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Complete Blood Cells Findings Among Covid-19 In-Patients at Covid-19 Reference Hospitals, West Nusa Tenggara

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Abstract: Covid-19 virus still attacks various worldwide sectors, especially health. The current problem is that the Covid-19 vaccine is still in progress, so the best strategy to deal with this problem is to prevent this disease's spread. In the laboratory sector, complete blood cells tend to use as a screening method for disease, especially infectious disease. This study describes the CBCs findings among Covid-19 patients at Covid-19 reference hospitals in West Nusa Tenggara. This study will enhance the data to provide early diagnosis for patients with Covid-19. This was a retrospective study conducted from Mei to July 2020. A total of four hospitals have access to 85 medical records of Covid-19 patients. The patient's data included in this study should have (1) initials; (2) Gender; (3) Age; (4) Patients' disease other than Covid-19; and (5) The results of the first CBCs examination. Incomplete data excluded from the study. The CBCs data collected from Hospital Management Information Systems (HMIS) and Laboratory Information Systems (LIS). The data were analyzed descriptively. The results showed that 5.88% of patients with comorbidities or another disease reported abnormal CBCs results. In comparison, another 94.12% of patients without another disease than Covid-19 tend to present normal results. In conclusion, most of the CBC's findings among Covid-19 patients in West Nusa Tenggara show normal value among patients with no disease other than Covid-19.
Keyword: Covid-19; complete blood cells; hospital management information systems; laboratory information systems

INTRODUCTION

In recorded human history, the latest Covid-19 is the third coronaviral (CoV) outbreak (Yi et al., 2020). The world has faced highly pathogenic human CoVs, i.e., Severe Acute Respiratory Syndrome (SARS-CoV) and Middle East Respiratory Syndrome (MERS-CoV), which initially triggered an outbreak in China and Saudi Arabia in 2003 and 2012, respectively. The virus spread and reaches quickly worldwide, with horrible morbidity and mortality (Paules et al., 2020). The Covid-19 infection symptoms begin to appear after a five to six-day incubation period (Qun Li et al., 2020). The time between the onset of COVID-19 symptoms to death ranges from 6-41 days, with a median of 14 days (Wang et al., 2020).

As the symptoms, fever is often occurring among Covid-19 cases, which can be accompanied by no symptom. Dry cough, shortness of breath, dizziness, muscle ache, sore throat, rhinorrhea, headache, diarrhea, chest pain, vomiting, and nausea are other symptoms of Covid-19 infection. Sometimes, patients had no fever, and several had no irregular radiological findings (Guan et al., 2020).

A covid-19 pandemic occurs to be an issue to the world. All health professionals have attempted to find out how to prevent, manage, and cure this pandemic. Covid-

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19 patients with and without symptoms or abnormalities should be screened for the virus for early diagnosis (Chen et al., 2020). Besides, many studies have reported improvements in the laboratory detection data of Covid-19 patients, and studies have usually concentrated on one or more hematology parameters (Fan et al., 2020; Y. Huang et al., 2020; Terpos et al., 2020).

Infected patients with COVID-19, whether hospitalized or outpatient, are at high risk for venous thromboembolism (Terpos et al., 2020). Thrombocytosis, lymphopenia, and increased C-reactive protein were typical laboratory findings, although the majority of Covid-19 patients (Huang et al., 2020). Another study from Fan (2020) reported that older age, lymphopenia, and raised lactate dehydrogenase (LDH) were associated with intensive care unit admissions. Patients who transferred to the intensive care unit had a deeper nadir absolute lymphocyte count (ALC), absolute monocyte count (AMC), hemoglobin, and a higher peak of absolute neutrophil count (ANC) and LDH than patients who did not need ICU stay.

The most widely conducted hematological laboratory test worldwide is a CBC, and most routine laboratories fitted with a hematology analyzer. Some of the studies reported a variety of abnormal changes in CBCs parameters among Covid-19 patients. There is a lack of a summary of the data and the geographical variety, so it is essential to conduct this study to describe the CDCs findings among Covid-19 patients at Covid-19 reference hospitals in West Nusa Tenggara, Indonesia.

MATERIALS AND METHOD

This research was conducted in May-July 2020 at the Mataram City Hospital, Bhayangkara Hospital, Patuh Patut Patju Hospital, and North Lombok Regional Hospital. This study's ethical feasibility comes from the Ethics Committee of the Faculty of Medicine, Al-Azhar Islamic University, with number: 19/EC/FK-06/UNIZAR/V/2020. The 85 patients' data used in this study was the first result of patients' CBCs since confirmed positive for Covid-19. The data included in this study should have (1) initials; (2) Gender; (3) Age; (4) Patients' disease other than Covid-19; and (5) The results of the first CBCs examination. Incomplete data excluded from the study. The variables studied were gender, age, hemoglobin, hematocrit, number of leukocytes, number of platelet cells, number of erythrocyte cells, erythrocyte index (MCV, MCH, MCHC), leukocyte count (absolute and percentage), red cell distribution width (RDW-CV), and neutrophils-lymphocytes ratio.

Data collection started from the Hospital Management Information Systems (HIMS) to see the medical record number, initial, gender, age, and comorbidities of Covid-19 patients. Some hospitals had HIMS that integrated with the Laboratory Information System (LIS) so that patient data and CBCs results can be accessed more easily. In another hospital, researchers must continue with patient data from HIMS to obtain CBCs of patients in the laboratory if HIMS and LIS are not integrated. The data obtained grouping by age to the study variables, computerized, and then presented in tabular form.

RESULTS AND DISCUSSION

This study conducted using 85 data from the medical record. The data calculated, and the result shows that female patients (64%) with positive Covid-19 status were more than male patients (36%) (Figure 1).

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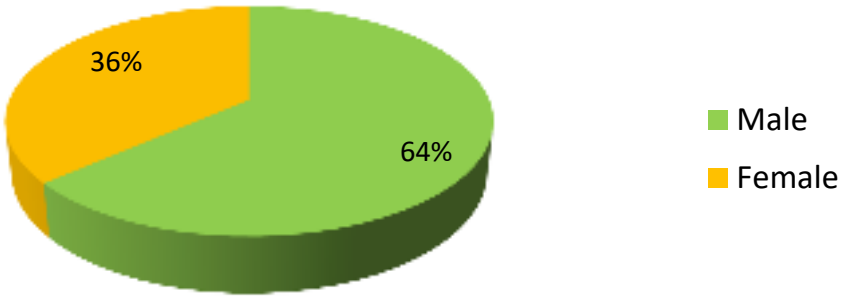

Figure 1. Gender distribution of Covid-19 patient's data (n=85)

Figure 2 shows that patients with positive Covid-19 were one patient aged two years old (<5 years old), eight patients aged 6-19 years old, 14 patients aged 20-29 years old, 17 patients aged 30-39 years old, 18 patients aged 40-49 years old, 14 patients aged 50-59 years old, and 13 patients aged more than 60 years old.

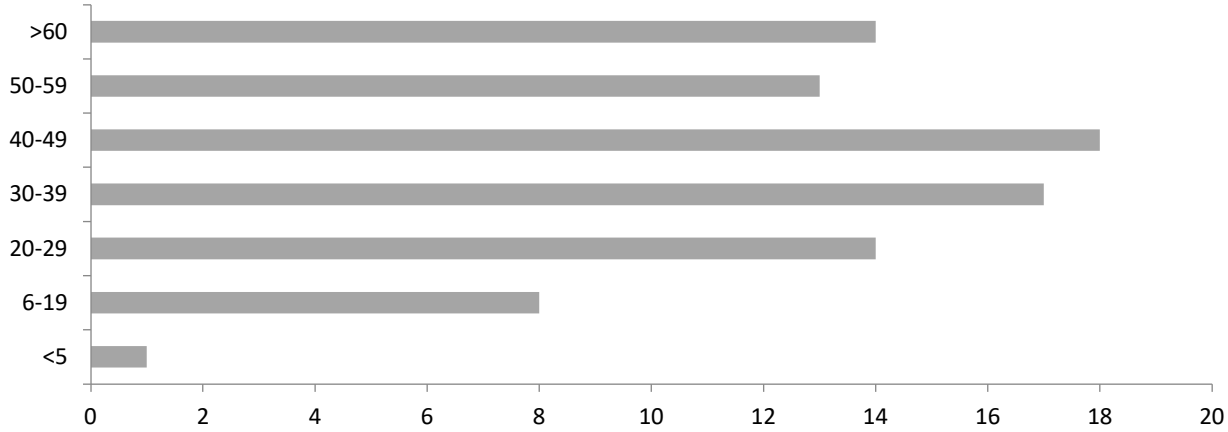

Figure 2. Age Distribution of Covid-19 Patient's Data (n=85)

Table 1. Data Characteristics among Covid-19 Patients without Comorbidity Disease

