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Effect of CURB-65 Score on Length of Stay for Pneumonia Patients at Hospital Royal Prima

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Abstract**—** *Pneumonia is an acute infection of the lung parenchyma caused by one pathogen or co-infection with other pathogens. Several studies have been conducted to evaluate several instruments for assessing pneumonia patients. One of them reported that the SIPF (Shock Index and Hypoxemia) score could better predict the patient's need for an ICU (Intensive Care Unit) compared to CURB-65 and PSI (Pneumonia severity index). Therefore, this study aims to determine the effect of the CURB-65 score on the length of stay of pneumonia patients hospitalized at Royal Prima Hospital. This study is a descriptive study with a cross-sectional approach in 36 patients with pneumonia at the Royal Prima General Hospital Medan in 2019. The results of this study indicate that pneumonia patients with a CURB-65 score between 3-5 have a 10.74 times risk of being hospitalized more than one week compared with patients with a CURB-65 score between 0-2, where the investigators believed 95% risk scores would be in the range 1.35-85.21 in the reachable population. So it can be concluded that the CURB-65 score can be used to predict the length of stay of pneumonia patie*.

Keywords**—** *Pneumonia, Royal Prima, CURB-65, length of stay*.

I. INTRODUCTION

Pneumonia is an acute infection of the lung parenchyma caused by one pathogen or co-infection with other pathogens. In the past, pneumonia was classified into Community-Acquired Pneumonia (CAP), Hospital-Acquired Pneumonia (HAP), and Ventilator-Associated Pneumonia (VAP). However, as time goes by, Multiple-Drug Resistant (MDR) Pathogens are found who come to be treated at the hospital, where these pathogens tend to be found in HAP. The increasing involvement of MDR pathogens in pneumonia prompted a change in the classification from Pneumonia to CAP and Health Care-Associated Pneumonia (HCAP). HCAP is then grouped into HAP and VAP (Mandell and Wunderink, 2010; Mackenzie, 2016)

World in 2016. Based on the World Health Organization / World Health Organization (WHO) data, lower respiratory infections are still deadly infectious diseases, with around 3 million deaths worldwide in 2016. Deaths from these infections are still the fatal cause of death from infectious diseases from various countries in the world. However, in developing countries, this infection is the highest cause of death, with a crude death rate of around 75 per 100,0000 population (Top 10 causes of death, 2018). In adults, pneumonia is also the single leading cause of death in children in the world. From WHO data, in 2017, as many as 808,694 children under the age of five died from pneumonia, which is 15% of all deaths of children aged under five years. Pneumonia can occur in children and their families anywhere, but the highest prevalence is found in South Asia and Sub-Saharan Africa (World Health Organization, 2019).

CAP is a deadly and common infection. These infections have had a significant impact on changing health care systems around the world. The incidence of CAP in the world is quite varied. In Europe, the incidence of CAP varies considerably from 20.6/10,000 population per year in Iceland to 79.9/10,000 population per year in the UK. Meanwhile, in developed countries such as the United States, the incidence rate of CAP ranges from 24.8/10,000 population per year to 106/10,000 people per year in the adult population <65 years.

Meanwhile, the incidence of CAP in the elderly 65-79 years is 63/10,000 population per year and reaches 164.3/10,000 population per year at age > 80 years. While in Asia alone, the incidence of CAP is 142.5 per 10,000 population in the Philippines, 402.5 per 10,000 population in Indonesia, and 98.8 per 10,000 population (Ferreira-Coimbra, Sarda and Rello, 2020). In addition to the high incidence and mortality, CAP also costs a lot, ranging from $9 to USD 10 (Mandell and Wunderink, 2010).

HAP is a Health Care Infection (HAI) common throughout the world, with an incidence of more than 21 cases per 1,000 cases admitted to the hospital. HAP includes two subgroups, namely Nonventilator HAP (NV-HAP) and Ventilator-Associated Pneumonia (VAP). In 2011 the incidence of HAI was 21.8% (95% CI: 18.4%-25.6%), namely 157,400 infections (95% CI: 50,800-281,400), of which 60.9% of cases were found to be NV-HAP (Giuliano, Baker and Quinn, 2018). Kim et al. (2018) reported that viral infection in HCAP (13.8%) was lower than CAP (24.6%). However, the infectious agent that causes pneumonia does not affect the prognosis of pneumonia (Kim et al., 2018).

