Correlation between the Number of Leucocytes and Neutrophil to Lymphocytes Count Ratio in Children with Pneumonia at RSUD Koja Jakarta

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ABSTRACT

Pneumonia is an acute lower respiratory tract infection that affects the lungs. This disease is one of infant and toddlers’ biggest causes of death. Immature immunity, poor air quality, poor sanitation and nutrition, and incomplete immunization make children vulnerable to this disease. This study used an analytic observational method with a cross-sectional research design. The research subjects used as many as 30 respondents with pneumonia in children with an age range of 1 year - 17 years who were in the pediatric ward at Koja Hospital. The study was conducted at the Koja Hospital laboratory from February to June 2022. The sample in this study was the result of a complete blood count, namely the examination of the leukocyte count and the value of the neutrophil-lymphocyte ratio in pediatric patients with pneumonia. The data was collected by performing a complete blood count using the Sysmex XN 1000 Hematology Analyzer. Data analysis in this study used the Pearson product-moment correlation test with a 95% confidence level. Using the Statistical product and service solution version 23 program. The results showed a significance value (p) of 0.05 > 0.03. This study concludes that there is a correlation between the number of leucocytes and the value of the neutrophil-lymphocyte ratio in pediatric patients with pneumonia at Koja Hospital, Jakarta.

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1. Introduction

Pneumonia is an acute lower respiratory tract infection that affects the lungs. The lungs are made up of small sacs called alveoli. These alveoli are filled with air when a healthy person breathes. But when a person has pneumonia, these alveoli are filled with fluid or pus which makes it difficult for the patient to breathe thereby limiting the intake of oxygen that enters. Pneumonia can be spread in various ways, including when coughing and sneezing (WHO, 2014). The causes can vary, most are caused by microorganisms (viruses or bacteria) and a small part is caused by other things (aspiration or radiation).) (Said M, 2015). In patients with pneumonia, there is a build-up of sputum in the respiratory tract, the patient can produce a lot of mucus and thicken the alveolar fluid. This increase in sputum production will cause impaired airway hygiene. If the cleanliness of the airway is disturbed, it will hinder the fulfillment of oxygen supply to the brain and cells throughout the body, if left for a long time will cause hypoxemia and then develop into severe hypoxia and decreased consciousness. (Sari, 2016) because of this pneumonia sufferers can die (Misnadiarly, 2008).

Pneumonia is a health problem in the world because it is one of the biggest causes of death in infants and toddlers, not only in developing countries but also in developed countries such as America, Canada, and other European countries. Based on data from the World Health Organization and the Ministry of Health of the Republic of Indonesia (2018), the incidence of pneumonia is more common in developing countries.
countries. Pneumonia attacks about 450 million people every year, the number of pneumonia sufferers in Indonesia in 2019 based on the Indonesian Health Profile of the Ministry of Health is more than 400 thousand cases. The Jakarta Capital Special Region Health Office estimates 43,309 cases of pneumonia or pneumonia in children during 2019 (IDI, 2020). And in North Jakarta alone there were 7,687 cases of pneumonia in children (P2P Jakarta Health Office, 2019). This is because the immune system in children is still weak and immature, making them susceptible to disease (Aryani et al., 2018). Due to the high cases of pneumonia in children that occur in Jakarta, especially in North Jakarta, it is necessary to conduct research related to establishing a fast and inexpensive diagnosis of pneumonia.

One of the most common blood tests to diagnose pneumonia is a complete blood count. A white blood cell count is a complete blood count. If the result is an increase in the number, it is confirmed that infection or inflammation accompanies it. It’s just that this examination is not specifically a diagnosis of pneumonia. Other supporting examinations such as chest X-rays (Thorax) are required. The role of inflammatory markers is quite large in assessing the course of pneumonia, one of which is the Neutrophil Lymphocyte Ratio (NLR) which combines neutrophils as an active inflammatory component and lymphocytes as regulators and protective components in a single parameter. This research is needed as an evaluation of the role of NLR as a biomarker for the diagnosis of pneumonia. Based on research on previous journal studies that discussed NLR as a risk factor for bacterial infection in children, it was concluded that the NLR Ratio of 4.67 was a risk factor for bacteremia. This cut-off value can be used to initiate antibiotic therapy to prevent a worse prognosis (Yullyantara et al., 2019). In another journal, it was also found that at the cut-off limit of 6.4 the NLR can be relied upon as a marker of bacterial sepsis (Luhulima et al., 2018). Thus, this study is considered necessary as an initial diagnosis of pneumonia considering the increasing cases of pneumonia in children in North Jakarta, especially in Koja Hospital.

The limitation of the problem in this study is the correlation between the number of leukocytes and the NLR value in pediatric pneumonia patients with an age range of 1 year – 17 year in the pediatric ward of Koja Hospital. With the criteria of moderate to severe pneumonia. Based on the description of the background, the formulation of the problem is "How is the correlation between the number of leukocytes and NLR in pediatric patients with moderate to severe pneumonia in the inpatient ward of the pediatric section of Koja Hospital, North Jakarta."