Variable	n=80					
	n	%	Mean	SD	Min	Max
Sex						
Male	49	61.25				
Female	31	38.75				
Age			39.84	16.34	2.00	75.00
<5	1	1.25				
6-19	8	10				
20-29	14	17.5				
30-39	17	21.25				
40-49	18	22.5				
50-59	13	16.25				
>60	9	11.25				

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Table 2. Hemoglobin, Red Blood Cell, Hematocrit, Platelet, White Blood Cell, MCV, MCH, and MCHC Results among Covid-19 Patients without Comorbidity Disease

Variable			n=80			
	n	%	Mean	SD	Min	Max
Hemoglobin (13 - 18 mmol/L)			13.65	2.57	6.20	24.30
Low	18	22.5				
Normal	58	72.5				
High	4	5				
RBC (4.4 – 5.6 x 10^{12} cell/L)			4.83	0.75	2.10	6.56
Low	13	16.25				
Normal	54	67.5				
High	13	16.25				
Hematocrit (40% - 50%)			39.77	6.52	16.60	52.20
Low	21	26.25				
Normal	55	68.75				
High	4	5				
Platelets (170 – 380 x10^{9}/L)			286.99	90.41	21.00	620.00
Low	5	6.25				
Normal	64	80				
High	11	13.75				
MCV (80 – 100 fL)			80.61	12.04	7.90	94.20
Low	26	32.5				
Normal	54	67.5				
MCH (28– 34 pg)			28.19	3.74	17.30	50.50
Low	35	43.75				
Normal	44	55				
High	1	1.25				
MCHC (32 – 36 g/dL)			33.89	1.68	26.40	37.40
Low	5	6.25				
Normal	68	85				
High	7	8.75				
WBC (3.20 – 10 x10^{9}/L)			9.25	4.72	3.69	36.13
Low	1	1.25				
Normal	53	66.25				
High	26	32.5				

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Table 3. Differential blood count, Neutrophil Lymphocyte Ratio, and Platelet Lymphocyte Ratio results among Covid-19 Patients without Comorbidity Disease

Variable	n=80					
	n	%	Mean	SD	Min	Max
Basophil (0-2%)			0.69	2.08	0.00	17.80
Normal	77	96.25				
High	3	3.75				
Eosinophil (0-6%)			3.37	3.13	0.00	13.40
Normal	65	81.25				
High	15	18.75				
Neutrophil (40-70%)			56.02	18.47	0.30	94.70
Low	7	8.75				
Normal	61	76.25				
High	12	15				
Lymphocyte (15-45%)			31.55	12.38	2.00	62.80
Low	11	13.75				
Normal	50	62.5				
High	19	23.75				
Monocyte (0-10%)			8.03	6.15	1.30	36.90
Normal	63	78.75				
High	17	21.25				
Basophil (0-0.15 x10^6/L)			0.14	0.22	0.00	1.08
Normal	60	75				
High	20	25				
Eosinophil (0-0.5 x 10^6/L)			0.62	1.77	0.00	14.00
Normal	62	77.5				
High	18	22.5				
Neutrophil (1.26-7.3 x 10^6/L)			5.44	4.72	0.02	33.20
Low	4	5				
Normal	64	80				
High	12	15				
Lymphocyte (0.8-4 x 10^6/L)			2.61	1.13	0.34	6.76
Low	4	5				
Normal	68	85				
High	8	10				
Monocyte (0.1-0.8 x 10^6/L)			0.69	0.55	0.15	3.13
Normal	63	78.75				
High	17	21.25				
NLR (3.13-5.0)			2.96	5.78	0.00	36.20
Normal	69	86.25				
High	11	13.75				
PLR (>180)			140.12	111.23	10.40	720.59
Normal	69	86.25				
High	11	13.75				

The results from 80 positive Covid-19 patients show mostly normal conditions on all parameters from the first CBC examination (at first admission) (Table 1). The standard value of assessing the low, high, and normal value of each parameter is

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based on clinical data interpretation guidelines by the Indonesian Ministry of Health (2011).

Fan et al. (2020) reported that most Singapore patients had normal CBC (normal Hb, WBC, and platelet count). There were no patients with moderate to severe thrombocytopenia, commonly seen in other viral diseases, such as dengue fever, prevalent in Indonesia.

Normal or low hemoglobin levels cannot be used as a diagnostic parameter for Covid-19 infection but can be used as a supporting parameter in determining the severity or recovery of patients during treatment (Fan et al., 2020; Huang et al., 2020; Lippi & Plebani, 2020).

In general, the white blood cell count appears normal or decreased in Covid-19 patients at first admission (Huang et al., 2020). The same findings were observed in asymptomatic patients (Hu et al., 2020). Also, age dependence has been reported to be associated with disease severity, and a higher WBC count has been observed in elderly patients than younger adults with Covid-19 (Lin et al., 2020).

The 80 samples showed a tendency for the patient's platelet count to be normal because most patients did not have comorbidities, so that the severity of this disease was thought to be low. Huang et al. (2020) reported that as many as 8% of patients requiring Intensive Care Unit (ICU) care had a low platelet count compared to 4% of patients who did not require ICU care.

Table 4. Data Characteristics among Covid-19 Patients with Another Disease

Variable	n=5					
	n	%	Mean	SD	Min	Max
Sex						
Male	5	100.00				
Age						
50-59	1	20.00				
>60	4	80.00				
Comorbid Disease						
Dyspnea	1	20.00				
Urinary tract infection + benign prostatic hyperplasia	1	20.00				
Chronic obstructive pulmonary disease	1	20.00				
Chronic kidney disease + Hypertension Stage 2	1	20.00				
Pulmonary tuberculosis + chronic kidney disease	1	20.00				

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Table 5. Hemoglobin, Red Blood Cell, Hematocrit, Platelet, White Blood Cell, MCV, MCH, and MCHC Results among Covid-19 Patients with Another Disease

Variable	n=5					
	n	%	Mean	SD	Min	Max
Hemoglobin (13 – 18 mmol/L)			12.78	2.79	8	15.2
Low	1	20.00				
Normal	4	80.00				
RBC (4.4 – 5.6 x 10^{12} cell/L)			4.36	0.86	2.9	5.2
Low	1	20.00				
Normal	4	80.00				
Hematocrit (40% - 50%)			37.28	8.79	24	47.9
Low	3	60.00				
Normal	2	40.00				
Platelets (170 – 380 x10^9/L)			280	184	121	589
Low	1	20.00				
Normal	3	60.00				
High	1	20.00				
MCV (80 – 100 fL)			85.56	6.64	76.5	92.6
Low	1	20.00				
Normal	4	80.00				
MCH (28– 34 pg)			29.38	1.38	27.9	31.1
Low	1	20.00				
Normal	4	80.00				
MCHC (32 – 36 g/dL)			34.44	2.01	31.8	36.5
Low	1	20.00				
Normal	2	40.00				
High	2	40.00				
WBC (3.20 – 10 x10^9/L)			12.06	4.56	5.4	16.5
Normal	2	40.00				
High	3	60.00				

Table 6. Differential Blood Count, Neutrophil Lymphocyte Ratio, and Platelet Lymphocyte Ratio Results among Covid-19 Patients with Another Disease

Variable	n=5					
	n	%	Mean	SD	Min	Max
Basophil (0-2%)			0.28	0.13	0.1	0.4
Normal	5	100.00				
Eosinophil (0-6%)			0.84	1.06	0.1	2.7
Normal	5	100.00				
Neutrophil (40-70%)			80.16	6.43	72.5	89.2
Normal	1	20.00				
High	4	80.00				
Lymphocyte (15-45%)			12.8	3.79	7.8	16.8
Normal	5	100.00				
Monocyte (0-10%)			5.92	2.86	2.6	10

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Normal	4	80.00				
High	1	20.00				
Basophil (0-0.15 x10^6/L)			0.04	0.05	0	0.1
Normal	5	100.00				
Eosinophil (0-0.5 x 10^6/L)			0.1	0.17	0	0.4
Normal	5	100.00				
Neutrophil (1.26-7.3 x 10^6/L)			9.92	4.33	3.9	14.8
Normal	1	20.00				
High	4	80.00				
Lymphocyte (0.8-4 x 10^6/L)			1.42	0.34	0.9	1.8
Normal	5	100.00				
Monocyte (0.1-0.8 x 10^6/L)			0.62	0.19	0.4	0.9
Normal	4	80.00				
High	1	20.00				
NLR (3.13-5)			6.9	2.83	4.3	11.4
High	2	40.00				
PLR (>180)			198.5	116	94.5	380
Normal	3	60.00				
High	2	40.00				

Table 2 shows a total of five positive Covid-19 patients with another disease reported. Most of them were elderly people. There were only three patients with comorbid disease of Covid-19 (i.e., chronic kidney disease + hypertension stage 2; chronic obstructive pulmonary disease; and pulmonary tuberculosis + chronic kidney disease). CBC parameters in this data were most abnormal in the neutrophil percentage, neutrophil absolute, neutrophil-lymphocyte ratio (NLR), and platelet lymphocyte ratio (PLR).

