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Rationality of Antibiotic Use on Pneumonia Patients at dr. Doris Sylvanus Hospital Palangkaraya in 2022

Studi Rasionalitas Penggunaan Antibiotik Pasien Pneumonia RSUD dr. Doris Sylvanus Palangka Raya Tahun 2022

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Abstract

Pneumonia can be defined as a condition when a microorganism triggers inflammation of the lung parenchyma. The bronchioles and alveoli will be filled with inflammatory leukocyte exudate and fluid, causing respiratory difficulties and symptoms such as coughing, dyspnea, chest pain, and shock in severe cases. Pneumonia infections caused by bacteria can be treated with antibiotics. Bacterial patterns and sensitivity test results available at the hospital are used as a guide in selecting empiric therapy given to patients. Diagnostic limitations in differentiating viral and bacterial pathogens in pneumonia have led to increased use of antibiotics and contributed to the growth of antibiotic resistance. This research aims to determine the rationality of antibiotic use in pneumonia patients' resistance at RSUD dr.Doris Sylvanus Palangka Raya in 2022. A descriptive observational approach using a cross-sectional method was used to examine the medical records of pneumonia patients. Antibiotics commonly used by patients diagnosed with pneumonia at RSUD dr.Doris Sylvanus Palangka Raya in 2022 is Moxifloxacin with 153 patients (22.53%), then Levofloxacin with 143 patients (21.06%), and Ceftriaxone with 137 patients (20.18%). The total defined daily dose/100 days of antibiotics for pneumonia patients is 88.85 and according to the Gyssens criteria, the use of antibiotics is 82.62% rational.

Keywords: pneumonia; antibiotic; defined daily dose; gyssens criteria

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Abstrak

Pneumonia dapat didefinisikan sebagai kondisi ketika suatu mikroorganisme memicu peradangan pada parenkim paru. Bronkiolus dan alveoli akan terisi oleh eksudat leukosit inflamasi dan cairan sehingga menyebabkan kesulitan pernafasan dan gejala seperti batuk, produksi sputum, dispnea, nyeri dada, dan disfungsi pernapasan dan/atau syok pada kasus yang parah. Infeksi pneumonia yang disebabkan oleh bakteri dapat diobati dengan antibiotik. Pola bakteri dan hasil uji sensitivitas yang tersedia di rumah sakit digunakan sebagai pedoman dalam memilih terapi empiris yang diberikan kepada pasien. Keterbatasan diagnostik dalam membedakan patogen virus dan bakteri pada pneumonia telah menyebabkan peningkatan penggunaan antibiotik dan berkontribusi terhadap pertumbuhan resistensi antibiotik. Penelitian ini bertujuan untuk mengetahui rasionalitas penggunaan antibiotik terhadap resistensi pasien pneumonia di RSUD dr. Doris Sylvanus Palangka Raya pada tahun 2022. Observasi deskriptif dengan metode *cross-sectional* digunakan untuk memeriksa rekam medis pasien pneumonia. Antibiotik yang biasa digunakan oleh pasien yang terdiagnosis pneumonia di RSUD dr. Doris Sylvanus Palangka Raya pada tahun 2022 adalah *Moxifloxacin* sebanyak 153 pasien (22,53%), kemudian *Levofloxacin* sebanyak 143 pasien (21,06%), dan *Ceftriaxone* sebanyak 137 pasien (20,18%). Total *defined daily dose*/100 hari pemberian antibiotik pada pasien pneumonia adalah 88,85 dan menurut kriteria Gyssens penggunaan antibiotik rasional 82,62%.

Kata kunci: pneumonia; antibiotik; defined daily dose; kriteria Gyssens

Introduction

Pneumonia is a condition where the lungs become inflamed, which is the cause of death and is also one of the biggest health problems that must be overcome, so further research and studies regarding this problem need to be carried out. Every year, nearly 1 million children die of pneumonia worldwide and approximately about 15% of all deaths occur in children under the age of five. This means a loss of over 2500 children's lives every day or 100 children every hour.[1] In Indonesia, the scope of pneumonia discoveries in toddlers over the last 11 years seems quite fluctuating. The highest coverage in 2016 was 65.3%. In 2015-2019 there was a change in the estimated number of cases from 10% to 3.55%, this caused the coverage to be high that year. A significant decrease was seen in 2020-2021 compared to the coverage of the last 5 years. This decrease was caused by the impact of the COVID-19 pandemic, where there was a stigma towards COVID-19 sufferers which impacted the decrease in the number of visits by children with coughing or breathing difficulties at the health center. In 2019 the number of visits for children with coughing or difficulty breathing was 7,047,834 visits, in 2020 it was 4,972,553 visits, there was a 30% decrease from visits in 2019, and in 2021 it decreased again to 4,432,177, which ultimately had an impact on the discovery of pneumonia in children under five.[2] The coverage of pneumonia in children under five years old who were found and treated according to standards in

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Central Kalimantan Province in 2019 was 126 percent, much higher than in 2018, which was 72.3 percent.[3]