2. Method

This type of research uses the Analytical Observational method with a cross-sectional design. The object of this research is the number of leukocytes and the value of the neutrophil-lymphocyte ratio in pediatric patients with pneumonia with an age range of 1 year – 17 years who are in the pediatric ward of Koja Hospital. The sampling technique is EDTA blood, namely by using a purposive sampling technique, namely a sampling technique that considers certain characteristics and specifications. (Masturoh, 2018).

Analysis of the data used in this study is as follows:

2.1 Normality Test

The normality test aims to test the variables in the regression model of the dependent variable, independent variable, or normal distribution or not (Suardi, 2019). The normality test used in this study is the Kolmogorov Smirnov test which is a classic test to determine the distribution of random data from small or large samples. One of the conditions for the Kolmogorov Smirnov test is interval or ratio scale data and the data comes from a random sample. The data is said to be normal if the significant value (p) is 0.05 and said to be abnormal if the significant value (p) <0.05.

2.2 Hypothesis Test

Hypothesis testing is carried out using a simple linear regression test with the help of the SPSS program, namely to test whether there is a relationship between the independent variable (free) and the dependent variable (bound) (Masturoh, 2018). Pearson correlation test is a simple correlation test technique that only involves one dependent variable (bound) and one independent variable (free). In this study, the Pearson product-moment correlation test was used to determine the correlation between the number of leukocytes and the NLR in pediatric patients with pneumonia. The research criteria for testing this hypothesis are:

a. Significant value (p) less than 0.05 (p < 0.05):

There is a relationship between the number of leukocytes and the value of the neutrophil-lymphocyte ratio in pediatric patients with pneumonia who are treated in the pediatric ward of Koja
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Hospital, North Jakarta.

b. Significant value (p) greater than or equal to 0.05 (p 0.05):

There is no relationship between the number of leukocytes and the value of the neutrophil-lymphocyte ratio in pediatric patients with pneumonia in the pediatric ward of Koja Hospital, North Jakarta.

3. Result and Discussion

3.1 Research Results

Research on the correlation between the number of leukocytes and the value of the neutrophil-lymphocyte ratio in pediatric patients with pneumonia at Koja Hospital Jakarta from February to March 2022 was obtained from 30 respondents who met the research criteria and agreed to give informed consent. Samples were taken by purposive sampling with the following results:

Table 1

| No | Age   | Gender | Leukocyte Count | NLCR |
|----|-------|--------|-----------------|------|
| 1  | 2 Year| Female | 8.300           | 1.65 |
| 2  | 1 Year| Female | 13.800          | 1.68 |
| 3  | 2 Year| Male   | 8.400           | 1.16 |
| 4  | 1 Year| Male   | 11.400          | 0.38 |
| 5  | 4 Year| Female | 7.700           | 2.40 |
| 6  | 6 Year| Female | 18.800          | 14.85|
| 7  | 1 Year| Female | 12.700          | 2.19 |
| 8  | 3 Year| Male   | 16.500          | 1.70 |
| 9  | 2 Year| Male   | 12.600          | 8.33 |
| 10 | 1 Year| Male   | 23.100          | 2.72 |
| 11 | 1 Year| Female | 8.800           | 1.54 |
| 12 | 1 Year| Male   | 4.300           | 3.61 |
| 13 | 2 Year| Male   | 12.600          | 8.33 |
| 14 | 6 Year| Female | 9.300           | 2.10 |
| 15 | 10 Year| Male  | 15.900          | 5.11 |
| 16 | 5 Year | Male   | 3.800            | 2.17 |
| 17 | 1 Year | Male   | 11.400          | 2.57 |
| 18 | 6 Year | Male   | 14.800          | 5.06 |
| 19 | 1 Year | Male   | 7.600           | 4.04 |
| 20 | 3 Year | Male   | 8.900           | 3.64 |
| 21 | 15 Year| Female | 13.500          | 4.18 |
| 22 | 8 Year | Female | 15.100          | 13.68|
| 23 | 5 Year | Female | 16.100          | 6.76 |
| 24 | 2 Year | Female | 12.600          | 1.40 |
| 25 | 3 Year | Female | 5.700           | 2.21 |
| 26 | 3 Year | Male   | 16.600          | 4.91 |
| 27 | 3 Year | Male   | 25.200          | 5.69 |
| 28 | 1 Year | Female | 14.400          | 1.16 |
| 29 | 5 Year | Male   | 8.100           | 1.81 |
| 30 | 4 Year | Female | 14.100          | 8.56 |

(Source: Primary and Secondary Data, 2022)

a. Characteristics of Pediatric Pneumonia Patients in Koja Hospital

There are 30 patients with pneumonia in children, so the characteristics of 30 pediatric patients with pneumonia can be identified as follows:
1) **Age**

Table 2

| No | Age                      | Frequency | Percentage |
|----|--------------------------|-----------|------------|
| 1  | Toddler (1 Year to 5 Years) | 24        | 80.0 %     |
| 2  | Childhood (6 Years to 11 Years) | 5         | 16.67 %    |
| 3  | Early teens (12 years to 16 years) | 1         | 3.34 %     |
|    | Total                    | 30        | 100%       |

(Source: Primary and Secondary Data, 2022)

Based on table 2, it is known that the characteristics of pediatric pneumonia sufferers in Koja Hospital are the majority aged from the Toddler group (1 year to 5 Years) as many as 24 patients or 80.0%.

