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Description of antibiotic therapy of hospitalized-community-acquired pneumonia in PKU Muhammadiyah Gamping hospital

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ABSTRACT

Long-term administration of IV antibiotics risks increasing treatment costs and patient morbidity, but until now, intravenous (IV) antibiotics are still the most comprehensive choice in treating community pneumonia inpatients in hospitals. The purpose of this study was to describe the use of antibiotics and duration of AB replacement from IV administration to oral administration (P.O) in community-acquired pneumonia (CAP) patients at PKU Muhammadiyah Gamping Hospital (PMGH). This study used a cross-sectional design. Data were collected prospectively by purposive sampling. Inclusion criteria were hospitalized patients with CAP who received AB IV therapy for 24-72 hours. Patients with lung cancer or sepsis were excluded. Data were collected from medical records, laboratory examination records, and drug administration. Data were analyzed univariately. The number of 38 patients according to the criteria with a mean age of 59.8 ± 12.7 years; most were male (55.3%) and comorbid with heart failure (13.2%). The mean length of hospitalization was 4.9 ± 1.6 days. Most of the patients received Cephalosporins antibiotic group, either given IV (89.5%) or P.O. (78.1%); the rest received the quinolone group. The mean time of changing AB from IV to oral administration was 134.25 ± 15.98 hours. Most inpatient CAP patients at PMGH received a cephalosporins group, either IV or orally.

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Keywords: Community pneumonia, intravenous antibiotics, comorbidities, intravenously, oral antibiotics

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INTRODUCTION

Multidrug resistance (MDR) is a severe problem in the world and Indonesia. Antibiotics are a class of drugs essential in providing therapy to patients who have an infection (Farida et al., 2017). Patients who risk exposure to infection, namely immunocompromised and surgical conditions or injury, need antibiotics to protect the body from infection (Tambun et al., 2019). The long-term use of intravenous antibiotics has risks an increased patient in-hospital stay, patient's costs, and morbidity. Based on scientific evidence, it is known that intravenous antibiotics for 2 - 3 days followed by oral antibiotics can provide the best benefit for patients. Inaccuracy in the management of antibiotic therapy in hospitalized pneumonia patients has increased MDR incidence in Indonesia and the world (Bestari & Karuniawati, 2019).

In Indonesia, community-acquired pneumonia or CAP is an infectious disease with a high hospitalization rate, including at PKU Muhammadiyah Gamping Hospital (PMGH) (Tambun et al., 2019). The prevalence of pneumonia in Indonesia in 2013 was 4.5%. In the elderly, the prevalence of pneumonia becomes higher at 15.5%. Pneumonia is still one of the ten significant diseases that require hospitalization (Bestari & Karuniawati, 2019). Pneumonia is defined as an inflammation of the lungs caused by microorganisms (bacteria, viruses, fungi, parasites). Based on the origin of the causative microorganisms, pneumonia is divided into two types: community pneumonia, where microorganisms are from the community, and nosocomial pneumonia, where microorganisms originate from the hospital environment (Park et al., 2010). Pneumonia caused by Mycobacterium tuberculosis is not included in the category of pneumonia. At the same time, lung inflammation caused by non-microorganisms (chemicals, radiation, aspiration of toxic substances, drugs) is called pneumonitis (Teixeira-Lopes et al., 2019). The results of previous studies based on the description of germs in sputum cultures stated that the cause of community pneumonia was Klebsiella pneumonia, Pseudomonas aeruginosa, Streptococcus viridian's, Acinetobacter sp, Serratia sp, Enterobacter sp, Coagulase Negative Staphylococcus, Streptococcus sp (Tambun et al., 2019). Pneumonia is one of the infectious diseases with a high rate of bed use in the inpatient department at PKU Muhammadiyah Gamping Hospital, with a total of 234 patients in 2017. Research has been conducted to determine the use of antibiotics, and the duration of replacement from IV to per oral (PO) AB administration in CAP patients hospitalized at PMGH has not been widely used. This study aimed to describe the use of AB and the duration of AB replacement from IV to oral in CAP patients at PKU Muhammadiyah Gamping Hospital (PMGH).

