Original Research Article

Description of Hematologic Parameters at Arrival and When Pneumonia Occurred in Patients with Stroke Treated at Intensive Care Unit at Prof. I.G.N.G Ngoerah General Hospital Denpasar in from 2019 to 2021

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ABSTRACT

Stroke-associated pneumonia is one of the most common complications. Incidence 6.7 - 36.98 % can lead to prolonged hospitalization, poor functional outcomes, also high morbidity and mortality. Hematological results indicating the occurrence of a bacterial infection process are markers in stroke patients with pneumonia. 47 stroke patients with pneumonia. There were 40 male patients (85.1%) and 7 female patients (14.9%). Patients aged 50 years were 28 patients (59.6%). History of trauma occurred in 67 patients (69.7%) and 29 patients (30.2%). Increase in white blood cells in 35 patients (74.5%) at arrival and 41 patients (47.2%) at the onset of pneumonia, platelet 3 patients at arrival (6.4%) and 13 patients at the onset of pneumonia (27.7%), neutrophil 40 patients at arrival (85.1%) and 43 patients at the onset of pneumonia (91.5%), monocytes 7 patients at arrival (14.9%) and 11 patients (23.4%) at the onset of pneumonia, lymphocytes 16 patients (34.0%) at arrival and 22 patients (46.8%) at the onset of pneumonia. Decreased red blood cell values in 17 patients (36.2%) at arrival and 22 patients (46.8%) at the onset of pneumonia, Hb 15 patients (31.9%) at arrival and 27 patients (57.4%) at the onset of pneumonia, and Hematocrit 14 patients (29.8%) at arrival and 24 patients (51.1%) at the onset of pneumonia.

There was an increase in blood hematology results from the results of white blood cells, neutrophils, lymphocytes, monocytes, and platelets and there was a decrease in blood results from red blood cells, hemoglobin, and hematocrits. While the neutrophil to lymphocyte ratio, Mean Corpuscular Volume, Mean Corpuscular Hemoglobin, Mean Corpuscular Hemoglobin Concentration, Red Cell Distribution Width, and eosinophil values did not find any significant changes at arrival and at the time of pneumonia in stroke patients who were treated at the Intensive Care Unit.

Keywords: Hematology, Stroke, Pneumonia

INTRODUCTION

Stroke-related pneumonia is the most common complication and this condition can lead to prolonged hospitalization, poor functional outcome, and high morbidity and mortality.[2,4-7] The poor prognosis associated with pneumonia has been studied. Hoffmann *et al* developed and validated the A2DS2, a 10-point clinical model with high sensitivity and specificity for predicting the occurrence of pneumonia.[1,4,5] Neutrophil to Lymphocyte Ratio (NLR) is the absolute neutrophil count

divided by the absolute lymphocyte count and is been shown to be a new hematological and inflammatory parameter. NLR is associated with a variety of diseases, such as community-acquired pneumonia, axial spondyloarthritis, and coronary angiography, as well as a systemic inflammatory response that reflects the abnormal immune status of the disease. Other bacterial infection hematological markers such as White Blood Cells (WBC), neutrophils, lymphocytes, and monocytes can be examined.[1,2,3] Acute stroke patients with long treatment are at high risk of pneumonia. This condition is experienced by many elderly patients and has minimal mobilization. Apart from clinical indications of infection, a complete blood count hematology examination can be used to see whether the process of pneumonia infection is ongoing.

METHOD
The method of this research is using descriptive retrospective. This research was conducted by collecting data from medical records and inpatient installations at Prof. I.G.N.G Ngoerah General Hospital Denpasar and collecting patient data from 2019 to 2021 with a total sample of 47 cases. The data included in the inclusion criteria were medical record data which contained information about the research variables such as gender, age, and patients who were checked for complete blood counts upon arrival and when pneumonia occurred. The research sample was all cases of stroke patients with pneumonia who were treated in the intensive care unit based on medical record data for the period of 2019 to 2021. The obtained data were then analyzed using Statistical Product and Service Solutions (SPSS), 25th version. The weakness of this study is the research design which is descriptive and retrospective. This study did not specifically distinguish between the classification of hemorrhagic and ischemic strokes. The minimum number of samples in this study made the results of

this study less generalizable. Further research is needed with a larger sample and more detailed and clear sample data.

