RESEARCH ARTICLE

Correlation of Neutrophil and Lymphocyte Counts in Patient Infected with Coronavirus (Covid-19)

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ABSTRACT

Coronavirus Disease 2019 (Covid-19) causes hyper-inflammation and poor clinical conditions leading to high mortality in the world. Neutrophil and lymphocyte counts are used to describe disease severity in many clinical conditions including COVID-19. The purpose of this study was to determine the relationship between neutrophils and lymphocyte counts in patients infected with the coronavirus (Covid-19). The type of research used was cross-sectional. The sample in this study were patients infected with the Coronavirus (Covid-19) in a special isolation room who did a complete blood check at Brawijaya Hospital Surabaya. Types of data obtained from LIS (Laboratory Information System). The results of the study on the number of neutrophils in coronavirus (Covid-19) patients at Brawijaya Hospital showed an average neutrophil count of 5,174 cells/uL and an average lymphocyte count of 1,514 cells/uL. Data analysis showed that there was no correlation between the number of neutrophils and lymphocytes in patients infected with the Coronavirus (Covid-19) at Brawijaya Hospital Surabaya, possibly related to differences in immunity in each person.

Keywords: coronavirus (Covid-19); neutrophils; lymphocytes

INTRODUCTION

Coronavirus Disease 2019 (Covid-19) is a viral infection caused by the acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This infection has caused medical conditions in the world. As of October 2020, worldwide confirmed cases of more than 40 million people with more than 1,000,000 deaths. [1]

Fever and cough are the two most common symptoms. Many patients have mild symptoms and some have helpful anticipation. To date, there have been several coronavirus patients who have progressed to severe pneumonia, aspiration edema, severe respiratory distress, or other organ disorders and eventually died. Given the rapid spread and real danger of the Coronavirus (Covid-19), it is imperative to continue to improve clinical determination capacities such as its assessment and treatment. [2]

Early identification is needed to predict the condition of patients who are at risk for worsening symptoms.
Basic laboratory tests, such as blood tests, especially neutrophil and lymphocyte counts are used as elements of patient anticipation in various clinical situations. [3]

Coronavirus (Covid-19) patients with severe symptoms may experience impaired immune response, which can lead to the development of viral hyperinflammation. Therefore, patients with severe symptoms should undergo laboratory parameter testing for hyperinflammatory markers to increase mortality. The number of neutrophil-lymphocytes is one indicator of the inflammatory response that is widely used as an examination of Covid-19 patients. An increase in the number of neutrophils and lymphocytes may reflect an increased inflammatory process and may be associated with a poor prognosis. [4]

An increase in the number of neutrophil-lymphocytes and age are simultaneously associated with the severity of the disease and the occurrence of infection. Increasing age and neutrophil-lymphocyte count can be considered independent biomarkers of poor outcomes. [2]

Neutrophils are the main component of leukocytes that actively migrate to the immune system or organ. Neutrophils are present in many lung diseases associated with ARDS, such as Covid-19 infection. [2] Lymphocytes play a role in maintaining the body's immune system. Lymphocytes have prognostic value in determining severe cases and supporting laboratory tests for Covid-19 disease. [6]

The Surabaya Brawijaya Hospital is used for the isolation of Covid-19 patients, including the examination of neutral and leukocytes in Covid-19 patients. Based on this description, the author is interested in examining the relationship between the number of neutrophils and the number of lymphocytes in patients infected with the Coronavirus (Covid-19) at Brawijaya Hospital, Surabaya

METHODS

The type of research used was cross-sectional to know the relationship between neutrophils count and lymphocytes counts in patients infected with the coronavirus (Covid-19) at Brawijaya Hospital Surabaya, which was carried out at one time. The location of this research was Brawijaya Hospital Surabaya in January to July 2021 and the time data collection was in October 2020 to April 2021. The population in this study were patients infected with the coronavirus (Covid-19) who did a Complete Blood Examination at Brawijaya Hospital Surabaya from October 2020 to April 2021. The sample study was patients infected with Coronavirus (Covid-19) in a special isolation room who did a Complete Blood Count testing at Brawijaya Hospital Surabaya from October 2020 to April 2021 with the criteria that the patient has a positive PCR test result.