Hu et al. (2020) reported that there was variability within the severe group, with 87.5% of critically ill patients having neutrophilia. Other investigators have also reported neutrophilia in some elderly patients after admission (Lin et al., 2020). The likelihood of neutrophilia being a predictor of disease severity has been further supported by other investigators who investigated 82 deaths in Covid-19 patients and demonstrated that neutrophilia was present in 74.3% of cases after admission and increased to 100% in the last 24 hours before death (Zheng et al., 2020)

A study in Wuhan with a sample of 40 people consisting of 15 men (37.5%) and 25 women (62.5%) stated that absolute neutrophil levels were significantly higher in severe cases of Covid-19 than in severe cases (Liu et al., 2020).

Increased NLR and age were significantly associated with disease severity. The binary logistic analysis identified increased NLR as an independent factor for poor clinical outcome of Covid-19 (Yang et al., 2020). Increased NLR is a risk factor for death not only in infectious diseases but also in malignancies, acute coronary syndromes, intracerebral hemorrhage, polymyositis, and dermatomyositis (Azab et al., 2010; Giede-Jeppe et al., 2017; Guthrie et al., 2013; Ha et al., 2018).

Qu et al. (2020) proposed PLR as an indicator reflecting the severity of inflammation in the treatment process by comparing the PLR changes during treatment. It was found that the higher the PLR cut-off point, the longer patient stays

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in the hospital. Therefore, the investigators speculate that changes in the platelet/lymphocyte ratio in the blood during treatment may reflect disease progression and Covid-19 patients' prognosis. This disparity in numbers may, in part, represent the extent of the epidemiological data available.

The limitation of this study is that the data still limit to 85 patients. A higher number of data can enhance the study. Another limitation is that CBCs cannot be used as a determining indicator of the presence of the Covid-19 virus in a patient's blood. This complete blood count is more precisely used as a supporting parameter in determining the patient's severity or recovery during the treatment period. Careful evaluation of whole blood parameters at the start and during the disease can help clinicians formulate a tailored treatment approach and promptly provide intensive care to patients who are most in need.

CONCLUSION

Most of the CBCs findings among Covid-19 patients at Covid-19 reference hospitals in West Nusa Tenggara show normal value among patients with no disease other than Covid-19. Older age and having comorbidities show a complete blood cell picture different from other Covid-19 patients who have confirmed positive without comorbidities. Several studies that have been conducted in several countries, especially those outsides of Wuhan, China, show some similarities in the percentage of blood cell levels from hematological parameters that tend to be normal. The next study should add a greater number of patient’s data so the result can be generalized.

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CONFLICT OF INTEREST

The authors declare no conflict of interest in this study.

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COMPLETE BLOOD CELLS FINDINGS AMONG COVID-19 PATIENTS AT COVID-19 REFERENCE HOSPITALS, WEST NUSA TENGGARA

Abstract: Covid-19 virus still attacks various worldwide sectors, especially health. The current problem is that the Covid-19 vaccine is still on progress, so the best strategy to deal with this problem is to prevent the spread of this disease. In the laboratory sector, complete blood cells ~~(CBCs)~~ tend to use as a screening method for disease, especially infectious disease. This study aims to describe the CBCs findings among Covid-19 patients at Covid-19 reference hospitals in West Nusa Tenggara. This study will enhance the data to provide early diagnose for patients with Covid-19. This was a retrospective study conducted from Mei to July 2020. A total of four hospitals have access to 85 medical records of Covid-19 patients. The patient's data included in this study should have (1) An initials; (2) Gender; (3) Age; (4) Patients' disease other than Covid-19; and (5) The results of the first CBCs examination. Incomplete data were excluded from the study. The CBCs data were collected from Hospital Management Information Systems (HMIS) and Laboratory Information Systems (LIS). The data were analyzed descriptively. The results showed that 5.88% of patients had comorbidities or another disease reported tends to present abnormal CBCs results, while another 94.12% of patients without another disease than Covid-19 tend to present normal results. In conclusion, most of the CBCs findings among Covid-19 patients in West Nusa Tenggara show normal value among patients with no disease other than Covid-19.

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Keyword: Covid-19; complete blood cells; hospital management information systems; laboratory information systems

INTRODUCTION

In recorded human history, the latest Covid-19 is the third coronaviral (CoV) outbreak (Yi et al., 2020). The world has faced highly pathogenic human CoVs i.e., Severe Acute Respiratory Syndrome (SARS-CoV) and Middle East Respiratory Syndrome (MERS-CoV), which originally triggered an outbreak in China and Saudi Arabia in 2003 and 2012, respectively. The virus spread and reaches quickly all over the countries with horrible morbidity and mortality (Paules et al., 2020). Symptoms of the Covid-19 infection begin to appear after a five to six day incubation period (Qun Li et al., 2020). The time between the onset of COVID-19 symptoms to death ranges from 6-41 days with a median of 14 days (Wang et al., 2020).

As the symptoms, fever is often occurring among Covid-19 cases, which can be accompanied by no symptom. Dry cough, shortness of breath, dizziness, muscle ache, sore throat, rhinorrhea, headache, diarrhea, chest pain, vomiting, and nausea are another symptoms of Covid-19 infection. Sometimes, patients had no fever, and several had no irregular radiological findings (Guan et al., 2020).

Covid-19 pandemic occur to be an issue to the world. All of the health professionals have done some attempt to find out how to prevent, manage, and cure this pandemic.

Covid-19 patients with and without symptoms or abnormalities, should be screened for the virus for early diagnosis (Chen et al., 2020). In addition, many studies have reported improvements in the laboratory detection data of Covid-19 patients and studies have usually concentrated on one or more hematology parameters (Fan et al., 2020; Y. Huang et al., 2020; Terpos et al., 2020).

Infected patients with COVID-19, whether hospitalized or outpatient, are at high risk for venous thromboembolism (Terpos et al., 2020). Thrombocytosis, lymphopenia, and increased C-reactive protein were typical findings in the laboratory although the majority of Covid-19 patients (Huang et al., 2020). Another study from Fan (2020) reported that older age, lymphopenia, and raised lactate dehydrogenase (LDH) were associated with intensive care unit admissions. Patients who were transferred to the intensive care unit had a deeper nadir absolute lymphocyte count (ALC), absolute monocyte count (AMC), hemoglobin, and a higher peak of absolute neutrophil count (ANC) and LDH than patients who did not need ICU stay.

The most widely conducted hematological laboratory test worldwide is a CBC and most routine laboratories are fitted with a hematology analyzer. Some of the studies reported variety of abnormal changes on CBCs parameters among Covid-19 patients. There is a lack of a summary of the data and the geographical variety, so it is important to conduct this study to describe the CDCs findings among Covid-19 patients at Covid-19 reference hospitals in West Nusa Tenggara, Indonesia.

MATERIALS AND METHOD

This research was conducted in May-July 2020 at the Mataram City Hospital, Bhayangkara Hospital, Patuh Patut Patju Hospital, and North Lombok Regional Hospital. Ethical feasibility in this study comes from the Ethics Committee of the Faculty of Medicine, Al-Azhar Islamic University with number: 19 / EC / FK-06 / UNIZAR / V / 2020.The 85 patients' data used in this study was first result of CBCs of patients since confirmed positive for Covid-19. The data included in this study should have (1) initials; (2) Gender; (3) Age; (4) Patients' ~~Comorbid~~ disease ~~data~~other than Covid-19; and (5) The results of the first CBCs examination. Incomplete data were excluded from the study. The variables studied were gender, age, hemoglobin, hematocrit, number of leukocytes, number of platelet cells, number of erythrocyte cells, erythrocyte index (MCV, MCH, MCHC), leukocyte count (absolute and percentage), red cell distribution width (RDW-CV), and neutrophils-lymphocytes ratio.

Data collection started from the Hospital Management Information Systems (HIMS) to see the medical record number, initial, gender, age, and comorbidities of Covid-19 patients. Some of the hospital had HIMS that integrated with the Laboratory Information System (LIS) so that patient data and CBCs results can be accessed more easily. In another hospital, researchers must continue with patient data from HIMS to obtain CBCs of patients in the laboratory if HIMS and LIS are not integrated. The data that has been obtained are grouped according to the study variables, computerized, and then presented in tabular form.

RESULTS AND DISCUSSION

This study was conducted using 85 data from medical record. The data were calculated and the result shows that female patients (64%) with positive Covid-19 status

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were more than male patients (36%) (Figure 1).