Meanwhile, the prevalence of pneumonia in Indonesia is recorded by the Indonesian Ministry of Health through Basic Health Research (Riskesdas). The results to Riskesdas 2018, the majority of pneumonia diagnosed by health workers in Indonesia was 1.6 percent in 2013 and experienced an increase to 2 percent in 2018. Meanwhile, in North Sumatra, the prevalence of pneumonia based on the diagnosis of health workers was around 1 percent in 2013 and has increased to about 2.25 percent in 2018. However, the prevalence rate is lower than the prevalence of pneumonia when assessed through the diagnosis of health workers and symptoms, where the pneumonia prevalence rate in Indonesia increased to 4.5 percent in 2018; the same thing was also found in North Sumatra, where the prevalence rate also increased to 4 percent (Ministry of Health of the Republic of Indonesia, 2019).

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With the increasing incidence of pneumonia and increasing. An instrument is needed to assess the prognosis of pneumonia. Each hospital can develop a protocol for handling pneumonia patients and assist in making decisions in the management of pneumonia patients by health workers. Several studies have been conducted to evaluate several instruments for assessing pneumonia patients. Eldaboosy et al. (2015) reported that the SIPF (Shock Index and Hypoxemia) score could better predict the patient's need for an ICU (Intensive Care Unit).

II. Literature Review

2.1. Pneumonia

Pneumonia is an acute infection of the lung parenchyma caused by one pathogen or co-infection with other pathogens (Mandell and Wunderink, 2010; Mackenzie, 2016). What is meant by community pneumonia or also called acquired pneumonia, is pneumonia that occurs outside the hospital. At the same time, pneumonia that occurs in the hospital is called nosocomial pneumonia (Wed, 2013).

In the past, pneumonia was classified into Community-Acquired Pneumonia (CAP), Hospital-Acquired Pneumonia (HAP), and Ventilator-Associated Pneumonia (VAP). However, as time goes by, Multiple-Drug Resistant (MDR) Pathogens are found who come to be treated at the hospital, where these pathogens tend to be found in HAP. The increasing involvement of MDR pathogens in pneumonia prompted a change in the classification from Pneumonia to CAP and Health Care-Associated Pneumonia (HCAP). HCAP is then grouped into HAP and VAP (Mandell and Wunderink, 2010; Mackenzie, 2016)

The etiology of pneumonia is based on the classification of pneumonia. So the etiology of pneumonia is grouped into Community-Acquired Pneumonia (CAP), Hospital-Acquired Pneumonia (HAP), and Ventilator-Associated Pneumonia (VAP).

The potential etiology of CAP is in the form of bacteria, fungi, viruses, and protozoa. Most CAP cases are caused by various new pathogens, which can be seen in the following table.

TABLE 1. Microbes Cause Community-Acquired Pneumonia by Treatment Location Lokasi

Outpatient	**Inpatient**	
	Non-ICU	**ICU**
Streptococcus pneumoniae	*S. pneumoniae*	*S. pneumoniae*
Mycoplasma pneumoniae	*M. Pneumoniae*	*Staphylococcus aureus*
Haemophilus influenza	*Chlamydophila pneumoniae*	*Legionella spp.*
C. pneumoniae	*H. influenzae*	Gram-negative bacilli
Respiratory virus*	*Legionella spp.* Respiratory Virus*	*H. influenzae*

Although Streptococcus pneumonia is the most common microorganism, it is also necessary to consider other organisms that cause pneumonia. In most cases, it becomes essential to consider the causative pathogen as a “Typical” pathogenic bacterium or an “Atypical” organism. Typical bacterial pathogens include S. pneumonia, Haemophilus influenza, and in particular patients S. aureus and gram-negative bacteria such as Klebsiella pneumonia and Pseudomonas aureginosa. At the same time, atypical organisms are Mycoplasma pneumoniae, Chlamydophila pneumonia, Legionella spp, and respiratory viruses such as influenza virus, adenovirus, and Respiratory Syncytial Virus (RSV). Data show that approximately 18% of patients with viral CAP require hospitalization.

Meanwhile, atypical infections of M. pneumoniae and C. pneumoniae were often found in outpatients and Legionella spp. In hospitalized patients. In 10-15% of CAP cases with polymicrobial infection shows a combination of typical and atypical conditions (Mandell and Wunderink, 2010).

Anaerobic infection plays a significant role in pneumonia when aspiration is preceded several days to weeks before pneumonia. The combination of an unprotected airway and teething is a risk factor for anaerobic infection. In addition, anaerobic pneumonia infection is exacerbated by the formation of abscesses and empyema, and parapneumonic effusions (Mandell and Wunderink, 2010).