The data collection technique in this study used secondary data obtained from Coronavirus (Covid-19) patients in a special isolation room who performed a Complete Blood Count test that had been recorded at the LIS (Laboratory Information System) Brawijaya Hospital Surabaya. The data collection had been approved by the Ethics Committee of Brawijaya Hospital through an ethical clearance letter. The analysis data used was the Pearson correlation test.

RESULTS

The results of data collection during October-April 2021 in Coronavirus (Covid-19) patients were conducted Complete Blood Count test at Brawijaya Hospital Laboratory as 72 data obtained as follows:

Table 1. Results of neutrophil and lymphocyte count testing of covid 19 patients

Variable	Mean	Min	Max
Neutrophil	5.174 cells/uL	1.580 cells/uL	11.900 cells/uL
Lymphocytes	1.514 cells/uL	3.460 cells/uL	430 cells/uL

Table 1 shows the average neutrophils count was 5,174 cells/uL, the highest neutrophil count was 11,900 cell/uL and the lowest was 1,580 cell/uL. Average lymphocytes count was 1,514 cells/uL, the highest lymphocyte count was 3,460 cell/uL and the lowest at 430 cell/uL.
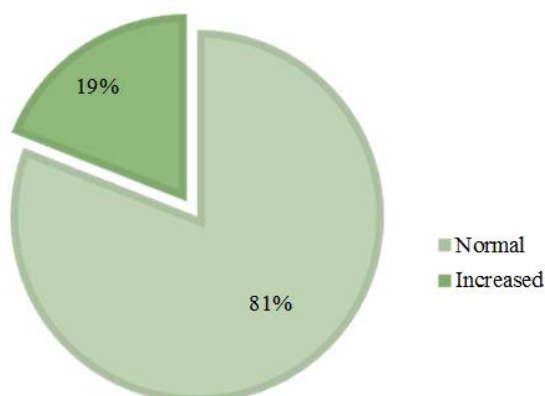

Figure 1. Percentage of neutrophils count

Figure 1 shows of normal neutrophils count by 58 patients (81%) and increased by 14 patients (19%).
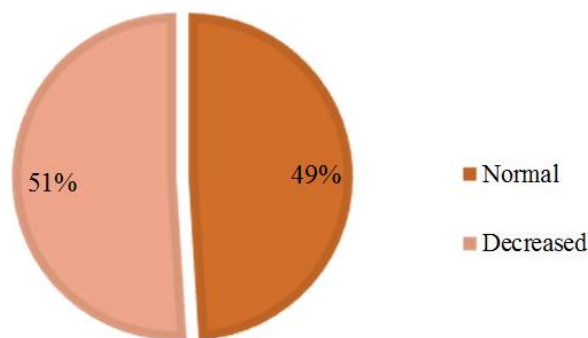
Figure 2. Percentage of lymphocytes count

The normal lymphocyte counts by 35 patients (49%) and decreased by 37 patients (51%). The data obtained first conducted normality test using Kolmogorov Smirnov test and obtained a p-value of neutrophils was 0.401 (p >0.05) which means normally distributed neutrophil data and p-value lymphocytes are 0.618 (p >0.05) which means normally distributed lymphocyte data.

After the normal distribution data was known, Pearson correlation tests were obtained a p-value of 0.088 (p >0.05) which means no correlation was identified between neutrophil and lymphocyte counts in patients infected with coronavirus (covid-19). Obtained a correlation coefficient of -0.202 which means that the increasing number of neutrophils, the decreased lymphocyte counts with a low correlation rate.