Pneumonia infections caused by bacteria can be treated with antibiotics. Bacterial patterns and sensitivity test results available at the hospital are used as a guide in selecting empiric therapy given to patients.[4] Diagnostic limitations in differentiating viral and bacterial pathogens in pneumonia have been a contributing factor in the growth of antibiotic resistance.[5] Ineffective use of antibiotics eventually also causes antibiotic resistance.[6] In fact, many studies have found that there is irrationality in the use of antibiotics which can slowly increase the risk of bacterial resistance to antibiotics.[7]

The exact cause of pneumonia can be determined by the results of laboratory examinations, before that the patient can be given initial treatment based on empirical pneumonia guidelines. Half of 21,825 patients discharged from 46 hospitals experienced excessive use of antibiotics after leaving hospital care.[8] The type of antibiotic use that extends beyond hospital discharge varies, based on the circumstances and includes excessive duration of pneumonia and unnecessary treatment of asymptomatic bacteriuria. Excessive use of antibiotics shows that prescribing culture, doctor's attitudes, or organizational processes play a role in irrational antibiotic prescribing. A number of studies have concluded that irrationality of the prescription and use of antibiotics in several hospitals in Indonesia is common and there has been bacterial resistance to various types of antibiotics.[9,10] This research aims to determine the rationality of antibiotic use in pneumonia patients' resistance at RSUD dr.Doris Sylvanus Palangka Raya in 2022.

Methods

The research was a descriptive observational study conducted cross-sectionally. The research population came from all patients diagnosed with pneumonia based on ICD 10 listed in the medical record data of the Medical Records Installation at dr. Doris Sylvanus Hospital Palangka Raya in 2022. The inclusion criteria in this study were outpatients and inpatients who had a complete diagnosis of pneumonia, aged ≥18 years, included data related to antibiotic use. The data collection procedure begins by opening the medical record data, taking data related to the characteristics and administration of antibiotics in terms of quantity and dose, interval, route and time of administration. In terms of quality, antibiotic administration will be assessed using the Gyssens flow chart, at each category level. The quantity of antibiotics is calculated using the formula for each type of antibiotic per patient and then the Defined Daily Dose (DDD)/100 days

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of hospitalization is obtained.[11]Only inpatient antibiotics use can be calculated with DDD method. Quantitative analysis was carried out in units of DDD / 100 days of patient care, using the formula:

$$\frac{Grams\ of\ Antibiotics\ used}{DDD\ WHO\ Standard} \times \frac{100}{Total\ Length\ of\ Stay}$$

All data obtained was ultimately analyzed using univariate analysis methods and then produced an overview of distribution, frequency and percentages. This research was carried out after receiving ethical review pass from The Committee of Medical Research Ethics of Faculty of Medicine Palangka Raya University on 26th of June 2023, with reference number 74/UN24.9/LL/2023. The Gyssens flow is used as an assessment flow to determine the quality category for each antibiotic used. Group 0 is in the rational category, groups I-VI is the irrational category.

Results

The research was carried out using secondary data in the form of medical records obtained from the Medical Records Installation section of RSUD dr. Doris Sylvanus. Pneumonia patients at RSUD dr. Doris Sylvanus Palangka Raya in 2022 who met the criteria were 626 people.

The Gyssens flow is used as an assessment flow to determine the quality category for each antibiotic used. Group 0 is in the rational category, groups I-VI is the irrational category. Gyssens flow is divided into several categories which are described as follows:

0	: appropriate/rational use
I	: not on time
IIA	: incorrect dose
IIB	: incorrect interval
IIC	: inappropriate method of administration
IIIA	: given too long
IIIB	: given too short
IVA	: there are other antibiotics that are more effective
IVB	: there are other antibiotics that are less toxic
IVC	: there are other antibiotics that are cheaper
IVD	: there are other antibiotics that are more specific
V	: use of antibiotics without indication
VI	: medical records are incomplete for Evaluation

Quantitatively, the Defined Daily Dose (DDD) method can be used. World Health Organization (WHO) has developed the Anatomical Therapeutic Chemical Classification (ATC) as a global standard for the study of drug use and reporting of drug reactions. DDD is commonly used to measure drug use in adults.

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Table 1 Characteristics of dr. Doris Sylvanus hospital Pneumonia Patients in 2022

Variable	Frequency (n)	Percentage (%)
Gender		
Male	371	59.27
Female	255	40.73
Installation		
Outpatient	147	23.84
Inpatient	479	76.52
Age		
17-25 years old	34	5.43
26-35 years old	51	8.15
36-45 years old	79	12.62
46-55 years old	122	19.49
56-65 years old	175	27.96
>65 years old	165	26.36

Table 2 dr. Doris Sylvanus hospital Pneumonia patients antibiotics Quality in 2022

Gyssens Criteria	Frequency (n)	Percentage (%)
O	561	82.62
I	0	0.00
IIA	44	6.48
IIB	15	2.21
IIC	2	0.29
IIIA	16	2.36
IIIB	10	1.47
IVA	0	0.00
IVB	0	0.00
IVC	0	0.00
IVD	31	4.57