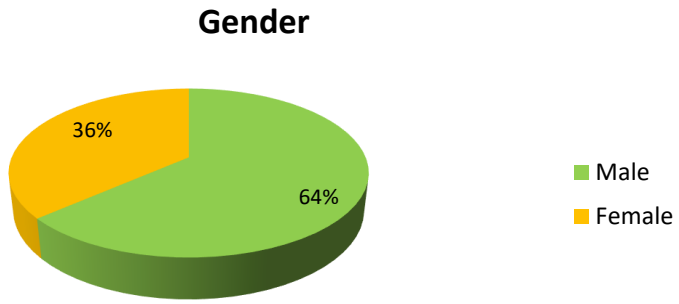

Figure 1. Gender distribution of Covid-19 ~~patients~~patient's data (n=85)

Figure 2 shows that patients with positive Covid-19 were one patient aged 2 years old (<5 years old), 8 patients aged 6-19 years old, 14 patients aged 20-29 years old, 17 patients aged 30-39 years old, 18 patients aged 40-49 years old, 14 patients aged 50-59 years old, and 13 patients aged more than 60 years old.

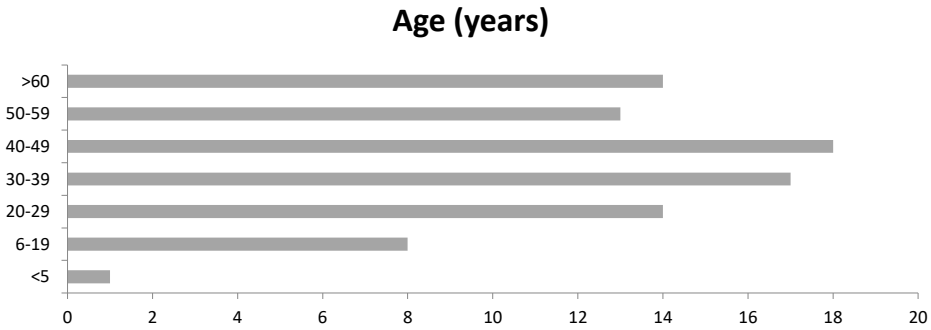

Figure 2. Age distribution of Covid-19 ~~patients~~patient's data (n=85)

Table 1. ~~CBCs~~ Data characteristics ~~results~~ among Covid-19 patients without comorbidity disease

Variable	n=80					
	n	%	Mean	SD	Min	Max
Sex						
Male	49	61.25				
Female	31	38.75				
Age			**39.84**	**16.34**	**2.00**	**75.00**
<5	1	1.25				
6-19	8	10				

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20-29	14	17.5				
30-39	17	21.25				
40-49	18	22.5				
50-59	13	16.25				
>60	9	11.25				
~~Hemoglobin (13 - 18 mmol/L)~~			~~13.65~~	~~2.57~~	~~6.20~~	~~24.30~~
~~Low~~	~~18~~	~~22.5~~				
~~Normal~~	~~58~~	~~72.5~~				
~~High~~	~~4~~	~~5~~				
~~RBC (4.4 – 5.6 x 10^{12} cell/L)~~			~~4.83~~	~~0.75~~	~~2.10~~	~~6.56~~
~~Low~~	~~13~~	~~16.25~~				
~~Normal~~	~~54~~	~~67.5~~				
~~High~~	~~13~~	~~16.25~~				
~~Hematocrit (40% - 50%)~~			~~39.77~~	~~6.52~~	~~16.60~~	~~52.20~~
~~Low~~	~~21~~	~~26.25~~				
~~Normal~~	~~55~~	~~68.75~~				
~~High~~	~~4~~	~~5~~				
~~Platelets (170 – 380 x10^{9}/L)~~			~~286.99~~	~~90.41~~	~~21.00~~	~~620.00~~
~~Low~~	~~5~~	~~6.25~~				
~~Normal~~	~~64~~	~~80~~				
~~High~~	~~11~~	~~13.75~~				
~~MCV (80 – 100 fL)~~			~~80.61~~	~~12.04~~	~~7.90~~	~~94.20~~
~~Low~~	~~26~~	~~32.5~~				
~~Normal~~	~~54~~	~~67.5~~				
~~MCH (28– 34 pg)~~			~~28.19~~	~~3.74~~	~~17.30~~	~~50.50~~
~~Low~~	~~35~~	~~43.75~~				
~~Normal~~	~~44~~	~~55~~				
~~High~~	~~1~~	~~1.25~~				
~~MCHC (32 – 36 g/dL)~~			~~33.89~~	~~1.68~~	~~26.40~~	~~37.40~~
~~Low~~	~~5~~	~~6.25~~				
~~Normal~~	~~68~~	~~85~~				
~~High~~	~~7~~	~~8.75~~				
~~WBC (3.20 – 10 x10^{9}/L)~~			~~9.25~~	~~4.72~~	~~3.69~~	~~36.13~~
~~Low~~	~~1~~	~~1.25~~				
~~Normal~~	~~53~~	~~66.25~~				
~~High~~	~~26~~	~~32.5~~				
~~Basophil (0-2%)~~			~~0.69~~	~~2.08~~	~~0.00~~	~~17.80~~
~~Normal~~	~~77~~	~~96.25~~				
~~High~~	~~3~~	~~3.75~~				
~~Eosinophil (0-6%)~~			~~3.37~~	~~3.13~~	~~0.00~~	~~13.40~~
~~Normal~~	~~65~~	~~81.25~~				
~~High~~	~~15~~	~~18.75~~				
~~Neutrophil (40-70%)~~			~~56.02~~	~~18.47~~	~~0.30~~	~~94.70~~
~~Low~~	~~7~~	~~8.75~~				
~~Normal~~	~~61~~	~~76.25~~				
~~High~~	~~12~~	~~15~~				
~~Lymphocyte (15-45%)~~			~~31.55~~	~~12.38~~	~~2.00~~	~~62.80~~
~~Low~~	~~11~~	~~13.75~~				
~~Normal~~	~~50~~	~~62.5~~				
~~High~~	~~19~~	~~23.75~~				

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~~Monocyte (0-10%)~~			~~8.03~~	~~6.15~~	~~1.30~~	~~36.90~~
~~Normal~~	~~63~~	~~78.75~~				
~~High~~	~~17~~	~~21.25~~				
~~Basophil (0-0.15 x10^6/L)~~			~~0.14~~	~~0.22~~	~~0.00~~	~~1.08~~
~~Normal~~	~~60~~	~~75~~				
~~High~~	~~20~~	~~25~~				
~~Eosinophil (0-0.5 x 10^6/L)~~			~~0.62~~	~~1.77~~	~~0.00~~	~~14.00~~
~~Normal~~	~~62~~	~~77.5~~				
~~High~~	~~18~~	~~22.5~~				
~~Neutrophil (1.26-7.3 x 10^6/L)~~			~~5.44~~	~~4.72~~	~~0.02~~	~~33.20~~
~~Low~~	~~4~~	~~5~~				
~~Normal~~	~~64~~	~~80~~				
~~High~~	~~12~~	~~15~~				
~~Lymphocyte (0.8-4 x 10^6/L)~~			~~2.61~~	~~1.13~~	~~0.34~~	~~6.76~~
~~Low~~	~~4~~	~~5~~				
~~Normal~~	~~68~~	~~85~~				
~~High~~	~~8~~	~~10~~				
~~Monocyte (0.1-0.8 x 10^6/L)~~			~~0.69~~	~~0.55~~	~~0.15~~	~~3.13~~
~~Normal~~	~~63~~	~~78.75~~				
~~High~~	~~17~~	~~21.25~~				
~~NLR (3.13-5.0)~~			~~2.96~~	~~5.78~~	~~0.00~~	~~36.20~~
~~Normal~~	~~69~~	~~86.25~~				
~~High~~	~~11~~	~~13.75~~				
~~PLR (>180)~~			~~140.12~~	~~111.23~~	~~10.40~~	~~720.59~~
~~Normal~~	~~69~~	~~86.25~~				
~~High~~	~~11~~	~~13.75~~	-	-	-	-

Table 2. Hemoglobin, Red Blood Cell, Hematocrit, Platelet, White Blood Cell, MCV, MCH, and MCHC results among Covid-19 patients without comorbidity disease

Variable	n=80					
	n	%	Mean	SD	Min	Max
Hemoglobin (13 - 18 mmol/L)			**13.65**	**2.57**	**6.20**	**24.30**
Low	18	22.5				
Normal	58	72.5				
High	4	5				
RBC (4.4 – 5.6 x 10^{12} cell/L)			**4.83**	**0.75**	**2.10**	**6.56**
Low	13	16.25				
Normal	54	67.5				
High	13	16.25				
Hematocrit (40% - 50%)			**39.77**	**6.52**	**16.60**	**52.20**
Low	21	26.25				
Normal	55	68.75				
High	4	5				
Platelets (170 – 380 x10^9/L)			**286.99**	**90.41**	**21.00**	**620.00**
Low	5	6.25				
Normal	64	80				
High	11	13.75				
MCV (80 – 100 fL)			**80.61**	**12.04**	**7.90**	**94.20**
Low	26	32.5				