RESULT
The result of the study research samples that met the study inclusion criteria, so the total sample that was successfully collected was 47 stroke patients with pneumonia. Based on the results of the study of gender, there were 40 male patients (85.1%) and 7 female patients (14.9%) with stroke and pneumonia.

Table 1 shows the characteristics of patients based on gender.

Table 1. Distribution of Stroke Patients with Pneumonia in the Intensive Care Unit by Gender

Sex	Frequency	Percentage (%)
Male	40	85.1
Female	7	14.9
Total	**47**	**100**

Table 2 shows the distribution of patients by age. In this study, research samples were only divided into 2 age groups, those aged under 50 years and those aged 50 and over. From the results of the study, it was found that the age of stroke patients with pneumonia under 50 years was 19 patients (40.4%), while the age group of 50 years and over was 28 patients (59.6%).

Table 2. Distribution of Stroke Patients with Pneumonia at the Intensive Care Unit by Age

Age	Frequency	Percentage (%)
< 50 years	19	40.4
> 50 years	28	59.6
Total	**47**	**100**

Table 3 shows the distribution of WBC at arrival and at the time of pneumonia in stroke patients who were treated at the intensive care unit. From the results of the WBC study at arrival and at the time of the occurrence of pneumonia in stroke patients, 12 patients (25.5%) were normal and 35 patients (74.5%) had increased at the start. WBC evaluation results after the patients were treated at the intensive care unit, 6 patients (12.8%) and 41 patients (87.2%) experienced an increase in WBC.

Table 3. Distribution of Stroke Patients with Pneumonia in the Intensive care unit Based on White Blood Cells

White Blood Cell	Frequency at arrival	Frequency at the onset of pneumonia
Normal	12 (25.5 %)	6 (12.8%)
Abnormal	35 (74.5%)	41 (87.2%)
Total	**47**	**47**

Table 4 shows the distribution of Red Blood Cells (RBC) at arrival and at the time of pneumonia in stroke patients who were treated at the intensive care unit. From the results of the RBC study at arrival and at the time of pneumonia in stroke patients, 30 patients (63.8%) were normal and 17 patients (36.2%) were abnormal at the start. Evaluation of RBC results after patients were admitted to the intensive care unit were 25 patients with normal RBC (53.2%) and 22 patients with abnormal RBC (46.8%).

Table 4. Distribution of Stroke Patients with Pneumonia Based on RBC

Red Blood Cell	Frequency at arrival	Frequency at the onset of pneumonia
Normal	30 (63.8 %)	25 (53.2%)
Abnormal	17 (36.2%)	22 (46.8%)
Total	**47**	**47**

Table 5 shows the distribution of hemoglobin at arrival and at the time of pneumonia in stroke patients who were treated at the intensive care unit. From the results of the hemoglobin study at arrival and at the time of the occurrence of pneumonia in stroke patients, 32 patients (68.1%) were normal and 15 patients (31.9%) were abnormal at the start. Evaluation of hemoglobin results after the patient was admitted to the intensive care unit, 20 (42.6%) patients was normal and 27 (57.4%) patients had abnormal hemoglobin.

Table 5. Distribution of Stroke Patients with Pneumonia based on Haemoglobin

Hemoglobin	Frequency at arrival	Frequency at the onset of pneumonia
Normal	32 (68.1%)	20 (42.6%)
Abnormal	15 (31.9%)	27 (57.4%)
Total	**47**	**47**

Table 6 shows the distribution of hematocrit at arrival and at the time of pneumonia in stroke patients who were treated in the intensive care unit. From the results of the hematocrit study at arrival and at the time of pneumonia in stroke patients, 33 patients (70.2%) were normal and 14 patients (29.8%) were abnormal at the start. Evaluation of hematocrit results after the patient was admitted to the intensive care unit, 20 patients (42.6%) was normal and 27 patients (57.4%) had abnormal hematocrit.