Table 3 Antibiotics Quantitiy of dr. Doris Sylvanus hospital Inpatients Installation in 2022

Antibiotic	ATC Code	DDD/100
Moxifloxacin	J01MA14	18.66
Levofloxacin	J01MA12	12.62
Ciprofloxacin	J01MA02	0.30
Ceftriaxone	J01DD04	27.42
Cefotaxime	J01DD01	0.46
Ceftazidime	J01DD02	7.38
Cefixime	J01DD08	1.48
Cefoperazone	J01DD12	0
Meropenem	J01DH02	4.49
Imipenem	J01DH51	0.28
Azithromycin	J01FA10	1.40
Clindamycin	J01FF01	0.20
Vancomycin	J01XA01	12.52
Streptomycin	J01GA01	0
Amikacin	J01GB06	0.37
Ampicilin -Sulbactam	J01CR01	1.29

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Irrational use of antibiotics can result in various health consequences, namely healing inefficiency, increased morbidity and mortality, increased health care costs, and ultimately in the long term can trigger bacterial antibiotic resistance. The rational use of antibiotics is related to various aspects, including health workers, patients, and health services facilities.[12] Analysis of general practitioner interviews and scientific publications revealed that antibiotic selection is guided by four main factors, namely the causative bacteria, the patient's condition, the nature of the antibiotic, and the doctor's internal factors.[13] Identification of the causative bacteria is not easy in primary care, because general practitioners may not be able to carry out bacterial tests during consultations. Therefore they only use data from the patient's form symptoms and epidemiological data (for example the prevalence of the causative agent) to formulate a hypothesis regarding the most likely causative bacteria.

Discussion

Research conducted at the Medical Records Installation of RSUD dr. Doris Sylvanus Palangka Raya in 2022 analyzed 626 patients diagnosed with pneumonia who received antibiotic therapy. Among them, 53 patients were treated with a combination of more than one type of antibiotic. The most frequent diagnosis was ICD-10 J15.9 Bacterial Pneumonia, affecting 198 individuals (31.63%), followed by J18.9 Pneumonia, Unspecified, which accounted for 149 cases (23.8%). The use of the ICD classification system facilitates the comparison, interpretation, and analysis of diseases and health conditions according to international standards.

The majority of pneumonia patients receiving antibiotics were male, with 371 cases (59.27%), compared to 255 female patients (40.73%). The age group with the highest number of pneumonia cases was 56–65 years, comprising 175 patients (27.96%), followed by those aged over 65 years, with 165 cases (16.36%). This demographic trend aligns with other studies showing higher pneumonia rates in men and older adults. Gender-based differences in gut microbiota composition, immune response, lifestyle habits (e.g., smoking), and comorbidities contribute to this disparity. Additionally, the increased prevalence of pneumonia in older populations corresponds to the progressive decline in respiratory function and a weakened immune system.

In terms of antibiotic use, Moxifloxacin was the most frequently prescribed, given to 153 patients (22.53%), followed by Levofloxacin (143 patients, 21.06%) and Ceftriaxone (137 patients, 20.18%). These findings align with previous studies identifying fluoroquinolones as a commonly used antibiotic group due to their broad-spectrum efficacy against both Gram-positive and Gram-negative bacteria. These antibiotics act by inhibiting bacterial DNA replication and transcription, essential processes for bacterial cell survival. The prescription of these drugs

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adheres to empirical therapy guidelines established by the Ministry of Health and the Pulmonary Doctors Association.

Quantitative analysis using the ATC/DDD method revealed that Ceftriaxone had the highest defined daily dose (DDD) of 27.42, followed by Moxifloxacin (18.66 DDD) and Levofloxacin (12.62 DDD). These results are consistent with research conducted at RSU PKU Muhammadiyah Bantul in 2019, where Ceftriaxone was also widely used. Ceftriaxone, a third-generation cephalosporin, inhibits bacterial growth by disrupting peptidoglycan cross-linking in cell walls, a critical step catalyzed by penicillin-binding proteins. This feature enhances its efficacy against Gram-negative bacteria.

Quality analysis of antibiotic use based on the Gyssens criteria showed that 82.62% of antibiotic prescriptions for pneumonia patients at RSUD dr. Doris Sylvanus was rational. This figure contrasts with findings from other hospitals in Indonesia, where antibiotic use often tends to be irrational. Factors contributing to irrational use include errors in medical record documentation, interruptions in treatment due to patients failing to follow up, and limitations in ICD-based disease categorization, which can disrupt the continuity and retrospective analysis of patient history.

Conclusion

Pneumonia patients at RSUD dr. Doris Sylvanus Palangka Raya in 2022 was predominantly treated with Ceftriaxone, Moxifloxacin, and Levofloxacin. The total DDD/100 days of antibiotic hospitalization for these patients was 88.85, with 82.62% of antibiotic use classified as rational according to the Gyssens criteria.

Based on the findings, it is recommended that future research be conducted during different periods to enable a more comprehensive comparison of antibiotic usage patterns. Additionally, further studies should explore the relationship between antibiotic use and patient outcomes to provide deeper insights into treatment effectiveness and optimize clinical practices.

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