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Normal	54	67.5				
MCH (28– 34 pg)			**28.19**	**3.74**	**17.30**	**50.50**
Low	35	43.75				
Normal	44	55				
High	1	1.25				
MCHC (32 – 36 g/dL)			**33.89**	**1.68**	**26.40**	**37.40**
Low	5	6.25				
Normal	68	85				
High	7	8.75				
WBC (3.20 – 10 x10^9/L)			**9.25**	**4.72**	**3.69**	**36.13**
Low	1	1.25				
Normal	53	66.25				
High	26	32.5				

Table 3. Differential blood count, Neutrophil Lymphocyte Ratio, and Platelet Lymphocyte Ratio results among Covid-19 patients without comorbidity disease

Variable	n=80					
	n	%	Mean	SD	Min	Max
Basophil (0-2%)			**0.69**	**2.08**	**0.00**	**17.80**
Normal	77	96.25				
High	3	3.75				
Eosinophil (0-6%)			**3.37**	**3.13**	**0.00**	**13.40**
Normal	65	81.25				
High	15	18.75				
Neutrophil (40-70%)			**56.02**	**18.47**	**0.30**	**94.70**
Low	7	8.75				
Normal	61	76.25				
High	12	15				
Lymphocyte (15-45%)			**31.55**	**12.38**	**2.00**	**62.80**
Low	11	13.75				
Normal	50	62.5				
High	19	23.75				
Monocyte (0-10%)			**8.03**	**6.15**	**1.30**	**36.90**
Normal	63	78.75				
High	17	21.25				
Basophil (0-0.15 x10^6/L)			**0.14**	**0.22**	**0.00**	**1.08**
Normal	60	75				
High	20	25				
Eosinophil (0-0.5 x 10^6/L)			**0.62**	**1.77**	**0.00**	**14.00**
Normal	62	77.5				
High	18	22.5				
Neutrophil (1.26-7.3 x 10^6/L)			**5.44**	**4.72**	**0.02**	**33.20**
Low	4	5				
Normal	64	80				
High	12	15				
Lymphocyte (0.8-4 x 10^6/L)			**2.61**	**1.13**	**0.34**	**6.76**
Low	4	5				
Normal	68	85				
High	8	10				

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Monocyte (0.1-0.8 x 10^6/L)			**0.69**	**0.55**	**0.15**	**3.13**
Normal	63	78.75				
High	17	21.25				
NLR (3.13-5.0)			**2.96**	**5.78**	**0.00**	**36.20**
Normal	69	86.25				
High	11	13.75				
PLR (>180)			**140.12**	**111.23**	**10.40**	**720.59**
Normal	69	86.25				
High	11	13.75				

The results from 80 data of positive Covid-19 patients show mostly normal condition on all parameters from first CBC examination (at first admission) (Table 1). The standard value of assessing the low, high, and normal value of each parameter was based on guidelines for clinical data interpretation by Indonesian Ministry of Health (2011).

Fan et al. (2020) reported that most patients in Singapore had normal CBC (normal Hb, WBC and platelet count). There were no patients with moderate to extreme thrombocytopenia, which is commonly seen in other viral diseases, such as dengue fever, which is prevalent in Indonesia.

Normal or low hemoglobin levels cannot be used as a diagnostic parameter for Covid-19 infection, but can be used as a supporting parameter in determining the severity or recovery of patients during treatment (Fan et al., 2020; Huang et al., 2020; Lippi & Plebani, 2020).

In general, the white blood cell count appears normal or decreased in Covid-19 patients at first admission (Huang et al., 2020). The same findings were observed in asymptomatic patients (Hu et al., 2020). Also age dependence has been reported to be associated with disease severity, and a higher WBC count has been observed in elderly patients compared with younger adults with Covid-19 (Lin et al., 2020).

The 80 samples showed a tendency for the patient's platelet count to be normal because most patients did not have comorbidities so that the severity of this disease was thought to be low. Huang et al. (2020) reported that as many as 8% of patients requiring Intensive Care Unit (ICU) care had a low platelet count compared to 4% of patients who did not require ICU care.

Table ~~24~~. Data characteristics ~~CBCs results~~ among Covid-19 patients with another disease

Variable	n=5					
	n	%	Mean	SD	Min	Max
Sex						
Male	5	100.00				
Age						
50-59	1	20.00				
>60	4	80.00				
Comorbid Disease						
Dyspnea	1	20.00				
Urinary tract infection + benign prostatic hyperplasia	1	20.00				

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Chronic obstructive pulmonary disease	1	20.00				
Chronic kidney disease + hypertension Stage 2	1	20.00				
Pulmonary tuberculosis + chronic kidney disease	1	20.00				
~~**Hemoglobin (13 – 18 mmol/L)**~~			~~**12.78**~~	~~**2.79**~~	~~**8**~~	~~**15.2**~~
~~Low~~	~~1~~	~~20.00~~				
~~Normal~~	~~4~~	~~80.00~~				
~~**RBC (4.4 – 5.6 x 10^{12} cell/L)**~~			~~**4.36**~~	~~**0.86**~~	~~**2.9**~~	~~**5.2**~~
~~Low~~	~~1~~	~~20.00~~				
~~Normal~~	~~4~~	~~80.00~~				
~~**Hematocrit (40% - 50%)**~~			~~**37.28**~~	~~**8.79**~~	~~**24**~~	~~**47.9**~~
~~Low~~	~~3~~	~~60.00~~				
~~Normal~~	~~2~~	~~40.00~~				
~~**Platelets (170 – 380 x10^{9}/L)**~~			~~**280**~~	~~**184**~~	~~**121**~~	~~**589**~~
~~Low~~	~~1~~	~~20.00~~				
~~Normal~~	~~3~~	~~60.00~~				
~~High~~	~~1~~	~~20.00~~				
~~**MCV (80 – 100 fL)**~~			~~**85.56**~~	~~**6.64**~~	~~**76.5**~~	~~**92.6**~~
~~Low~~	~~1~~	~~20.00~~				
~~Normal~~	~~4~~	~~80.00~~				
~~**MCH (28– 34 pg)**~~			~~**29.38**~~	~~**1.38**~~	~~**27.9**~~	~~**31.1**~~
~~Low~~	~~1~~	~~20.00~~				
~~Normal~~	~~4~~	~~80.00~~				
~~**MCHC (32 – 36 g/dL)**~~			~~**34.44**~~	~~**2.01**~~	~~**31.8**~~	~~**36.5**~~
~~Low~~	~~1~~	~~20.00~~				
~~Normal~~	~~2~~	~~40.00~~				
~~High~~	~~2~~	~~40.00~~				
~~**WBC (3.20 – 10 x10^{9}/L)**~~			~~**12.06**~~	~~**4.56**~~	~~**5.4**~~	~~**16.5**~~
~~Normal~~	~~2~~	~~40.00~~				
~~High~~	~~3~~	~~60.00~~				
~~**Basophil (0-2%)**~~			~~**0.28**~~	~~**0.13**~~	~~**0.1**~~	~~**0.4**~~
~~Normal~~	~~5~~	~~100.00~~				
~~**Eosinophil (0-6%)**~~			~~**0.84**~~	~~**1.06**~~	~~**0.1**~~	~~**2.7**~~
~~Normal~~	~~5~~	~~100.00~~				
~~**Neutrophil (40-70%)**~~			~~**80.16**~~	~~**6.43**~~	~~**72.5**~~	~~**89.2**~~
~~Normal~~	~~1~~	~~20.00~~				
~~High~~	~~4~~	~~80.00~~				
~~**Lymphocyte (15-45%)**~~			~~**12.8**~~	~~**3.79**~~	~~**7.8**~~	~~**16.8**~~
~~Normal~~	~~5~~	~~100.00~~				
~~**Monocyte (0-10%)**~~			~~**5.92**~~	~~**2.86**~~	~~**2.6**~~	~~**10**~~
~~Normal~~	~~4~~	~~80.00~~				
~~High~~	~~1~~	~~20.00~~				
~~**Basophil (0-0.15 x10^{6}/L)**~~			~~**0.04**~~	~~**0.05**~~	~~**0**~~	~~**0.1**~~
~~Normal~~	~~5~~	~~100.00~~				
~~**Eosinophil (0-0.5 x 10^{6}/L)**~~			~~**0.1**~~	~~**0.17**~~	~~**0**~~	~~**0.4**~~

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Normal	5	100.00				
Neutrophil (1.26-7.3 x 10^6/L)			9.92	4.33	3.9	14.8
Normal	1	20.00				
High	4	80.00				
Lymphocyte (0.8-4 x 10^6/L)			1.42	0.34	0.9	1.8
Normal	5	100.00				
Monocyte (0.1-0.8 x 10^6/L)			0.62	0.19	0.4	0.9
Normal	4	80.00				
High	1	20.00				
NLR (3.13-5)			6.9	2.83	4.3	11.4
High	2	40.00				
PLR (>180)			198.5	116	94.5	380
Normal	3	60.00				
High	2	40.00	-	-	-	-

Table 5. Hemoglobin, Red Blood Cell, Hematocrit, Platelet, White Blood Cell, MCV, MCH, and MCHC results among Covid-19 patients with another disease

