappropriate use was common, with significant deviations from recommended guidelines. Empirical Therapy: Empirical antibiotic therapy was prevalent, often without de-escalation even after culture results were available, leading to higher mortality rates (Price AS, 2016).

METODOLOGY

This study is a descriptive observational study using a cross sectional study design using a retrospective data collection method of medical records of patients with confirmed Community Acquired Pneumonia (CAP) who underwent hospitalisation at the a government hospital from January 2023 to December 2023. The sample in this study was the population that met the inclusion and exclusion criteria.

The inclusion criteria in this study were non-ICU inpatients who had been diagnosed with Community Acquired Pneumonia and received antibiotic therapy, adult Community Acquired Pneumonia patients >18 years old, patients with or without comorbidities, had medical record data with complete patient data (age, gender, clinical condition, diagnosis, date of admission, date of discharge) and antibiotic data (drug name, dose, route, time and interval of administration). The exclusion criteria for this study were medical records of patients with Community Acquired Pneumonia who died or were referred to other hospitals, patients with infectious diagnoses other than Community Acquired Pneumonia, patients discharged at their own request before being declared cured, patients with incomplete medical record data.

Data were collected on the characteristics of CAP patients based on gender and age. The data that has been collected is then analysed descriptively in the form of percentages and presented in tabular form. Evaluation of the accuracy of antibiotic use is reviewed based on the accuracy of the selection of antibiotic type, dose, route, time and interval of antibiotic administration based on therapeutic guidelines, namely PPAB 2021, IDSA 2019 and PDPI 2021. Data were processed using Microsoft Excel and the results of data analysis were presented in tabular form with descriptive descriptions.

RESULTS AND DISCUSSION

Patient Characteristics

The medical record data of CAP patients used in this study amounted to 34 medical records that met the inclusion criteria in the period January - December 2023. The characteristics of CAP patients are listed in Table 1 as follows.

Table 1. Characteristics of Gender and Age of CAP Patients in the Inpatient Installation of a Government Hospital Batam period 2023

Characteristics	Total (n=34)	(%)
Gender		
Male	14	41
Women	20	59
Age category		
17-25 years old	0	0
26-35 years old	7	20,6
36-45 years old	5	14,7
46-55 years	7	20,6
56-65 years	7	20,6
>65 years	8	23,5

Source: Age Category based on MOH RI 2009

Table 1 shows that the most common gender suffered by CAP patients is female as many as 20 patients (59%), while male gender is 14 patients (41%). The results obtained are similar to research at Makassar City Hospital which shows that female patients 52.7% have a higher percentage compared to men (Sukriya et al., 2022). (Sukriya et al, 2022). Community Acquired Pneumonia (CAP) has historically been reported to occur more frequently in men than women. This is usually attributed to biological and behavioural differences between genders, such as higher exposure to risk factors in men (e.g. smoking). New research suggests that the incidence of CAP in women may be higher than previously thought. Research from the European Respiratory Society noted that although men have a higher risk of toxic habits and comorbidities, the frequency of Streptococcus pneumoniae pathogens causing CAP is higher in women. (Quero, 2017).

Based on age, 23.5% of CAP patients were aged >65 years and 20.6% occurred at the age of 46 - 65 years. Age plays an important role in the occurrence of CAP. In elderly patients, the prevalence of pneumonia patients increases approximately 2 - 4 times that which occurs at that age. This is due to a decrease in the level of the body's immune system as a person ages, starting when a person is 50 years old so that they can be easily attacked by infectious diseases. The older a person gets, the more susceptible they are to infectious diseases characterised by decreased lung function, which can reduce the effectiveness of respiratory system performance. This is caused by an increase in chest wall stiffness which makes it easier for pathogens to invade the lower respiratory tract and cause infections including pneumonia (Price AS, 2016).

Overview of Antibiotic Use

The description of antibiotic use in inpatient CAP patients at the Batam Corporate Hospital for the period January - December 2023 can be seen in Table 2.