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RESEARCH METHODS

Design

This research is a quantitative descriptive observational study with prospective data collection. This approach was carried out to describe the patient's demographic and clinical characteristics, the type of drug, the type and class of antibiotics, and the length of stay and clinical outcomes of inpatient pneumonia at PKU Muhammadiyah Gamping Hospital. Quantitative research was conducted by analyzing the medical records of Pneumonia patients who were hospitalized at PKU Muhammadiyah Gamping Hospital prospectively.

Subjects and instruments

The research subjects were patients diagnosed with Community-acquired Pneumonia (CAP) hospitalized at PKU Muhammadiyah Gamping Hospital (PMGH), Sleman - Special Region of Yogyakarta in October - December 2018. The study's target population was patients diagnosed with pneumonia who underwent hospitalization at PKU Muhammadiyah Gamping Hospital in the Month. October – December 2018 with a total of 57 patients. The sample for the study was 38 patients who met the inclusion and exclusion criteria. Subject inclusion criteria were: Adult male

and female patients aged between 18-80 years diagnosed with pneumonia, patients who can eat and drink (not experiencing digestive disorders), receive intravenous antibiotic therapy for 24-72 hours, the patient dies but is more than 30 years old than 48 hours in treatment. Exclusion criteria were patients who had comorbidities in the course of their disease, namely the presence of mass or cancer in the lung, patients who had sepsis in the course of their illness. The tools/instruments used in the study were: patient informed consent, data collection sheets (Case Report Form), and writing instruments.

Research procedure

Preparation Stage: This stage includes preliminary research and the manufacture of research equipment (research protocols, data collection tools, and data collection tools). This research has been approved by Ethics committee of Universitas Ahamd Yani No. Skep/012/KEPK/IV/2019.

Subject recruitment stage. In summary, the recruitment stages of the subject are as follows (i) Patients who are taken area patients diagnosed with pneumonia by Doctor and undergoing inpatient treatment at PKU Muhammadiyah Gamping Hospital in the period October to December 2018, which are included in the inclusion criteria. (ii) Obtaining the patient's consent to participate in the study, the patient filled out and signed the informed consent form.

Data collection stage. During PMGH, patient data is recorded in the Case Report Form or patient report sheet, prepared by the researcher team, and reviewed by the etic committee. The case report form contains patient demographic data, the date the patient was treated, the date the patient went home, diagnosis of disease, history of drug use, records of patient progress in treatment, laboratory data (hemogram), vital signs, data on drug therapy and use of antibiotics. Data on length of stay was obtained from medical records, determined by calculating the difference in days between the date the patient went home and the patient began to be treated.

Data Analysis

Quantitative research data that has been collected will be analyzed statistically using SPSS 20. Data analysis was carried out. The univariate analysis aims to describe the characteristics of each research variable. Characteristics include age, gender, length of hospitalization, non-infectious comorbidities, patient therapy data (route of administration, class of antibiotics, type of IV to oral antibiotic replacement) displayed in the form of a frequency distribution table (amount and percentage) by using frequencies analysis and obtained from the SPSS 20.0 software.

RESULT AND DISCUSSION

Overview of patient characteristics

Characteristics of CAP patients in this study were age, gender, history of comorbidities, and length of hospitalization. According to the target population in this study, the number of patients was 57 patients. A total of 19 patients were excluded according to the established criteria, so the number of patients who met the patient criteria was 38 patients. A total of 6 patients. died after the patient had been hospitalized for more than 48 hours. Table 1 presents the demographic and clinical characteristics of the patients. In Table 1, it is known that most of the subjects' demographic characteristics and living habits are less than 60 years old, male, and do not smoke.