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Variable	n=5					
	n	%	Mean	SD	Min	Max
Sex						
Male	5	100.00				
Age						
50-59	1	20.00				
>60	4	80.00				
Comorbid Disease						
Dyspnea	1	20.00				
Urinary tract infection + benign prostatic hyperplasia	1	20.00				
Chronic obstructive pulmonary disease	1	20.00				
Chronic kidney disease + hypertension Stage 2	1	20.00				
Pulmonary tuberculosis + chronic kidney disease	1	20.00				
Hemoglobin (13 – 18 mmol/L)			12.78	2.79	8	15.2
Low	1	20.00				
Normal	4	80.00				
RBC (4.4 – 5.6 x 10^{12} cell/L)			4.36	0.86	2.9	5.2
Low	1	20.00				
Normal	4	80.00				
Hematocrit (40% - 50%)			37.28	8.79	24	47.9
Low	3	60.00				
Normal	2	40.00				
Platelets (170 – 380 x10^9/L)			280	184	121	589
Low	1	20.00				
Normal	3	60.00				
High	1	20.00				

MCV (80 – 100 fL)			**85.56**	**6.64**	**76.5**	**92.6**
Low	1	20.00				
Normal	4	80.00				
MCH (28– 34 pg)			**29.38**	**1.38**	**27.9**	**31.1**
Low	1	20.00				
Normal	4	80.00				
MCHC (32 – 36 g/dL)			**34.44**	**2.01**	**31.8**	**36.5**
Low	1	20.00				
Normal	2	40.00				
High	2	40.00				
WBC (3.20 – 10 x10^9/L)			**12.06**	**4.56**	**5.4**	**16.5**
Normal	2	40.00				
High	3	60.00				

Table 6. Differential blood count, Neutrophil Lymphocyte Ratio, and Platelet Lymphocyte Ratio results among Covid-19 patients with another disease

Variable	n=5					
	n	%	Mean	SD	Min	Max
Basophil (0-2%)			**0.28**	**0.13**	**0.1**	**0.4**
Normal	5	100.00				
Eosinophil (0-6%)			**0.84**	**1.06**	**0.1**	**2.7**
Normal	5	100.00				
Neutrophil (40-70%)			**80.16**	**6.43**	**72.5**	**89.2**
Normal	1	20.00				
High	4	80.00				
Lymphocyte (15-45%)			**12.8**	**3.79**	**7.8**	**16.8**
Normal	5	100.00				
Monocyte (0-10%)			**5.92**	**2.86**	**2.6**	**10**
Normal	4	80.00				
High	1	20.00				
Basophil (0-0.15 x10^6/L)			**0.04**	**0.05**	**0**	**0.1**
Normal	5	100.00				
Eosinophil (0-0.5 x 10^6/L)			**0.1**	**0.17**	**0**	**0.4**
Normal	5	100.00				
Neutrophil (1.26-7.3 x 10^6/L)			**9.92**	**4.33**	**3.9**	**14.8**
Normal	1	20.00				
High	4	80.00				
Lymphocyte (0.8-4 x 10^6/L)			**1.42**	**0.34**	**0.9**	**1.8**
Normal	5	100.00				
Monocyte (0.1-0.8 x 10^6/L)			**0.62**	**0.19**	**0.4**	**0.9**
Normal	4	80.00				
High	1	20.00				
NLR (3.13-5)			**6.9**	**2.83**	**4.3**	**11.4**
High	2	40.00				
PLR (>180)			**198.5**	**116**	**94.5**	**380**
Normal	3	60.00				
High	2	40.00				

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Table 2 shows a total of five positive Covid-19 patients with another disease reported. Most of them were elderly people. There were only 3 patients with comorbid disease of Covid-19 (i.e. chronic kidney disease + hypertension stage 2; chronic obstructive pulmonary disease; and pulmonary tuberculosis + chronic kidney disease). The parameters of CBC in this data were mostly abnormal in the neutrophil percentage, neutrophil absolute, neutrophil lymphocyte ratio (NLR), and platelet lymphocyte ratio (PLR).

Hu et al. (2020) reported that even within the severe group there was variability, with 87.5% of critically ill patients having neutrophilia. Other investigators have also reported neutrophilia in some elderly patients after admission (Lin et al., 2020). The likelihood of neutrophilia being a predictor of disease severity has been further supported by other investigators who investigated 82 deaths in Covid-19 patients and demonstrated that neutrophilia was present in 74.3% of cases after admission, and increased to 100% in the last 24 hours before death (Zheng et al., 2020)

A study in Wuhan with a sample of 40 people consisting of 15 men (37.5%) and 25 women (62.5%), stated that absolute neutrophil levels were significantly higher in severe cases of Covid-19 than in severe cases (Liu et al., 2020).

Increased NLR and age were significantly associated with disease severity. Binary logistic analysis identified increased NLR as an independent factor for poor clinical outcome of Covid-19 (Yang et al., 2020). Increased NLR is a risk factor for death not only in infectious diseases but also in malignancies, acute coronary syndromes, intracerebral hemorrhage, polymyositis, and dermatomyostis (Azab et al., 2010; Giede-Jeppe et al., 2017; Guthrie et al., 2013; Ha et al., 2018).

Qu et al. (2020) proposed PLR as an indicator reflecting the severity of inflammation in the treatment process, by comparing the PLR changes during treatment. It was found that the higher the PLR cut-off point, the longer patient to stay in hospital. Therefore, the investigators speculate that changes in the platelet / lymphocyte ratio in the blood during treatment may reflect disease progression and the prognosis of Covid-19 patients. This disparity in numbers may in part represent the extent of the epidemiological data available.

Limitation of this study is the data still limit on 85 patients. The higher number of data can enhance the study. Another limitation is CBCs cannot be used as a determining indicator of the presence of the Covid-19 virus in a patient's blood. This complete blood count is more precisely used as a supporting parameter in determining the severity or recovery of the patient during the treatment period. Careful evaluation of whole blood parameters at the start and during the course of the disease can assist clinicians in formulating a tailored treatment approach and promptly providing intensive care to patients who are most in need.

CONCLUSION

Most of the CBCs findings among Covid-19 patients at Covid-19 reference hospitals in West Nusa Tenggara show normal value among patients with no disease other than Covid-19. Older age and having comorbidities ~~have~~ show a complete blood cells picture that is different from other Covid-19 patients who have confirmed positive

without comorbidities. Several studies that have been conducted in several countries, especially those outside of Wuhan, China, show some similarities in the percentage of blood cell levels from hematological parameters that tend to be normal. The next study should add more number of patient's data so the result can be generalized.

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Restate the purpose
Emphasize the main finding
Summarize other results
Suggest future work

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CONFLICT OF INTEREST

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The authors declare no conflict of interest in this study.

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ARTICLE ACCEPTANCE LETTER

To
I Putu Dedy Arjita
Faculty of Medicine, Universitas Islam Al-Azhar Jl. Unizar No.20, Turida, Sandubaya, Mataram 83232, West Nusa Tenggara.

Dear author/s
I have pleasure to inform you that your following Original Article has been accepted for publication in Medical Laboratory Technology Journal

Complete Blood Cells Findings Among Covid-19 In-Patients at Covid-19 Reference Hospitals, West Nusa Tenggara

***I Putu Dedy Arjita, Sabariah, Ayu Anulus**

Faculty of Medicine, Universitas Islam Al-Azhar
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It will be published in Volume 6, No.2, December 2020 issue. It is further mentioned for your information that our journal is a double blind peer reviewed indexed international journal.

With regards
Yours sincerelv

Leka Lutpiatina
Editor

Medical Laboratory Technology Journal
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COMPLETE BLOOD CELLS FINDINGS AMONG COVID-19 PATIENTS AT COVID-19 REFERENCE HOSPITALS, WEST NUSA TENGGARA

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Abstract: Covid-19 virus still attacks various worldwide sectors, especially health. The current problem is that the Covid-19 vaccine is still on progress, so the best strategy to deal with this problem is to prevent the spread of this disease. In the laboratory sector, complete blood cells (CBCs) tend to use as a screening method for disease, especially infectious disease. This study aims to describe the CBCs findings among Covid-19 patients at Covid-19 reference hospitals in West Nusa Tenggara. This was a retrospective study conducted from Mei to July 2020. A total of four hospitals have access to 85 medical records of Covid-19 patients. The CBCs data were collected from Hospital Management Information Systems (HMIS) and Laboratory Information Systems (LIS). The data were analyzed descriptively. The results showed that 5.88% of patients had comorbidities or another disease reported tends to present abnormal CBCs results, while another 94.12% of patients without another disease than Covid-19 tend to present normal results.