Table 2. Overview of Antibiotic Use in CAP Patients at a Government hospital for the period 2023

Antibiotics	Total	Percentage (%)
Single Therapy		
Cephalosporin Group:		
• Ceftriaxone	12	35,28
• Ceftizoxime	5	14,7
• Ceftazidime	2	5,9
Fluoroquinolone group:		
• Moxifloxacin	6	17,64
• Levofloxacin	3	8,84
β-Lactam group:		
• Meropenem	1	2,94
Combination Therapy		
• Meropenem + Levofloxacin	1	2,94
• Ceftriaxone + Moxifloxacin	1	2,94
• Levofloxacin + Imipenem	1	2,94
• Ceftazidime + Levofloxacin	1	2,94
• Moxifloxacin + Imipenem	1	2,94
Total	34	100

Table 2 shows that the most widely used antibiotic is Ceftriaxone, a class III cephalosporin antibiotic which is a derivative of β-lactam with a percentage of 35.28%. Based on the results of this study, it shows similar results with research conducted by Pahriyani et al (2015) in RSUD Budi Asih Jakarta which showed the most antibiotics used were Ceftriaxone 52.73%. Likewise, the results of research by Farida et al (2017) in Surakarta Regional Referral Hospital, the most common antibiotic used in adult pneumonia patients was Ceftriaxone 66.12%.

Ceftriaxone has a longer half-life than the other cephalosporins so it can be given 1 to 2 times a day. Ceftriaxone is the most active cephalosporin class against penicillin-resistant pneumococcal strains. The dose of Ceftriaxone given is 1-2 g/day. Excretion of ceftriaxone is mainly through the bile ducts and no dose adjustment is required in conditions of decreased renal function. (Brunton L, 2018).

Evaluation of Antibiotic Use

The appropriateness of antibiotic use used to treat CAP patients at the Batam Corporate Hospital from January 2023 to December 2023 with the PPAB 2021, IDSA 2019 and PDPI 2021 guidelines can be seen in Table 3.

Table 3. Appropriateness of Antibiotic Use in CAP Patients at a government hospital Batam

Antibiotic Appropriateness for CAP Patients	Total	Percentage (%)
Types of Antibiotics		
Exactly	29	85,3
Inappropriate	5	14,7
Dosage		
Exactly	31	91,2
Inappropriate	3	8,8
Route		
Exactly	34	100
Inappropriate	-	
Time		
Exactly	34	100
Inappropriate	-	
Interval		
Exactly	28	82,4
Inappropriate	6	17,6

1. Correct selection of antibiotic type

   Appropriate selection of antibiotic types is the administration of drugs by considering the selection of antibiotic types that are in accordance with antibiotic use guidelines. (Nabila et al., 2021). Assessment in the accuracy of drug selection in this context is the selection of antibiotic types using standard guidelines, namely PPAB 2021, IDSA 2019 and PDPI 2021. Based on Table 3, 29 patients (85.3%) of CAP patients were found to have the right type and 5 patients (14.7%) were inappropriate. Inaccuracy occurs because the therapy given by the patient is not in accordance with the guidelines used, as is the case with Ceftizoxime given to inpatient CAP patients not in accordance with the recommendations given by the therapeutic guidelines used.
2. Correct Antibiotic Dose Selection

   Based on Table 3, 31 patients (91.2%) were categorised as appropriate doses and 3 patients (8.8%) were inappropriate. The dose accuracy in CAP patients is due to the doses given in the therapeutic dose range based on PPAB 2021, IDSA 2019 and PDPI 2021, namely Levofloxacin 750 mg, Ceftriaxone 1-2 g, Ceftazidime 1- 2g, Moxifloxacin 400 mg, Meropenem and Imipenem 500 mg-1g. The results of the study showed that there were 3 patients who needed dose adjustments, namely adjusting the dose of Ceftriaxone which was declared inappropriate because the dose of Ceftriaxone with the interval was excessive, Ceftriaxone was given 2x2 g in one day. According to PPAB 2021, IDSA 2019 and PDPI 2021, the dose of Ceftriaxone is 1-2 g in one day, so the Ceftriaxone dose is not included in the usual dose.