Table 6. Distribution of Stroke Patients with Pneumonia based on Hematocrit

Hematocrit	Frequency at arrival	Frequency at the onset of pneumonia
Normal	33 (70.2%)	20 (42.6%)
Abnormal	14 (29.8%)	27 (57.4%)
Total	**47**	**47**

Table 7 shows the distribution of Mean Corpuscular Volume (MCV) at arrival and at the time of pneumonia in stroke patients who were treated in the intensive care unit. From the results of the MCV study at arrival and at the time of pneumonia in stroke patients, 43 patients (91.5%) were normal and 4 patients (8.5%) were abnormal at arrival. The results of the evaluation of MCV after the patient was admitted to the intensive care unit were 42 patients with normal MCV (89.4%) and 5 patients (10.6%) had abnormal MCV.

Table 7. Distribution of Stroke Patients with Pneumonia in the intensive care unit Based on MCV

MCV	*Frequency at arrival*	*Frequency at the onset of pneumonia*
Normal	43 (91.5%)	42 (89.4%)
Abnormal	4 (8.5%)	5 (10.6%)
Total	**47**	**47**

Table 8 shows the distribution of Mean Corpuscular Hemoglobin (MCH) at arrival and at the time of pneumonia in stroke patients who were treated in the intensive care unit. From the results of the MCH study at arrival and at the time of pneumonia in stroke patients, 44 patients (93.6%) had normal MCH, and 3 patients (6.4%) had abnormal MCH at arrival. Evaluation of MCH results after patients were admitted to the intensive care unit, 44 patients (93.6%) had normal MCH and 3 patients (6.4%) had abnormal MCH.

Table 8. Distribution of Stroke Patients with Pneumonia based on MCH

MCH	*Frequency at arrival*	*Frequency at the onset of pneumonia*
Normal	44 (93.6%)	44 (93.6%)
Abnormal	3 (6.4%)	3 (6.4%)
Total	**47**	**47**

Table 9 shows the distribution of Mean Corpuscular Hemoglobin Concentration (MCHC) at arrival and at the time of pneumonia in stroke patients who were treated at the intensive care unit. From the results of the MCHC study, upon arrival and at the time of pneumonia in stroke patients, 42 patients (89.4%) were normal and 5 patients (10.6%) were abnormal at arrival. Evaluation of MCHC results after patients were admitted to the intensive care unit, 42 patients (89.4%) had normal MCHC and 5 patients (10.6%) had abnormal MCHC.

Table 9. Distribution of Stroke Patients with Pneumonia based on MCHC

MCHC	*Frequency at arrival*	*Frequency at the onset of pneumonia*
Normal	42 (89.4%)	42 (89.4%)
Abnormal	5 (10.6%)	5 (10.6%)
Total	**47**	**47**

Table 10 shows the distribution of Red Cell Distribution Width (RDW) at arrival and at the time of pneumonia in stroke patients who were treated at the intensive care unit. From the results of the RDW study, upon arrival and at the time of the occurrence of pneumonia in stroke patients, 35 patients (74.5%) had normal RDW and 12 patients (25.5%) had abnormal RDW at arrival. RDW evaluation results after the patients were admitted to the intensive care unit, 40 patients (85.1%) had normal RDW and 7 patients (14.9%) had abnormal RDW.

Table 10. Distribution of Stroke Patients with Pneumonia based on RDW

Red Distribution Width	*Frequency at arrival*	*Frequency at the onset of pneumonia*
Normal	35 (74.5%)	40 (85.1%)
Abnormal	12 (25.5%)	7 (14.9%)
Total	**47**	**47**

Table 11 shows the distribution of platelet at arrival and at the time of pneumonia in stroke patients who were treated at the intensive care unit. From the results of the platelet study, upon arrival and at the time of the occurrence of pneumonia in stroke patients, 44 patients (93.6%) had normal platelet and 3 patients (6.4%) had abnormal platelet at arrival. Evaluation of platelet results after patients were admitted to the intensive care unit, 34 patients (72.3%) had normal platelet and 13 patients (27.7%) had abnormal platelet.