MRSA (Methicillin-resistant Staphylococcus aureus) has been found as the primary cause of CAP, although not much. The reason for this is because of the spread of MRSA from the hospital environment to the community and the occurrence of genetic changes in MRSA that infect the community so that the MRSA strain can infect people who previously had no history of contact with health workers (Mandell and Wunderink, 2003). 2010).

Pneumonia occurs due to the proliferation of pathogens in the alveolus and the host's response to these pathogens. Microorganisms gain access to the lower respiratory tract in several ways, the most common of aspiration and oropharynx. Small amounts of aspiration are standard during sleep (particularly in the elderly) and patients with reduced consciousness. Many pathogens are inhaled as contaminated saliva droplets. Although rare, pneumonia can occur through hematogenous spread (e.g., from tricuspid endocarditis) or continuous extension from infection in the pleural space or mediastinum.

Mechanical factors are significant for the host defense system. The nasal hairs and the turbinates (turbinates) in the nostrils trap large particles before they reach the lower respiratory tract. The tree-like branching architecture of the tracheobronchial allows the capture of particles in the lining of the airways, where mucociliary clearance and local antibacterial factors can clear or kill potential pathogens. The gag reflex and cough mechanism provide essential protection from aspiration. In addition, the normal flora attached to the mucosal cells of the oropharynx, whose components are very constant, prevents the attachment of pathogenic bacteria and therefore reduces the risk of pneumonia due to these more virulent bacteria.

Suppose these defenses are defeated, or the microorganism is small enough to be inhaled into the alveolus. In that case, the macrophages present in the alveolus will become immediately efficiently clean or kill the pathogen. Macrophages are aided by local proteins (e.g., surfactant

proteins A and D) with intrinsic ozonizing effects or bacterial or antiviral activity. After being ingested by macrophages, pathogens, even if not dead, are eliminated via the mucociliary elevator or lymphatic vessels and are no longer a threat of infection. Only when the capacity of alveolar macrophages to digest or kill microorganisms is exceeded that clinical manifestations of pneumonia appear. In this situation, alveolar macrophages initiate an inflammatory response to strengthen lower airway defenses. The host inflammatory response, rather than the proliferation of microorganisms, triggers the clinical syndrome of pneumonia. The release of various inflammatory mediators, such as interleukin-1 (IL-1) and tumor necrosis factor (TNF), causes fever. Chemokines such as IL-8 and granulocyte colony-stimulating factor (GCSF) stimulate the release of neutrophils and their withdrawal to the lung, causing peripheral leukocytosis and increased purulent secretion. Inflammatory mediators released by newly arrived macrophages and neutrophils cause alveolar-capillary leak equivalent to that seen in acute respiratory distress syndrome (ARDS). However, in pneumonia this leakage is limited (at least initially). Even erythrocytes can penetrate the alveolar-capillary membrane, causing hemoptysis. Capillary leakage causes an infiltrate on chest X-ray and wet crackles audible on auscultation, and hypoxemia occurs because of the filling of the alveoli. In addition, some bacterial pathogens appear to interfere with the hypoxemic vasoconstriction that usually occurs in fluid-filled alveoli, and this disturbance can cause severe hypoxemia. The increased urge to breathe in the systemic inflammatory response syndrome (SIRS) causes respiratory alcoholysis. Reduced compliance due to hypoxaemic capillary leak, increased respiratory drive, increased secretions, and sometimes bronchospasm associated with infection cause the patient to experience dyspnea. If severe enough changes in lung mechanics due to reduced lung volume and flexibility and intrapulmonary blood shunts can cause patient death (Mandell and Wunderink, 2016)

III. METHOD RESEARCH

This type of research is a descriptive study with a cross-sectional approach. This study aims to observe the effect of the CURB-65 score on the length of stay of hospitalized pneumonia patients (Noor, 2008). The measurement method in this study was to take data from the medical records of patients who were hospitalized at the Royal Prima Hospital Medan in 2019. Aspects of measurement in this study as a whole are as follows:

TABLE 2. Aspects of Measurement of Dependent Variables

No	Variable	Definition	Instruments Measuring	Results	Scale
1	Score CURB-65	The CURB-65 score is calculated by assessing the clinical condition and the results of laboratory tests	Medical records	In the value range 0-5	Ratio

All data analysis carried out in this study was carried out with IBM SPSS Statistics 25 Software. After the research data were obtained, several analyzes were carried out, namely:

a. Univariate Analysis

Univariate analysis is an analysis that is carried out on a variable. This analysis was conducted to describe the characteristics/general description of each variable. This analysis is conducted to inform about a variable without being associated with other variables and intended to determine the frequency distribution of each dependent variable and independent variable, which is then presented descriptively and in tabular form.

b. Bivariate Analysis

Bivariate analysis used in this study is a different test. The difference test used is based on the normality of the data tested by the Shapiro-Wilk test, if the data distribution is normal, then a one-way ANOVA test is carried out, but if the data distribution is not normal, it will try to transform the data so that the data can be normally distributed. However, if the data is still not normally distributed, then the alternative test used is the Kruskal-Wallis test.