Table 1. Characteristics of Community-acquired Pneumonia (CAP) patients are undergoing inpatient care at PKU Muhammadiyah Gamping Hospital (PMGH) from October – December 2018

Characteristic's Patients		Number (%)
Age (year)	> 60 year	15 (39.5)
	< 60 year	23 (60.5)
Sex	Male	20 (52.6)
	Female	18 (47.4)
Smoking	Yes	5 (13.2)
	No	33 (86.8)
comorbidity	Yes	28 (73.68)
	No	10 (26.32)
Rontgen	Yes	4 (10.5)
	No	34 (89.5)
Acid Resistant Bacteria Test	Negative	5 (13.2)
	No	33 (86.8)
Morning Acid-Resistant Bacteria Test	Positive	1 (2.6)
	Negative	4 (10.5)
	No	33 (86.8)
Antibiotic Culture Examination	Yes	1(2.6)
	No	37 (97.4)

Based on Table 1, it is known that the majority of CAP patients undergoing hospitalization at PKU Muhammadiyah Gamping Hospital are under 60 years old, namely 23 patients (60.1%), the average age of patients is 58.7 ± 12.1 years or adults. The data from this study follow several previous studies. A previous study by Machlaurin, (2015) on the use of antibiotics in pneumonia patients during hospitalization showed that the average age of the patients was 56.6 ± 13.8 years. The research of Ramirez et al. (2012) on antibiotic replacement therapy in American hospitals showed that the mean age of the patients was 54 ± 20.4 years (Ramirez et al., 2012).

Based on the theory, the incidence of community pneumonia is higher in the elderly than in the young because, during this period, the body and organ functions begin to weakness, thereby reducing the body's resistance and the emergence of comorbidities (Mulyana, 2019; Von Lilienfeld-Toal et al., 2016). Putri & Hasan, (2014), in their research, provide the reason that in the elderly, there are anatomical and physiological changes due to the aging process which have essential consequences on functional lung reserves, the ability to overcome decreased lung compliance, and increased airway resistance to infection and decreased body resistance. Geriatric patients are more easily infected with pneumonia due to impaired vomiting reflex, weakened immunity, impaired temperature regulation response, and various degrees of cardiopulmonary abnormalities (Ahn & Hyun, 2019; Chang et al., 2017).

The research results conducted at PKU Muhammadiyah Gamping Hospital showed that pneumonia was more common in men (52.6%) when compared to women. Men are more at risk of infection because they are more dynamic and spend much time outside the home, making it easier to contact microorganisms. In Indonesia, the prevalence of smokers is relatively high, i.e.> 30%, exposure to cigarette smoke also increases the risk of pneumonia. There is ample evidence that tobacco is a significant risk factor for pneumonia. The estimated risk increases between 50% and 400% in smokers, and between 15% and 30% of cases of pneumonia can be avoided if smoking is eliminated. The risk of pneumonia is as high as ex-smokers who have stopped smoking for two years. The risk of second-hand smoke is still not well understood, although most studies state no significant difference in the overall population (Reitsma et al., 2017).

The data from this study follow previous research. Sari et al. (2017) showed that of 34 Pneumonia patients who were hospitalized, 67.6% were male (Sari et al., 2017). Prakoso et al., (2018) reported that of 41 Pneumonia patients, 65.2% were male. Machlaurin et al. (2017) in their research on empiric antibiotic therapy in inpatient pneumonia patients, reported that the most gender was male, namely 162 patients (94.70%). Sari et al. (2017) reported that from 158 Pneumonia patients, 83 (52.5%) were female. The results of these four studies reported that the number of Pneumonia patients who were male was more than female. Risk factors in smoking and drinking alcoholic beverages are more common among men than women (Othma2 et al., 2017). The effect of alcohol on the risk of pneumonia is not de2onstrated. However, some studies agree that high levels of alcohol consumption (>40-80 g/day) and heavy alcohol consumption (more than 100 g/day for men and 80 g/day for men) for women) are significant risk factors for pneumonia. Another thing that can influence is environmental factors, namely most smokers are male. Continuous exposure to cigarette smoke in healthy adults can increase the risk of developing lung disease and cause bronchitis and pneumonia (Dunkler et al., 2016).

Clinical conditions and comorbidities

In Table 2, the clinical conditions and comorbidities of pneumonia patients hospitalized at PKU Gamping Hospital.