Table 11. Distribution of Stroke Patients with Pneumonia based on Platelet

Platelet	Frequency at arrival	Frequency at the onset of pneumonia
Normal	44 (93.6%)	34 (72.3%)
Abnormal	3 (6.4%)	13 (27.7%)
Total	**47**	**47**

Table 12 shows the distribution of NLR at arrival and at the time of pneumonia in stroke patients who were treated in the intensive care unit. From the results of the NLR study at arrival and at the time of pneumonia in stroke patients, 23 patients (48.9%) had normal NLR and 24 (51.1%) had abnormal NLR at arrival. Evaluation of NLR results after patients were admitted to the intensive care unit as many as 22 patients (46.8%) had normal and 25 patients (53.2%) had abnormal NLR.

Table 12. Distribution of Stroke Patients with Pneumonia Based on NLR

Neutrophil to Lymphocyte Ratio	Frequency at arrival	Frequency at the onset of pneumonia
Normal	23 (48.9%)	22 (46.8%)
Abnormal	24 (51.1%)	25 (53.2%)
Total	**47**	**47**

Table 13 shows the distribution of neutrophils at arrival and at the time of pneumonia in stroke patients who were treated at the intensive care unit. From the results of the neutrophils study at arrival and at the time of pneumonia in stroke patients, 7 patients (14.9%) had normal neutrophils and 40 patients (85.1%) had abnormal neutrophils at arrival. The results of the neutrophils evaluation after the patient was admitted to the intensive care unit as many as 4 patients (8.5%) had normal neutrophils and 43 patients (91.5%) had abnormal neutrophils.

Table 13. Distribution of Stroke Patients with Pneumonia based on Neutrophil

Absolute Neutrophil	Frequency at arrival	Frequency at the onset of pneumonia
Normal	7 (14.9%)	4 (8.5%)
Abnormal	40 (85.1%)	43 (91.5%)
Total	**47**	**47**

Table 14 shows the distribution of lymphocytes at arrival and at the time of pneumonia in stroke patients who were treated in the intensive care unit. From the results of the lymphocytes study at arrival and at the time of the occurrence of pneumonia in stroke patients, 31 patients (66.0%) had normal lymphocytes and 16 (34.0%) had abnormal lymphocytes at arrival. Lymphocytes evaluation results after the patient were admitted to the intensive care unit as many as 25 patients (53.2%) had normal lymphocytes and 22 patients (46.8%) had abnormal lymphocytes.

Table 14. Distribution of Stroke Patients with Pneumonia based on Lymphocyte

Absolute Lymphocyte	Frequency at arrival	Frequency at the onset of pneumonia
Normal	31 (66.0%)	25 (53.2%)
Abnormal	16 (34.0%)	22 (46.8%)
Total	**47**	**47**

Table 15 shows the distribution of monocyte at arrival and at the time of pneumonia in stroke patients who were treated at the intensive care unit. From the results of the monocyte study at arrival and at the time of pneumonia in stroke patients, a total of 40 patients (85.1%) had normal monocyte and 7 patients (14.9%) had abnormal monocyte at arrival. The results of the monocyte evaluation after the patient was admitted to the intensive care unit as many as 36 patients (76.6%) had normal monocyte and 11 patients (23.4%) had abnormal monocyte.

Table 15. Distribution of Stroke Patients with Pneumonia based on Monocyte

Absolute Monocyte	Frequency at arrival	Frequency at the onset of pneumonia
Normal	40 (85.1%)	36 (76.6%)
Abnormal	7 (14.9%)	11 (23.4%)
Total	**47**	**47**

Table 16 shows the distribution of eosinophils at arrival and at the time of pneumonia in stroke patients who were treated at the intensive care unit. From the results of the eosinophils study at arrival and at the time of pneumonia in stroke patients, 46 patients (97.9%) had normal eosinophils and 1 patient (2.1%) had abnormal eosinophils at arrival. Eosinophils results of evaluation after the patient was admitted to the intensive care unit as many as 46 patients (97.9%) had normal eosinophil and 1 patient (2.1%) had abnormal eosinophil.