2) **Gender**

Table 3

| No | Age | Frequency | Percentage |
|----|-----|-----------|------------|
| 1  | Male | 16        | 53.34%     |
| 2  | Female | 14       | 46.66%     |
|    | Total | 30       | 100%       |

(Source: Primary and Secondary Data, 2022)

Based on table 3, it is known that the characteristics of pediatric Pneumonia sufferers in Koja Jakarta Hospital are the majority male, with as many as 16 patients or 53.34%.

b. **Normality test**

The normality test is used to determine whether the distribution of the leukocyte count and NLCR data is normally distributed or not so that it can determine the statistical test of the hypothesis to be used. The normality test method used in this study is the Kolmogorov Smirnov normality test with the following results:

Table 4

|               | Kolmogorov-Smirnov |
|---------------|-------------------|
| Leukocyte Count | 0.200             |
| NLR            | 0.200             |

The results of the normality test using the Kolmogorov Smirnov method obtained a significant value for both variables, both Leukocytes, and NLCR, which were above 0.05. With the results of the Leukocyte normality test of 0.200 > 0.05, it can be concluded that the two variables are normally distributed.

Because the distribution of this data is normal, it can be continued to do the Pearson Product Moment parametric statistical test which serves to determine whether there is a relationship between the independent variable and the dependent variable which is shown in table 5 below:

Table 5

| Correlation Pearson | n  | p    | r  |
|---------------------|----|------|----|
| Leukocyte Account   | 30 | 0.03 | 0.397 |
| NLR                 | 30 | 0.03 | 0.397 |

(Source: Primary and Secondary Data, 2022)

The results of the Pearson Product Moment parametric test contained in table 4-5 concluded that there was a relationship or correlation between the number of leukocytes and NLR in pediatric patients with pneumonia who were treated in the pediatric ward at Koja Hospital Jakarta. The results of the Pearson Product Moment parametric test are said to be significantly correlated if the significance value (p) < 0.05. Table 4-5 shows the significant value of the Pearson Product Moment parametric test of 0.03. Because the Pearson Correlation test is smaller than 0.05, the result is 0.03 < 0.05. So it can be concluded that there is a significant correlation or relationship between variables.

2.3 **Discussion**

The number of leukocytes in children with pneumonia at the Koja Hospital Jakarta showed that most of them were abnormal. The reference value for leukocytes based on the Ministry of Health of the
Republic of Indonesia Year 2011 is 3200-10,000/mm3. This indicates that children with pneumonia in Koja Hospital are dominated by the number of leukocytes in the blood > 10,000/mm3. Children with pneumonia in Koja Hospital related the results of the high number of leukocytes because Leukocytosis is a systemic inflammatory response to infection due to stimulation of proinflammatory cytokines and the presence of endotoxemia (de Jager et al., 2010). This study supports the research conducted by (Furer et al., 2011). Which mentions that leukocytosis is found in the majority of pneumonia patients. In terms of age, pneumonia sufferers are dominated by pediatric patients with an age range of 1 year - 5 years, which is 80.0%. This supports research conducted by (Nuraeni et al., 2019) which states that pneumonia sufferers mostly occur in toddlers.

NLR shows a mean value of 4.186. The NLR value in this study ranged from 0.38 to 14.85. Neutrophils are a type of leukocyte whose number increases in patients with pneumonia. Neutrophils are released mainly to fight pathogens by means of phagocytosis at the site of inflammation (Kolling et al., 2001).

The results of the analysis showed that there was a correlation or relationship between the number of leukocytes and the value of the neutrophil-lymphocyte ratio in patients with pneumonia in children at Koja Hospital. The results of this study are in line with research conducted by (Yullyantara et al., 2015) which describes that the results of this study indicate that the NLR value of 4.67 is a risk factor for bacteremia. This cut-off value can be used to initiate antibiotic therapy to prevent a worse prognosis (sepsis, multiple organ failure, and death). But the results of this study are not in line with research conducted (Pramana et al., 2015) which illustrates that there is no relationship between the number of leukocytes and the severity of pneumonia in children.

Examination of the leukocyte count and NLR can be influenced by pre-analytical, analytical, and post-analytical factors. Pre-analytical factors include: sampling in children is quite difficult so that sometimes only a few blood samples are obtained, and incorrect labeling of samples. Analytical factors include the quality of the reagents which are sometimes close to the expiration date, the value of the instrument calibration factor, and the quality of the control of the hematology tool which is getting less and less in quality. Meanwhile, post-analytical factors include the calculation and reporting of results that sometimes do not match those listed on the hematology analyzer.

4. Conclusion

There is a correlation or relationship between the number of leukocytes and the value of the neutrophil-lymphocyte ratio in pediatric patients with pneumonia at Koja Hospital. This conclusion was obtained after performing the Pearson Product Moment parametric test with a value of 0.03 < 0.05.

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