Keyword: Covid-19; complete blood cells; hospital management information systems; laboratory information systems

INTRODUCTION

In recorded human history, the latest Covid-19 is the third coronaviral (CoV) outbreak (Yi et al., 2020). The world has faced highly pathogenic human CoVs i.e., Severe Acute Respiratory Syndrome (SARS-CoV) and Middle East Respiratory Syndrome (MERS-CoV), which originally triggered an outbreak in China and Saudi Arabia in 2003 and 2012, respectively. The virus spread and reaches quickly all over the countries with horrible morbidity and mortality (Paules et al., 2020). Symptoms of the Covid-19 infection begin to appear after a five to six day incubation period (Qun Li et al., 2020). The time between the onset of COVID-19 symptoms to death ranges from 6-41 days with a median of 14 days (Wang et al., 2020).

As the symptoms, fever is often occurring among Covid-19 cases, which can be accompanied by no symptom. Dry cough, shortness of breath, dizziness, muscle ache, sore throat, rhinorrhea, headache, diarrhea, chest pain, vomiting, and nausea are another symptoms of Covid-19 infection. Sometimes, patients had no fever, and several had no irregular radiological findings (Guan et al., 2020).

Covid-19 pandemic occur to be an issue to the world. All of the health professionals have done some attempt to find out how to prevent, manage, and cure this pandemic. Covid-19 patients with and without symptoms or abnormalities, should

be screened for the virus for early diagnosis (Chen et al., 2020). In addition, many studies have reported improvements in the laboratory detection data of Covid-19 patients and studies have usually concentrated on one or more hematology parameters (Fan et al., 2020; Y. Huang et al., 2020; Terpos et al., 2020).

Infected patients with COVID-19, whether hospitalized or outpatient, are at high risk for venous thromboembolism (Terpos et al., 2020). Thrombocytosis, lymphopenia, and increased C-reactive protein were typical findings in the laboratory although the majority of Covid-19 patients (Huang et al., 2020). Another study from Fan (2020) reported that older age, lymphopenia, and raised lactate dehydrogenase (LDH) were associated with intensive care unit admissions. Patients who were transferred to the intensive care unit had a deeper nadir absolute lymphocyte count (ALC), absolute monocyte count (AMC), hemoglobin, and a higher peak of absolute neutrophil count (ANC) and LDH than patients who did not need ICU stay.

The most widely conducted hematological laboratory test worldwide is a CBC and most routine laboratories are fitted with a hematology analyzer. Some of the studies reported variety of abnormal changes on CBCs parameters among Covid-19 patients. There is a lack of a summary of the data and the geographical variety, so it is important to conduct this study to describe the CDCs findings among Covid-19 patients at Covid-19 reference hospitals in West Nusa Tenggara, Indonesia.

MATERIALS AND METHOD

This research was conducted in May-July 2020 at the Mataram City Hospital, Bhayangkara Hospital, Patuh Patut Patju Hospital, and North Lombok Regional Hospital. The data used in this study was first result of CBCs of patients since confirmed positive for Covid-19. The data included in this study should have (1) initials; (2) Gender; (3) Age; (4) Comorbid disease data; and (5) The results of the first CBCs examination. Incomplete data were excluded from the study. The variables studied were gender, age, hemoglobin, hematocrit, number of leukocytes, number of platelet cells, number of erythrocyte cells, erythrocyte index (MCV, MCH, MCHC), leukocyte count (absolute and percentage), red cell distribution width (RDW-CV), and neutrophils-lymphocytes ratio.

Data collection started from the Hospital Management Information Systems (HIMS) to see the medical record number, initial, gender, age, and comorbidities of Covid-19 patients. Some of the hospital had HIMS that integrated with the Laboratory Information System (LIS) so that patient data and CBCs results can be accessed more easily. In another hospital, researchers must continue with patient data from HIMS to obtain CBCs of patients in the laboratory if HIMS and LIS are not integrated. The data that has been obtained are grouped according to the study variables, computerized, and then presented in tabular form.

RESULTS AND DISCUSSION

This study was conducted using 85 data from medical record. The data were calculated and the result shows that female patients (64%) with positive Covid-19 status were more than male patients (36%) (Figure 1).

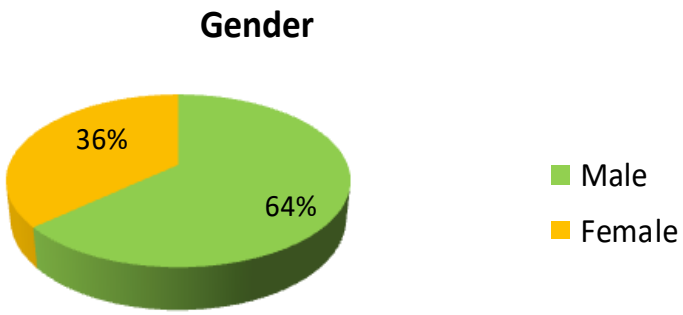

Figure 1. Gender distribution of Covid-19 patients data (n=85)

Figure 2 shows that patients with positive Covid-19 were one patient aged 2 years old (<5 years old), 8 patients aged 6-19 years old, 14 patients aged 20-29 years old, 17 patients aged 30-39 years old, 18 patients aged 40-49 years old, 14 patients aged 50-59 years old, and 13 patients aged more than 60 years old.

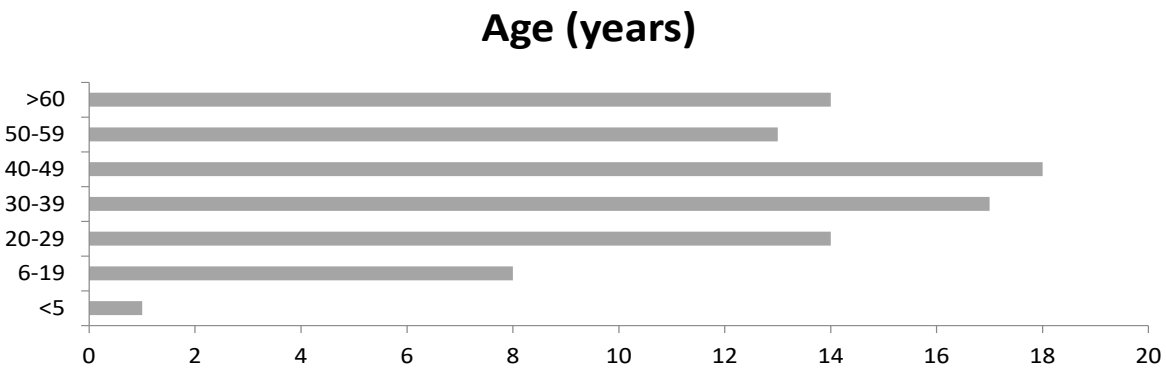

Figure 2. Age distribution of Covid-19 patients data (n=85)

Table 1. CBCs results among Covid-19 patients without comorbidity disease

Variable	n=80					
	n	%	Mean	SD	Min	Max
Sex						
Male	49	61.25				
Female	31	38.75				
Age			**39.84**	**16.34**	**2.00**	**75.00**
<5	1	1.25				
6-19	8	10				
20-29	14	17.5				
30-39	17	21.25				
40-49	18	22.5				

50-59	13	16.25				
>60	9	11.25				
Hemoglobin (13 - 18 mmol/L)			**13.65**	**2.57**	**6.20**	**24.30**
Low	18	22.5				
Normal	58	72.5				
High	4	5				
RBC (4.4 – 5.6 x 10^{12} cell/L)			**4.83**	**0.75**	**2.10**	**6.56**
Low	13	16.25				
Normal	54	67.5				
High	13	16.25				
Hematocrit (40% - 50%)			**39.77**	**6.52**	**16.60**	**52.20**
Low	21	26.25				
Normal	55	68.75				
High	4	5				
Platelets (170 – 380 x10^{9}/L)			**286.99**	**90.41**	**21.00**	**620.00**
Low	5	6.25				
Normal	64	80				
High	11	13.75				
MCV (80 – 100 fL)			**80.61**	**12.04**	**7.90**	**94.20**
Low	26	32.5				
Normal	54	67.5				
MCH (28– 34 pg)			**28.19**	**3.74**	**17.30**	**50.50**
Low	35	43.75				
Normal	44	55				
High	1	1.25				
MCHC (32 – 36 g/dL)			**33.89**	**1.68**	**26.40**	**37.40**
Low	5	6.25				
Normal	68	85				
High	7	8.75				
WBC (3.20 – 10 x10^{9}/L)			**9.25**	**4.72**	**3.69**	**36.13**
Low	1	1.25				
Normal	53	66.25				
High	26	32.5				
Basophil (0-2%)			**0.69**	**2.08**	**0.00**	**17.80**
Normal	77	96.25				
High	3	3.75				
Eosinophil (0-6%)			**3.37**	**3.13**	**0.00**	**13.40**
Normal	65	81.25				
High	15	18.75				
Neutrophil (40-70%)			**56.02**	**18.47**	**0.30**	**94.70**
Low	7	8.75				
Normal	61	76.25				
High	12	15				
Lymphocyte (15-45%)			**31.55**	**12.38**	**2.00**	**62.80**
Low	11	13.75				
Normal	50	62.5				
High	19	23.75				
Monocyte (0-10%)			**8.03**	**6.15**	**1.30**	**36.90**
Normal	63	78.75				
High	17	21.25				