Table 2. Clinical features and comorbidities of inpatient CAP patients at PKU Muhammadiyah Gamping Hospital (PMGH)

Clinical Parameters		
Complaint	Cough	34 (89.5)
	Hard to breathe	37 (97.4)
	Fever	16 (42.1)
	Heartburn	2 (5.3)
Vital sign	SBP	132.7 ± 26.6
	DBP	74.4 ± 10.9
	Pulse	101.7 ± 13.3
	Temperatur	36.9 ± 0.7
	Respiration Rate	28.9 ± 5.2
Laboratory data	Leucocytes	13,926.3 ± 6,917.9
	Basofil	0.24 ± 0.49
	Eosinofil	0.39 ± 0.72
	Neutrofil	79.9 ± 9.06
	Limfosit	14.8 ± 6.8
	Monosit	4.8 ± 2.9
Comorbidities	COPD	3 (7.9)
	Type II DM	7 (18.4)
	Asthma	9 (23. 7)
	CHD	8 (21.8)
	CKD	3 (7.9)
	hypertension	5 (13.2)

Based on the main complaint when admitted to the hospital and the data from clinical and laboratory examinations, the research subjects were following the criteria for community-acquired pneumonia (CAP) diagnosis. Community-acquired pneumonia patients generally have complaints of shortness of breath cough with phlegm, accompanied by an increase in the number of leukocytes and neutrophilia (Tambun et al., 2019).

From Table 2, it is also known that several comorbidities in patients with CAP are hospitalized at PMGH. The comorbidities types of hospitalized-CAP patients at PMGH were Asthma (23.7%), CHF (21.8%), non-ulcer type II DM (18.4%), hypertension (13.2%), COPD with exacerbations (7.9 %), and CKD (7.9%). The data on the percentage of comorbidities from this study is different from the results of Sari's (2016) study. Sari et al. (2017) in their research reported co-morbidities in pneumonia including: CHF (33.7%), type II diabetes (30.1%), hypertension (28.2%), CKD (7.5%), COPD (5.4%), and, Asthma (4.%).

Machlaurin et al. (2017) reported in their research that co-morbidities in pneumonia include CHF (56.7%), type II DM (19.3%), CKD (14.62%). CHF is a comorbid disease often found with the highest number in Pneumonia patients. Eurich et al. (2017) conveyed why pneumonia can cause CHF. Pneumonia causes oxygen levels in the blood to decrease so that the heart will be forced to pump more blood so that oxygen needs in the body are met. If hypoxia conditions for a long time, it will trigger heart failure. Another comorbid disease in pneumonia is DM which can cause organ damage, both anatomically and functionally. Chronic complications of DM cause macro and microvascular abnormalities so that the flow of oxygen to the lungs is reduced and increased potential for infection by anaerobic bacteria. Increased blood sugar levels in the body will decrease the function of neutrophils and monocytes, which are essential in fighting pathogenic bacterial infections, so the risk of infection will also increase (Seok et al., 2019). Chronic Kidney Disease (CKD) or Chronic Kidney Disease (CKD) is another comorbid disease in Pneumonia (Huang et al., 2014).

Therapeutic management of inpatient CAP patients

Based on Table 1, it is known that most of the subjects have comorbidities (73.7%). According to the clinical condition of the patients, many subjects received additional therapy, not only therapy related to CAP but also therapy for comorbidities, as presented in Table 2. In Table 2, it is known that drugs for asthma/COPD and drugs for respiratory disorders have the most types and number of prescriptions. Acetylcysteine is a mucolytic, was most often prescribed (38%), followed by inhaled Combivent (31%) and ranitidine injection (10%). The prescribing of these drugs followed the patient's primary complaints when he came to the hospital, namely shortness of breath and cough. Cough in CAP is generally a cough with phlegm, with purulent phlegm so that it requires strong mucolytics to facilitate the discharge of secretions (Cunha, 2001). In community pneumonia (CAP) as an inflammatory response, often followed by stress ulcers in the stomach, there is an increase in gastric juice production, causing gastric complaints. Ranitidine injection is often prescribed to reduce stress ulcers (Horowitz et al., 2020). The therapy description in pneumonia patients hospitalized at PKU Gamping Hospital is presented in Tables 2 and 3**.**

