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Research Article

Impact of Intervention on Reduction of White Blood Cells in the Management of Infection in Pneumonia Patients

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ABSTRACT

Objective: To study the impact of intervention on the reduction of white blood cells (WBC) in the management of infection in patients with pneumonia in Universitas Sumatera Utara (USU) hospital period July through September 2019.
Method: This three-month analytical prospective cohort study analyzed the reduction of WBC in the management of infection in pneumonia patients (n=42) before and after intervention in USU hospital. A self-designed questionair was used to assess the patients characterics, the required laboratory data including WBC, and length of stay (LOS). The base-line data were assessed after three days of treatment. The data with intervetion were assessed between July - September 2019. The Patients characteristics and drug utilization were analyzed descriptively. The levels of WBC before and after interventions were compared using paired samples t test ($p < 0.05$) was considered significant.
Results: Characteristics of the pneumonia patients: male, 61.9%; female, 38.1%. The mean age of patients with pneumonia was 60.48 ± 14.76 years. The most widely used antibiotic was ceftriaxone as much as 48%. There was a significant difference in reduction of WBC between patients with pneumonia before and after intervention, p= 0.002.
Conclusions: Intervention can significantly increase the treatment of infection in patients with pneumonia.

Keyword: Antibiotic, Pneumonia, WBC, Intervention.

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INTRODUCTION

Pneumonia is one of the leading causes of death in children and adult. Incidence of pneumonia in Indonesia in 2010 was high and included into the 10 major diseases that require hospitalization. The proportion of cases in men was 53.95% and 46.05% in women with the highest crude fatality rate (7.6%) compared to other diseases. Based on data from 2018 Riskesdas, prevalence of pneumonia in Indonesia based on the diagnosis of health workers was around 2.0%, while in 2013 was 1.8%. The prevalence of pneumonia in Sumatera Utara has increased, in 2013 by 1.1% and in 2018 by 2.3%[1].

Pneumonia is an acute respiratory infection that affects the lungs. In pneumonia patients alveoli of the lungs is filled with pus and fluid which interferes with normal individual breathing. This condition makes the pneumonia feels painful[2]. Pneumonia is a disease characterized by inflammation of the lung parenchyma usually caused by microorganisms (bacteria, fungi, viruses, parasites), chemicals, radiation, drugs[3].

The management of pneumonia is to eradicate the microorganisms that cause pneumonia and overall clinical cure. Treatment of pneumonia caused by bacterial infections is started with empirical administration of antibiotics with broad-spectrum while awaiting culture results for the definite treatment. Delay of antibiotics treatment for more than 4 hours may increase the risk of death. After an infecting pathogen is detected, than the broad spectrum antibiotic is replaced with narrow-spectrum antibiotic appropriate to the infecting patogen[4].

Delay in therapy of pneumonia patients can result in continuous inflammation (pleural effusion) which further lead to other complications such as suppurating lung tissue (lungs abscess), collapsed lung tissue (known as pneumothorax) and is spread by the blood circulation to the whole body, and can finally lead to death[5].
Irrational use of antibiotics raises various problems and is a global threat to health, especially bacterial resistance to antibiotics. Besides having an impact on morbidity and mortality, it also has a high negative social economic and impact[6].

The rational use of antibiotics requires that pneumonia patients receive medications appropriate to their clinical conditions (including complications suffered by the patients) in doses that meet their own individual requirements for an adequate period of time, and at the lowest cost to them and their community[7]. The success of antibiotic therapy is assessed based on many clinical outcomes (signs and symptoms of pneumonia), changes in the patient's body temperature, normalization of white blood cells (WBC) level and respiratory rate[8].
The role of pharmacists through pharmaceutical care is crucial to optimize the benefit of pharmacotherapy by ensuring the outcomes to improve patient's conditions and their quality of life[9]. Thus the involvement of pharmacists in inter healthcare professionals interaction is important especially in drug therapy monitoring, identification of drug related problems and provision of recommendation as well as patients counseling[10,11].
This study was conducted to evaluate the impact of intervention on the reduction of WBC in the management of infection in patients with pneumonia in USU hospital.

METHODS

This three-month analytical prospective cohort study analyzed the reduction of WBC in the management of infection in pneumonia patients (n=42) before and after intervention in USU hospital. A self-designed questionaire was used to assessed the number of medical record, gender, age, diagnosis, drug utilization, the required laboratory data including WBC and LOS. The ethical clearance was obtained from School of Nursing, Universitas Sumatera Utara, Medan, Indonesia. The inclusion criteria were pneumonia patients above the age of 18 years, and did not suffred from HIV virus and micobacterium tuberculosis. The base-line data were assessed after three days of treatment. The data with intervetion were assessed between July - September 2019. Intervention provided other heathcare providers based on preliminary study from the medical records of patients admitted in 2018. The Patients characteristics and drug utilization were analyzed descriptively. The levels of WBC before and after interventions were compared using paired samples t test ($p < 0.05$) was considered significant.

RESULT AND DISCUSSION

Characteristics of patients with pneumonia in this study based on gender, age, and LOS are shown in Table 1. This study shows that pneumonia infected more men (61.9%) compared to women (38.1%). Pneumonia is more common in men because men have a habit of smoking is an independent risk factor for the occurrence of pneumonia in adults[12].
Characteristics of patients with pneumonia by age can also be seen in Table 1. Most (40.48%) of the pneumonia patients were above 65 years, their mean age was 60.48 ± 14.76 years. Age had a significant impact on the incidence of pneumonia due to aging can lead to loss of elasticity and a decrease in lung function. In addition, a decrease in the immune response and comorbid conditions may have an impact also on the prognosis pneumonia[13]. Based on the Minister of Health in 2014, limits the elderly in Indonesia is more than 60 years. In old age decreased organ function and immune responses that accompany aging so it is more easily infected [14].
In term of LOS, pneumonia patients who were treated less than 7 days was 26 (61.90%) persons, while those hospitalized more than 7 days was 16 (38.10%). The mean LOS was 6.54 ± 3.29 days, In general, patients infected with bacteria are normally for about 7-10 days which depends on severity and its comorbidities as well as the development of complications[15].