After the one-way ANOVA test was carried out, the trial was continued with a follow-up test with a post-hoc test. In determining the type of further test used, the data homogeneity test was first carried out with the Levene test.

IV. ANALYZE AND RESULT

The characteristics of pneumonia patients hospitalized at the Royal Prima General Hospital Medan in 2019 as samples in the study included age, gender, BPJS class, and type of antibiotics.

4.1. Age

An overview of the age distribution of pneumonia patients hospitalized at the Royal Prima Medan General Hospital in 2019 based on length of stay can be seen in the following table.

TABLE 3. Age Frequency Distribution of Pneumonia Patients Inpatient at Royal Prima General Hospital Medan in 2019

Ages	Duration of Treatment [n (%)]		Total	Value P
	≤ 1 weeks	> 1 weeks		
Late Adolescence (17-25 years)	2 (5.6)	2 (5.6)	4 (11.1)	
Late Adults (36-45 years)	0 (0)	2 (5.6)	2 (5.6)	
Early Elderly (46-55 years old)	4 (11.1)	2 (5.6)	6 (16.7)	0.384
Late Elderly (46-65 years)	6 (16.7)	2 (5.6)	8 (22.2)	
Seniors (> 65 years)	9 (25.0)	7 (19.4)	16 (44.4)	
Total	**22 (61.1)**	**14 (38.9)**	**36 (100)**	

From the table data above, it can be seen that the majority of pneumonia patients hospitalized at the Royal Prima General Hospital Medan in 2019 came from the elderly age group, namely 16 people (44.4%) and the least came from the late adult age group, namely 36-36. 45 years which is only 2 people (5.6%). Based on the results of the chi square analysis, there is no relationship between age and length of stay of

pneumonia patients who were hospitalized at the Royal Prima General Hospital Medan in 2019. This can be seen from the P value > 0.05 (P value = 0.384).

4.2. Gender

An overview of the sex distribution of pneumonia patients hospitalized at the Royal Prima General Hospital Medan in 2019 based on length of stay can be seen in the following table.

TABLE 4. Gender Frequency Distribution of Pneumonia Patients Hospitalized at Royal Prima General Hospital Medan in 2019.

Genders	Duration of Treatment [n (%)]		Total	Value P
	≤ 1 weeks	> 1 weeks		
Man	10 (27.8)	4 (11.1)	14 (38.9)	0.311
Woman	12 (33.3)	10 (27.8)	22 (61.1)	
Total	**22 (61.1)**	**14 (38.9)**	**36 (100)**	

From the table data above, it can be seen that the majority of pneumonias hospitalized at the Royal Prima General Hospital Medan in 2019 were women, as many as 22 people (61.1%). While the remaining 14 people (38.9%) were men. Based on the results of the chi square analysis, there is no relationship between gender and length of stay of pneumonia patients hospitalized at the Royal Prima General Hospital Medan in 2019. This can be seen from the P value > 0.05 (P value = 0.311).

From the table data above, it can be seen that the majority of pneumonias hospitalized at the Royal Prima General Hospital Medan in 2019 were women, as many as 22 people (61.1%). While the remaining 14 people (38.9%) were men. Based on the results of the chi square analysis, there is no relationship between gender and length of stay of pneumonia patients hospitalized at the Royal Prima General Hospital Medan in 2019. This can be seen from the P value > 0.05 (P value = 0.311).

V. CONCLUSION

The conclusions that can be drawn from the results of this study are as follows:

a. The majority of pneumonia patients hospitalized at the Royal Prima General Hospital Medan in 2019 were women (61.1%) from the manual age group (44.4%).

b. The majority of pneumonia patients hospitalized at the Royal Prima General Hospital Medan in 2019 used ceftriaxone, namely 16 people (44.5%) with 16.7% using ceftriaxone one g/12 hour, 22.2% using ceftriaxone one g/8 hour, and 5.6% using ceftriaxone two g/day.

c. There is a significant relationship between the CURB-65 score and the length of stay in pneumonia patients hospitalized at the Royal Prima General Hospital (Niali P = 0.002).

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