Most of the therapy in patients during hospitalization was Acetylcysteine 200 mg (94.7%), as presented in Table 3. Based on the 2003 Guidelines for the Diagnosis and Management of CAP in Indonesia, one of the symptomatic therapies of CAP is mucolytic. The N-Acetylcysteine (NAC), a thiol reducing agent, has mucolytic properties by cleaving disulfide bonds (S – S) into sulfhydryl bonds (-SH) in mucoprotein complexes (Alotair et al., 2015). Ranitidine Inj (H2 receptor blockers) is used in 47.4% of patients to prevent digestive disorders in CAP patients and can be used to reduce vital lung capacity (FVC) and pulmonary expiratory capacity (FEV1) so that the lung load meets oxygen needs is reduced (Cavallazzi et al., 2015).

Albuterol and Ipratropium bromide combined with Pulmicort (Budesonide) were given in inhalation. Methylprednisolone, a type of corticosteroid, was used as much as 34.2%. Methylprednisolone aims to fight the inflammatory response found in the alveoli caused by bacterial or viral infections that cause pneumonia. Inflammation can worsen gas exchange in the alveoli so that the fulfillment of oxygen needs in the lungs is reduced (Vila-Corcoles et al., 2009).

Table 3. Overview of therapy for CAP patients was undergoing inpatient care at PMGH from October to December 2018

No	Drug Therapy	Frequency (%)
Asthma/COPD/ respiratory drug		
1	Salbutamol 2 mg	8 (21.1)
2	Inhalation Combivent : Pulmicort	31 (81.6)
3	Inhalation Ventolin: Pulmicort	2 (5.3)
4	Inhalation Ventolin: Flixotide	1 (2.6)
5	Inhalation Combivent : Flixotide	3 (7.9)
6	Seretide 250 mcg	7 (18.4)
7	Symbicort 160mcg	3 (7.9)
8	Spiriva inhaler	4 (10.5)
9	Methylprednisolone inj	13 (34.2)
10	Methylprednisolone 4mg	3 (7.9)
11	Acetylsistein 200 mg	36 (94.7)
12	*Azitromycin 500 mg*	*8 (21.1)*
Antidiabetes mellitus drug		
1	Novomix Flexpen	1 (2.6)
2	Levemir Flexpen	1 (2.6)
3	Pioglitazone 30 mg	2 (5.3)
4	Metformin 500 mg	5 (13.2)
5	Novorapid Flexpen	3 (7.9)
GIT drug		
1	Ranitidine Tablet 150 mg	4 (10.5)
2	Ranitidine Injection	18 (47.4)
Hemostatic drug		
1	Tranexamic acid 500 mg (tab)	
.2	Tranexamic acid 500 mg (inj)	2 (5.3)
CVD and anti-hypertension drug		
1	Irbesartan 150mg	2 (5.3)
2	Digoxin 0,25 mg	6 (15.8)
3	Candesartan 8 mg	9 (23.7)
4	Aspilet 80 mg	7 (18.4)
5	Amlodipin 10 mg	5 (13.2)
6	Bisoprolol 5 mg	4 (10.5)
Diuretic and chronic kidney disease drug		
1	Folic Acid 1 mg	2 (5.3)
2	Furosemid Inj	10 (26.3)
3	Furosemid 40 mg tablet	7 (18.4)
4	Spirolonolacton 25 mg	3 (7.9)
Analgetic and anti-piretic drug		
1	Paracetamol 500 mg tablet	3 (7.9)
.2	Paracetamol Infus	3 (7.9)
.**Antidislipidemia**		
.1	Simvastatin 10 mg	3 (7.9)

Use of antibiotics, length of hospitalization, and clinical outcomes

All PK patients hospitalized in the early stages received IV AB therapy and then continued with oral AB therapy. The groups of IV and oral antibiotics used in inpatient PK patients at the PMGH for October – December 2018 are presented in Table 4.