Basophil (0-0.15 x10^6/L)			**0.14**	**0.22**	**0.00**	**1.08**
Normal	60	75				
High	20	25				
Eosinophil (0-0.5 x 10^6/L)			**0.62**	**1.77**	**0.00**	**14.00**
Normal	62	77.5				
High	18	22.5				
Neutrophil (1.26-7.3 x 10^6/L)			**5.44**	**4.72**	**0.02**	**33.20**
Low	4	5				
Normal	64	80				
High	12	15				
Lymphocyte (0.8-4 x 10^6/L)			**2.61**	**1.13**	**0.34**	**6.76**
Low	4	5				
Normal	68	85				
High	8	10				
Monocyte (0.1-0.8 x 10^6/L)			**0.69**	**0.55**	**0.15**	**3.13**
Normal	63	78.75				
High	17	21.25				
NLR (3.13-5.0)			**2.96**	**5.78**	**0.00**	**36.20**
Normal	69	86.25				
High	11	13.75				
PLR (>180)			**140.12**	**111.23**	**10.40**	**720.59**
Normal	69	86.25				
High	11	13.75				

The results from 80 data of positive Covid-19 patients show mostly normal condition on all parameters from first CBC examination (at first admission) (Table 1). The standard value of assessing the low, high, and normal value of each parameter was based on guidelines for clinical data interpretation by Indonesian Ministry of Health (2011).

Fan et al. (2020) reported that most patients in Singapore had normal CBC (normal Hb, WBC and platelet count). There were no patients with moderate to extreme thrombocytopenia, which is commonly seen in other viral diseases, such as dengue fever, which is prevalent in Indonesia.

Normal or low hemoglobin levels cannot be used as a diagnostic parameter for Covid-19 infection, but can be used as a supporting parameter in determining the severity or recovery of patients during treatment (Fan et al., 2020; Huang et al., 2020; Lippi & Plebani, 2020).

In general, the white blood cell count appears normal or decreased in Covid-19 patients at first admission (Huang et al., 2020). The same findings were observed in asymptomatic patients (Hu et al., 2020). Also age dependence has been reported to be associated with disease severity, and a higher WBC count has been observed in elderly patients compared with younger adults with Covid-19 (Lin et al., 2020).

The 80 samples showed a tendency for the patient's platelet count to be normal because most patients did not have comorbidities so that the severity of this disease was thought to be low. Huang et al. (2020) reported that as many as 8% of patients requiring Intensive Care Unit (ICU) care had a low platelet count compared to 4% of patients who did not require ICU care.

Table 2. CBCs results among Covid-19 patients with another disease

Variable	n=5					
	n	%	Mean	SD	Min	Max
Sex						
Male	5	100.00				
Age						
50-59	1	20.00				
>60	4	80.00				
Comorbid Disease						
Dyspnea	1	20.00				
Urinary tract infection + benign prostatic hyperplasia	1	20.00				
Chronic obstructive pulmonary disease	1	20.00				
Chronic kidney disease + hypertension Stage 2	1	20.00				
Pulmonary tuberculosis + chronic kidney disease	1	20.00				
Hemoglobin (13 – 18 mmol/L)			**12.78**	**2.79**	**8**	**15.2**
Low	1	20.00				
Normal	4	80.00				
RBC (4.4 – 5.6 x 10^{12} cell/L)			**4.36**	**0.86**	**2.9**	**5.2**
Low	1	20.00				
Normal	4	80.00				
Hematocrit (40% - 50%)			**37.28**	**8.79**	**24**	**47.9**
Low	3	60.00				
Normal	2	40.00				
Platelets (170 – 380 x10^9/L)			**280**	**184**	**121**	**589**
Low	1	20.00				
Normal	3	60.00				
High	1	20.00				
MCV (80 – 100 fL)			**85.56**	**6.64**	**76.5**	**92.6**
Low	1	20.00				
Normal	4	80.00				
MCH (28– 34 pg)			**29.38**	**1.38**	**27.9**	**31.1**
Low	1	20.00				
Normal	4	80.00				
MCHC (32 – 36 g/dL)			**34.44**	**2.01**	**31.8**	**36.5**
Low	1	20.00				
Normal	2	40.00				
High	2	40.00				
WBC (3.20 – 10 x10^9/L)			**12.06**	**4.56**	**5.4**	**16.5**
Normal	2	40.00				
High	3	60.00				
Basophil (0-2%)			**0.28**	**0.13**	**0.1**	**0.4**
Normal	5	100.00				

Eosinophil (0-6%)			**0.84**	**1.06**	**0.1**	**2.7**
Normal	5	100.00				
Neutrophil (40-70%)			**80.16**	**6.43**	**72.5**	**89.2**
Normal	1	20.00				
High	4	80.00				
Lymphocyte (15-45%)			**12.8**	**3.79**	**7.8**	**16.8**
Normal	5	100.00				
Monocyte (0-10%)			**5.92**	**2.86**	**2.6**	**10**
Normal	4	80.00				
High	1	20.00				
Basophil (0-0.15 x10^6/L)			**0.04**	**0.05**	**0**	**0.1**
Normal	5	100.00				
Eosinophil (0-0.5 x 10^6/L)			**0.1**	**0.17**	**0**	**0.4**
Normal	5	100.00				
Neutrophil (1.26-7.3 x 10^6/L)			**9.92**	**4.33**	**3.9**	**14.8**
Normal	1	20.00				
High	4	80.00				
Lymphocyte (0.8-4 x 10^6/L)			**1.42**	**0.34**	**0.9**	**1.8**
Normal	5	100.00				
Monocyte (0.1-0.8 x 10^6/L)			**0.62**	**0.19**	**0.4**	**0.9**
Normal	4	80.00				
High	1	20.00				
NLR (3.13-5)			**6.9**	**2.83**	**4.3**	**11.4**
High	2	40.00				
PLR (>180)			**198.5**	**116**	**94.5**	**380**
Normal	3	60.00				
High	2	40.00				

Table 2 shows a total of five positive Covid-19 patients with another disease reported. Most of them were elderly people. There were only 3 patients with comorbid disease of Covid-19 (i.e. chronic kidney disease + hypertension stage 2; chronic obstructive pulmonary disease; and pulmonary tuberculosis + chronic kidney disease). The parameters of CBC in this data were mostly abnormal in the neutrophil percentage, neutrophil absolute, neutrophil lymphocyte ratio (NLR), and platelet lymphocyte ratio (PLR).

Hu et al. (2020) reported that even within the severe group there was variability, with 87.5% of critically ill patients having neutrophilia. Other investigators have also reported neutrophilia in some elderly patients after admission (Lin et al., 2020). The likelihood of neutrophilia being a predictor of disease severity has been further supported by other investigators who investigated 82 deaths in Covid-19 patients and demonstrated that neutrophilia was present in 74.3% of cases after admission, and increased to 100% in the last 24 hours before death (Zheng et al., 2020)

A study in Wuhan with a sample of 40 people consisting of 15 men (37.5%) and 25 women (62.5%), stated that absolute neutrophil levels were significantly higher in severe cases of Covid-19 than in severe cases (Liu et al., 2020).

Increased NLR and age were significantly associated with disease severity. Binary logistic analysis identified increased NLR as an independent factor for poor

clinical outcome of Covid-19 (Yang et al., 2020). Increased NLR is a risk factor for death not only in infectious diseases but also in malignancies, acute coronary syndromes, intracerebral hemorrhage, polymyositis, and dermatomyostis (Azab et al., 2010; Giede-Jeppe et al., 2017; Guthrie et al., 2013; Ha et al., 2018).

Qu et al. (2020) proposed PLR as an indicator reflecting the severity of inflammation in the treatment process, by comparing the PLR changes during treatment. It was found that the higher the PLR cut-off point, the longer patient to stay in hospital. Therefore, the investigators speculate that changes in the platelet / lymphocyte ratio in the blood during treatment may reflect disease progression and the prognosis of Covid-19 patients. This disparity in numbers may in part represent the extent of the epidemiological data available.

Limitation of this study is the data still limit on 85 patients. The higher number of data can enhance the study. Another limitation is CBCs cannot be used as a determining indicator of the presence of the Covid-19 virus in a patient's blood. This complete blood count is more precisely used as a supporting parameter in determining the severity or recovery of the patient during the treatment period. Careful evaluation of whole blood parameters at the start and during the course of the disease can assist clinicians in formulating a tailored treatment approach and promptly providing intensive care to patients who are most in need.

CONCLUSION

Older age and having comorbidities have a complete blood picture that is different from other Covid-19 patients who have confirmed positive. Several studies that have been conducted in several countries, especially those outside of Wuhan, China, show some similarities in the percentage of blood cell levels from hematological parameters that tend to be normal.

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