Table 1. Characteristics of hospitalized pneumonia patients based on gender, age, and length of stay

No.	Characteristics	n = 42	(%)
1	Gender		
	Male	26	61.9
	Female	16	38.9
2	Category Age (Years)		
	18-27	1	2.38
	28-36	3	7.14
	37-46	4	9.52
	47-55	2	4.76
	56-65	15	35.71
	> 65	17	40.48
	The mean age of patients	60.48 ± 14.76 years	
3	LOS		
	<7 days	26	61.90
	> 7 days	16	38.10
	The mean LOS	6.54 ± 3.29 days	

The antibiotics are empirically provided to pneumonia patients for 3 days. If there is improvement in the condition of the patients, the antibiotic is continued up to 7-14 days. If there is no improvement, then replacement of the antibiotics is done according to microbiological data and sensitivity test. The use of antibiotics in hospitalized pneumonia patients can be seen in Figure 1. The antibiotics utilization in these patients in decreasing order were ceftriaxone, azithromycin, meropenem, levofloxacin, ciprofloxacin, gentamycin, metronidazole, vancomycin, and cefixime. The most frequently used of antibiotics was ceftriaxone by 48% and the lowest antibiotic use was metronidazole, vancomycin and cefixime with a percentage of 1.33%. Ceftriaxone is a third generation cephalosporin group which is a derivative of β-lactam and the most active against strains resistant to penicillin pneumococus. Ceftriaxone has a half-life longer than the other cephalosporins group, so it can be given 1 to 2 times a day. Ceftriaxone given dose is 1-4 g / day. Ceftriaxone excretion is mainly through bile duct and no

dose adjustment is necessary in conditions kidney function decline[16]. Azithromycin is indicated for pneumonia caused by atypical bacteria with special manifestations of the patient experiencing dizziness and body aching aches. Atypical bacteria that are often found are Mycoplasma pneumoniae, Chlamydia pneumoniae, Legionella spp. Azithromycin has a wider distribution volume and a longer half-life[17]. Meropenem has a broad spectrum, but is more active against gram-negative and anerobic bacteria, than gram-positive bacteria. Very resistant to the β-lactamase enzyme. Meropenem is inactivated by dehydropeptidase in the kidney tubules so the concentration in urine is low[18, 19]. Levofloxacin and ciprofloxacin belong to the group Fluoroquinolone the mechanism of action of fluoroquinolone by inhibiting the enzyme DNA gyrase. This will prevent the process of relaxation of positive supercoil DNA needed in the process of replication and transcription in normal circumstances. Bacterial DNA is in the form of long double strands that cannot possibly fit in the bacterial cell, so they are formed into supercoils (coils). Fluoroinolone penetrates well into tissues and cells[18,19]. DNA gyrase is the main target of fluoroquinolone for most gram-negative bacteria[20]. Fluoroquinolone is bound to serum proteins approximately 24-38%. It is distributed quickly and widely into tissues and body fluids, including the skin and lungs. Fluoroquinolone levels in lung tissue are generally 2 to 5 times higher than plasma levels[21,22].

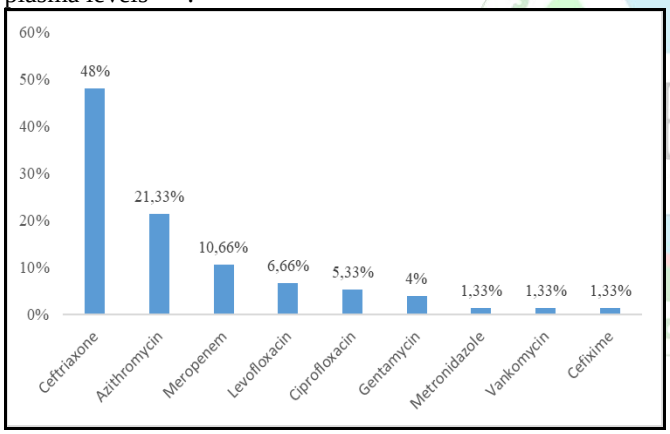

Figure 1. The use of antibiotics in hospitalized pneumonia patients

A high WBC value correlated remarkably well with early death (<48 h). To predict 30-day mortality, a high WBC value had a positive predictive value (PPV) of 53% and a negative predictive value (NPV) of 89%. More specifically, a high WBC value was associated with early mortality: the higher the score, the higher the mortality. Leukocyte score, similar to the CURB-65 score and the PSI, seems to perform better in predicting early mortality for pneumonia[23]. This study proved that the mean WBC values without intervention was 12.77 (10^3/µl) with WBC decrease as much as 0.96 (10^3/µl). With the intervention of pharmacist, WBC value was reduced to 10.69 (10^3/µl) with decrease as much as 3.05 (10^3/µl). Paired t test conducted proved a significant decrease in WBC with pharmacy intervention compared to those with usual care of pneumonia, p = 0.002.

CONCLUSIONS

Pharmacy intervention can significantly decrease the reduction of WBC in the treatment of patients with pneumonia. Role of pharmacists to improve the treatment outcomes of pneumonia is important.

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