Table 4. Routes and Groups of Antibiotics, duration of IV and oral AB, length of hospitalization, and clinical outcomes in CAP patients hospitalized at PMGH for October – December 2018

Characteristic	Parameter Frequency(%	Mean (±SD)
Intravenous antibiotic administration		
Cefalosporin group	34 (89.5 %)	
Quinolon group	4 (10.5 %)	
Total	38 (100%)	
Type of Antibiotic in per IV administration		
Ceftriakson	24 (68.75)	
Ceftazidime	6 (18.75)	
lefofloksasin	4(12.5)	
Total	38 (100%)	
Peroral antibiotic administrion		
Cephalosporin group	25 (78.1 %)	
Quinolon group	7 (21.9 %)	
Total	32 (100%)	
Type of antibiotic in peroral administration		
Cefiksim	22 (68.75%)	
Siprofloksasin	3 (9.375%)	
Lefofloksasin	7 (21.9%)	
Total	32 (100%)	
Classification of IV antibiotic administration		
Less than 72 hours	3 (7.9 %)	
More than 72 hours	35 (92.1%)	
Total	38 (100%)	
Clinical outcome		
Healed	32 (84.2)	
Dead	6 (15.8)	
Total	38 (100%)	
Length of stay (days)		4.9 ± 1.6
Duration of IV antibiotic administration (hours)		134.25 ± 15.98

The study results in Table 4 show that the cephalosporin antibiotic group was the most widely used on IV and oral use, as many as 34 patients (89.5%) on IV use and 25 patients (78.1%) oral use. Quinolones were used less in 4 patients (10.5%) on IV use and seven patients (21.9%) on oral use.

Research by Shrayteh et al. (2014) states that two classes of antibiotics are most commonly used IV and Oral, namely Quinolones (90%) and Macrolides (80%). Another study from Horowitz et al. (2020) stated that quinolones (45.9%) and penicillin (24.8%).

The research results at PMGH are as presented in Table 4. The types of IV antibiotics used were: Ceftriaxone (68.7%), Levofloxacin (12.5%), Ceftazidime (18.8%). The types of oral antibiotics used were: Cefixime (68.7%), Levofloxacin (28.2%), Ciprofloxacin (3.1%). Gram-positive bacteria and atypical bacteria mainly cause pneumonia. The bacteria found from the sputum examination of community pneumonia patients were gram-negative bacteria, including Klebsiella pneumonia 45.18%, Streptococcus pneumonia 14.04%, Streptococcus viridans 9.21%, Staphylococcus aureus 9%,

Pseudomonas aeruginosa 8.56%, Streptococcus hemolytic 7.89%. Enterobacter 5.26%, Pseudomonas spp. 0.9% (Farida et al., 2017).

Machlaurin., (2015) states that the three major types of intravenous antibiotics are Ceftriaxone (44.4%), Ciprofloxacin (38.2%), Meropenem (6.4%), While the three major oral antibiotics used are: Ciprofloxacin (38.6%), Cefadroxil (30.1%), Levofloxacin (24.3%). General considerations for the selection of antibiotic therapy are based on the drug's efficacy for both the patient and the effectiveness of therapy from the type/class of antibiotics used because it will help reduce the risk of antibiotic resistance. Another consideration factor is antibiotics' specification, including pharmacodynamic profile, patient compliance, safety, and cost (Prakoso et al., 2018). Recommendations for antibiotic therapy in hospitalized respiratory infection patients, non-ICU care, are fluoroquinolones (strong recommendation; level I evidence), B-lactam plus macrolides (strong recommendation; level I evidence) (beta-lactam antibiotics include cefotaxime, ceftriaxone, ampicillin, and Ertapenem for patients of choice; with doxycycline (level III evidence) as an alternative to macrolides, respiratory fluoroquinolones should be used for penicillin-allergic patients (Suharjono et al., 2009). Resistance to third-generation cephalosporins by gram-negative nosocomial pathogens can increase mortality, length of stay, and hospital costs. The administration of fluoroquinolones as a substitute for therapy for third-generation cephalosporins is most often used because cephalosporine is resistant to gram-negative nosocomial pathogens such as Enterobacter spp., P. aeruginosa, and K. pneumonia (Chastre et al., 2014). For patients hospitalized in a regular ward, antibiotic therapy should be given in less than 8 hours (Ziółkowski et al., 2018). The beta-lactam group was given without any modifiable factors plus the Intravenous preparation of anti-beta-lactamase or the Intravenous preparation of selafolaporin generation II, generation III, or Intravenous preparations of respiratory Fluoroquinolones. If there are modifiable factors, give Intravenous selafolaporin generation II, generation III, or Intravenous preparations of respiratory fluoroquinolone (McKinnell et al., 2018).