DISCUSSION

Based on data results collected from LIS (Laboratory Information System) in Coronavirus (Covid-19) patients at Brawijaya Hospital Surabaya during October - April 2021 with the patients by 72 people, the neutrophils average results is 5,174 cells / uL which means the average neutrophils in coronavirus patients is normal. The highest neutrophil count is 11,900 cells/uL and the lowest is 1,580 cells/uL. With a percentage of 19% neutrophil counts increased in 14 patients and 81% normal neutrophil counts in 58 patients.

The lymphocyte counts average resulted in 1,514 cells/uL, which means that the average number of lymphocytes in coronavirus patients is less than normal. The highest lymphocyte values are 3,460 cells/uL and the lowest is 430 cells/uL. With a percentage of 51% lymphocyte count decreased by 35 patients and 49% normal lymphocytes in 37 patients.

Fever and cough are the two most common symptoms. Many patients show mild symptoms and some of them have a bad history. To date, there have been several Covid-19 patients who have aggravated into severe pneumonia, Pulmo edema, acute respiratory syndrome, or multiple organ failure and eventually died. [2]

Some evidence suggests that in Covid-19 patients with severe symptoms can experience a compromised immune response, this can lead to the development of hyper inflammation from the virus. Therefore, patients with severe Covid-19 symptoms should be laboratory parameters tested for hyperinflammatory markers to improve mortality. [4]

Neutrophils are a major component of leukocytes that actively migrate to immune systems or organs. Neutrophils secrete large amounts of ROS (Reactive Oxygen Species) that induce damage from the cell's DNA. In addition, the human immune response caused by the virus relies primarily on lymphocytes, where systemic inflammation suppresses cellular immunity, significantly lowering CD4+ T lymphocyte levels and increasing CD8+ lymphocyte suppressor T.[2]

The results of analyzing data using Pearson correlation tests obtained a significant value of 0.088 (p > 0.05) which means there is no significant correlation between neutrophil and lymphocyte counts in patients infected with coronavirus (Covid-19).

That's because the normal neutrophil count is more than increased. whereas according to many theories, neutrophils in coronavirus (Covid-19) patients are increasing, which is caused by the severity of the Covid virus infection. This can happen because patients are have been infected with the Covid-19 virus and have tested positive for Covid through a PCR examination are not classified as severe, and it also is the patient has just been infected or has been exposed to the virus for a short time. Time and age factors also determine the risk of increasing neutrophil counts moreover, each patient's immunity is different which causes neutrophil counts in normal patients. Neutrophil values play a role in the severity of coronavirus (Covid-19) infection. Increase neutrophil counts indicate the intensity of the inflammatory response in Covid patients.

The main function of neutrophils is the cleaning of pathogens and debris through phagocytosis. They also have a different array of other immune roles, such as the release of NET (Neutrophil Extracellular Traps) for

inactivation of viral infections and the production of cytokines to limit viral replication. In patients with severe covid-19 neutrophil counts will increase compared to mild symptoms. [5]

While data on lymphocyte counts is obtained following existing theory, this proves that decreased lymphocyte counts in Covid-19 patients called lymphocytopenia caused by the virus entering the body and infects lymphocyte cells that will experience changes both in shape and number. Decrease lymphocyte counts indicates damage to the immune system. Lymphocyte results below the value of 500 cells / uL then the rate of viral infection is quite severe. Lymphoma is common in patients with COVID-19 by 72%, indicating a decrease in the immune system during SARS-CoV-2 infection. In addition, there was a decrease in CD4 + T cells, CD8 + T cells, B cells, and NK cells in COVID-19 patients. [6]

CONCLUSION

The results of this study concluded that the average number of neutrophils was 5,174 cells/uL, the average lymphocyte count was 1,514 cells/L. The results of data analysis showed that there was no relationship between neutrophils and the lymphocyte count of patients infected with the coronavirus (Covid-19) at Brawijaya Hospital, Surabaya. This is related to differences in immunity and clinical conditions in each Covid-19 patient. The limitations of obtaining other supporting clinical data made it difficult for researchers to interpret the correlation between neutrophils and leukocytes in this study. Future researchers are expected to have more accurate data regarding the clinical condition of the patient.

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