Table 16. Distribution of Stroke Patients with Pneumonia based on Eosinophil

Absolute Eosinophil	Frequency at arrival	Frequency at the onset of pneumonia
Normal	46 (97.9%)	46 (97.9%)
Abnormal	1 (2.1%)	1 (2.1%)
Total	**47**	**47**

DISCUSSION

In this study, there were 47 stroke patients with pneumonia. Patients were treated at the intensive care unit at Prof. I.G.N.G Ngoerah General Hospital Denpasar during the period 2019 - 2021. There were 47 stroke patients with pneumonia who had a hematological examination when they first arrived and when pneumonia occurred during intensive care at the intensive care unit. There are more males than females. Male patients were found with 40 cases and 7 cases of women. It is known from the prevalence of male stroke sufferers is said to be more than in women, that the ratio is 3-4: 1. This is also evidenced by risk factors in men greater than in women, such as lifestyle (smoking and alcohol). There was no significant difference in the likelihood of pneumonia cases from the hematological parameters in stroke patients between males and females.[7] Based on age in this study, researchers only divided the age group into 2 vulnerable age groups, patients aged less than 50 years and those aged more than 50 years. The most frequent cases were in the age group over 50 years and over, with around 28 patients (59.6%), while in the age group less than 50 years there were only 19 people (40.4%). Several previous studies said that the older the patient, the more susceptible to pneumonia in stroke patients because a person's immunity decreases with age.[7,8] Based on the hematological in this study, the results of the hematological parameter at arrival and at the time of pneumonia in stroke patients who were treated in the intensive care unit were 47 people. Increased blood WBC, neutrophils, lymphocytes, monocytes, and platelets can be seen at arrival and at the time of pneumonia in stroke patients who were treated at the intensive care unit. The increase in WBC can be seen from the beginning when pneumonia occurred with 35 cases increasing to 41 cases. Increase in lymphocytes from 16 cases at arrival to 22 cases. Monocytes were 7 cases to 11 cases. Neutrophils were 40 cases to 43 cases. Hao Ran Cheng *et al* found that there was an increase in the results of monocytes, lymphocytes, and WBC in stroke patients with the incidence of pneumonia during hospitalization due to bacterial infection. [9,10,11,12] Decreased RBC, hemoglobin, and hematocrit hematological results occurred in several cases, where the initial RBC decreased in 17 cases upon arrival and when pneumonia occurred, several cases were increasingly significant, decreasing to 22 cases. Hemoglobin results with a total of 15 cases when it came to 27 cases. Hematocrit with 14 cases becomes 24 cases. Anemia will cause increased hypercapnia and slow

the maturation of RBC in the bone marrow which facilitates the development of the ischemic syndrome. Hepcidin, inflammatory mediators and hormones iron regulator, plays an important role in the clinical course of pneumonia.[13,14,15,16] The NLR, MCV, MCHC, RDW, and eosinophil values did not change significantly from the time of arrival and the time of pneumonia in stroke patients. NLR is a marker of systemic inflammation and infection. In the cases in this study, several patients had experienced an increase at arrival and at the time of the onset of pneumonia so that no significant increase in results.

CONCLUSION

Based on the results of this study, it was found that there was a change in the hematological parameters in patients upon arrival and at the time of pneumonia in stroke patients treated at the intensive care unit at Prof. I.G.N.G Ngoerah General Hospital Denpasar. Increased blood hematology results from the results of WBC, neutrophil, lymphocyte, monocyte, platelet and obtained a decrease from the blood results of RBC, hemoglobin, and hematocrit. While the NLR, MCV, MCH, MHCH, RDW, and eosinophil values did not find any significant changes at arrival and at the time of pneumonia in stroke patients who were treated at the intensive care unit. Further research is needed with a larger sample and more detailed and clear sample data.

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