Based on Table 4, it is known that the use of AB by inpatient CAP patients at PMGH Yogyakarta is classified into two, namely less than 72 hours and equal to or more than 72 hours. Most CAP patients got AB equal to or more than 72 hours, namely in 35 patients (92.105%). Inpatient CAP patients at PMGH with antibiotics less than 72 hours were found in 3 patients (7.895%).

The length of hospitalization and the clinical outcome of the subjects are presented in Table 4. From Table 4, it is known that the average length of hospitalization is 4.9 ± 1.6 days, with 84.2% of the subjects declared cured and the rest (15.8%) dying. The switch from IV to oral antibiotic therapy in CAP patients hospitalized at PMGH was 118.7 ± 38.6 hours or equivalent to 4.9 ± 1.6 days, which is included in the reasonably good category. In general, the average length of stay in the hospital is 5.6 ± 3.7 days. Tejaswini et al. (2018) reported that the average length of hospitalization was 3.9 ± 1.7 days. Machlaurin, (2015) reported that the average length of hospitalization was 10.03 days. The length of hospitalization is one of the factors that can be used to measure the effectiveness of the use of drugs and to know the average time of therapy for pneumonia patients. The patient has been allowed to go home because antibiotics are effectively used for therapy for less than ten days (Machlaurin et al., 2017).

The use of antibiotics in patients with concomitant heart failure and impaired kidney function must be adjusted to the patient's condition. Fluoroquinolone antibiotics can cause prolongation of the QT interval as a sign of heart failure, so CAP patients with concomitant CHF are not allowed to be given fluoroquinolone antibiotics they can cause the patient's heart rhythm to become irregular which can eventually worsen heart function (Eurich et al., 2017).

As presented in Table 4, several types of antibiotics must also be considered whether a dose adjustment is necessary for patients with impaired renal function. Huang et al. (2014) stated that patients with CKD on the fluoroquinolone class of antibiotics, including ciprofloxacin and levofloxacin of the cephalosporin group, did not need to adjust the dose. Research by Ghazipura, (2013), which reviewed various guidelines for recommendations for providing antibiotic therapy to patients undergoing hospitalization, showed no significant evidence of differences in the administration of antibiotics for at least five days or more (Rusmini, 2016). According to the

Pneumonia Severity Index, another study conducted by Dimopoulos et al. (2008) showed that antibiotic therapy in pneumonia patients could be effectively shortened compared to the usual regimen for most adult patients, including those with mild and moderate disease severity (Pneumonia Severity Index).

Research Limitations

This study has limitations: including the limited number of subjects, most of the subjects were also not tested for sensitivity, and not all subjects were tested for Smear positive, so it is still possible for some subjects to experience pneumonia due to mycobacterium tuberculosis, given the high prevalence of pulmonary tuberculosis in Indonesia.

CONCLUSION

Intravenous antibiotic prescribing for CAP patients hospitalized at PKU Gamping Hospital is Cefalosporin (89.5%) and Quinolones (10.5%) with the duration of IV antibiotic use mostly more than 72 ho. Oral antibiotic prescriptions were Cephalosporins (78.1%) and Quinolones (21.9%). The mean length of hospitalization was 4.9 ± 1.6 days. Prescriptions based on the type of antibiotic in CAP patients hospitalized at PKU Muhammadiyah Gamping Hospital were: Ceftriaxone (68.7%), Levofloxacin (12.5%), Ceftazidime (18.8%), Cefixime (68.7%), Levofloxacin (28.2%), and Ciprofloxacin (3.1). %).. As many as 84.2% of the subjects were cured, and 15.8% died.

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