3. Appropriate Antibiotic Route Selection

   Based on Table 3, the results showed the correct route of antibiotic administration with a percentage of 100% with the route used was intravenous (IV). The route of administration is chosen based on the location of the infection and its efficiency. Intravenous administration of antibiotics can be considered in patients with moderate to severe infections. (Ministry of Health, 2011). In addition, intravenous administration is also required when the patient is unconscious, unable to swallow, dehydrated or in shock. The intravenous route of administration is carried out so that antibiotics can directly enter the systemic circulation and be distributed to infected tissues, so that it is hoped that the effect of antibiotic action and the healing process is maximised. (Lestari et al., 2017).

4. Timing of Antibiotic Administration

   Based on Table 3, the results showed timely administration of antibiotics with a percentage of 100%. To ensure the effectiveness of treatment and reduce the risk of complications, antibiotics must be given to CAP patients on time. Antibiotics for CAP are usually given according to a prescribed dosage schedule, either orally or intravenously. For oral treatment, the dose is usually given regularly every 8 or 12 hours, depending on the type of antibiotic and the instructions given by the doctor. Intravenous (IV) antibiotic administration in hospitals is generally done on a stricter schedule, often every 6 to 8 hours, to ensure optimal concentration of the drug in the blood and address the infection quickly. (Ferreira, 2020).

5. Appropriate Selection of Antibiotic Administration Interval

   Based on Table 3, the results of the assessment of the accuracy of antibiotic use intervals in CAP patients showed that 28 patients were categorised as appropriate (82.4%) while 6 patients were inappropriate (17.6%). Inappropriate intervals or frequency of administration were found in patients who used Moxifloxacin antibiotics, namely 2x400 mg in one day. According to the PPAB 2021, IDSA 2019 and PDPI 2021 guidelines, the interval for giving Moxifloxacin is 1x administration in one day. So that giving 2x a day is considered inappropriate. For therapeutic effectiveness and infection management, the selection of antibiotic administration intervals in CAP patients should be done correctly. The antibiotic schedule or interval should be adjusted according to the pharmacokinetics and pharmacodynamics of the drug, as well as the severity of pneumonia. Oral antibiotic doses usually change every 8 to 12 hours, depending on the type of drug and the patient's condition. (Oktaviani, Wahyono and Yuniarti, 2015).. However, in hospitalised patients with severe pneumonia, intravenous (IV) antibiotics may be given more frequently, e.g. every 6 to 8 hours, to ensure adequate blood levels of the drug and a rapid response to the infection (Kristiani et al., 2019).

CONCLUTIONS AND RECOMMENDATIONS

Conclutions

Based on the results of a study on the evaluation of antibiotic use in patients with Community Acquired Pneumonia (CAP) in the Inpatient Installation of the Batam Business Entity Hospital for the period January 2023 to December 2023, the characteristics of CAP patients inpatients at a Government Hospital Batam were mostly suffered by female patients (59%), age group >65 years (23.5%), the most widely used antibiotic description is Ceftriaxone (35.28%) and evaluation of the accuracy of antibiotic use based on guidelines obtained the right type of antibiotic by 85.3%, the right dose by 91.2%, the right route and time of administration by 100% and the right interval of administration by 82.4%.

Recomendations

This study is only an initial evaluation of the picture of antibiotic drug use in one location. We recommend conducting similar studies in different locations (hospitals, cities, countries) so that the results can be compared

ADVENCED RESEARCH

Still conducting further research to gain deeper insights into the Qualitative Analysis of Antibiotic Use in Community Acquired Pneumonia Cases in Inpatients at a Government Hospital Batam City

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