

# Correlations Between Laboratory, Clinical and RT-PCR Parameters in Covid-19 Patients Admitted in Nusa Tenggara Barat General Hospital

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## ABSTRACT

The main problems faced by the COVID-19 pandemic are the high risk of transmission, the lack of fast and valid screening tools, and the length of the disease healing process it will indirectly affect the speed of transmission. This study aimed to assess the clinical correlation and laboratories of COVID-19 patients so that they can be used as screening tools for first-time patients admitted to the hospital. This research was a cross-sectional study with a descriptive-analytical approach. Data were obtained retrospectively from medical record's patients admitted from march until May 2020 in Nusa Tenggara Barat Province General Hospital. The Data consists of clinical data (clinical symptom, age, gender, history of closed contact with positive COVID-19 patients), Laboratories data (number of leucocytes, platelets, neutrophils, lymphocytes, and lymphocyte and neutrophils ratio), and radiologic findings. There were 70 subjects and of these 36 subjects were confirmed positive for COVID-19 and 34 had negative rt-PCR results. The most common clinical symptoms in the study were fever (68.57%), cough (68.57%), and shortness of breath (57.14%). There is a significant result between the history of closed contact with the incidence of COVID-19 with weak correlations ( $r = 0.27$ ). The study also found significant results between COVID-19 EWS and the incidence of COVID-19 ( $r=0.783$ ). In laboratory examinations, a significant result was found between the number of platelets count and the incidence of COVID-19 ( $r = 0.337$ ). There was a significant result in COVID-19 EWS and platelets count with the incidence of COVID-19 ( $r=0.783$  and  $r=0.377$ ) but there is no significant result was found between the number of leukocytes, neutrophils, NLR, radiological images of COVID-19 events.

**Keywords:** COVID-19 EWS scores, clinical and laboratory parameters, COVID-19 patients.

## 1. INTRODUCTION

The COVID-19 pandemic firstly began in the Wuhan city of China's Hubei province with the discovery of unknown causes of pneumonia that was reported in December 2019, this case then spread rapidly throughout the world [1-3]. The pathogen as the etiology of the disease has been identified and is an RNA virus that belongs to the beta coronavirus group. This virus has similarities with the SARS-CoV virus which is the cause of severe acute respiratory distress syndrome (SARS) so it is further named SARS-CoV2 [4,5]. The SARS-CoV2 virus infects the alveolar epithelium through endocytosis mediated by the Angiotensin-converting enzyme II (ACE II) receptor, which further aids the fusion between the envelope of the virus and the host cell membrane so that

the virus can enter the host cell. Transmission of the spread of the SARS-CoV2 virus through droplets and direct contact. Patients infected with SARS-COV2 are the main source of transmission and upon entering the prodromal stage a large number of viruses are found in the upper airways, facilitating transmission. Mild symptoms during the incubation or prodromal period cause no barriers to daily activities or mobility of patients so that it is easy to transmit to other healthy individuals. Asymptomatic patients are also a source of transmission of SARS-CoV2 virus [3,5,6].

Based on research conducted at the beginning of the pandemic by Guan et al, 1099 patients who confirmed positive for COVID-19 had a median age of 47 years with the most sex being male. Contact history also had a role

in the transmission of COVID-19. The same study found 72.3% of cases that are not residents of Wuhan city have close contact with residents of Wuhan city and as many as 31.3% of these have a history of visiting Wuhan city<sup>7</sup>. Symptoms experienced by patients vary from asymptomatic, mild symptoms, moderate symptoms, severe to critical symptoms. The most clinical symptoms experienced by patients are fever, cough, and fatigue<sup>8</sup>. Other symptoms that can be experienced by patients are myalgia, shortness of breath, increased production of sputum, chest pain, diarrhea, headache, dizziness, sore throat, dizziness, cold, anosmia, nausea and vomiting, hemoptysis, skin rash, palpitations, and abdominal pain<sup>1-10</sup>. Severe symptoms that required treatment in an intensive care room (ICU) were experienced by 26% of patients<sup>7</sup>. Deaths in the early cases of the Covid-19 pandemic were found to be up to 4.3% [7].

The most common abnormal laboratory test results in COVID-19 patients are leukopenia, lymphocytopenia, increased levels of c-reactive protein, lactate dehydrogenase, increased transaminase enzymes, creatinine kinase, and d-dimer [1-4,7-10]. Some studies there were found an increase in the number of platelet counts. In cases with severe symptoms, abnormality of laboratory results is common compared with mild and moderate symptoms [7,8]. The ratio between neutrophils and lymphocytes (NLR) is one of the simple biomarkers that is often found to increase in COVID-19 patients. An increase in NLR value at the beginning of infection can be used to predict the progression of the disease [11].

Radiological examination in patients confirmed COVID-19 is needed to diagnose, evaluate the severity, and follow up. Chest X-ray examination has low sensitivity compared to thoracic CT-Scan. Nevertheless, chest X-ray examination can be used as a first-line because it's available in health facilities widely, and its decontamination process is easier than thoracic CT-Scan examination [12-15]. At the beginning of infection chest X-ray examination can be normal and abnormalities findings will be increased in 10<sup>th</sup> to 12<sup>th</sup> day of clinical/symptoms. Thoracic CT-Scan often provides an abnormality at the beginning of the illness and often go undetected with chest X-ray examination. The most common abnormality of radiological findings is bilateral ground-glass opacity, lesions are often located in the peripheral of the lung and affected the lower lobe most. Abnormality findings on a CT-Scan can be found early in the course of the disease even when the patient has not felt clinical symptoms (asymptomatic) [12-15].

The increase in the number of COVID-19 patients led to an increase in the burden of health systems, especially in the emergency room (ER) and triage [16,17]. Initial assessment of the patient is important to help determine the assessment towards the diagnosis of COVID-19 considering that the examination for the patient's diagnosis takes time and the patient needs determination

for isolation. One tool that can be used to help with such assessments is COVID-19 *Early Warning Scores* (COVID-19 EWS) [17]. Assessment with COVID-19 EWS is expected to help speed up assessment in triage and ER. Assessment with COVID-19 EWS helps predict the need for hospitalization as well as the possibility of patient deterioration that requires intensive care unit (ICU) [16-18]. Assessment with COVID-19 EWS which is widely used in ER and triage in Indonesia shown in Table 1.

**Table 1.** COVID-19 EWS [17].

Parameters	Assessment	Score
Sign of pneumonia on CT	Yes	5
History of close contact with COVID-19 confirmed patient	Yes	5
Fever	Yes	3
Age	≥ 44 years old	1
Sex	Male	1
T max*	37,8°C (100°F)	1
Meaningful respiratory symptoms (Including cough, expectoration, and dyspnea)	≥1 symptom	1
NLR**	≥5,8	1
Highly suspected patient ≥ 10		

\* The highest body temperature from illness onset to first hospital admission

\*\*NLR : neutrophil-to-lymphocyte ratio

## 2. RESEARCH METHODS

The aim of the study is to assess the clinical correlation and laboratories of COVID-19 patients so that they can be used as screening tools at the beginning of patients admitted in hospitals, particularly in triage and ER. This study is a cross-sectional study. The data were obtained retrospectively by recording the results of clinical, laboratory, and radiological examinations of suspected COVID-19 patients who underwent hospitalization at Nusa Tenggara Barat Province Hospital. The clinical parameters studied were clinical symptoms, age, gender, COVID-19 EWS (evaluated at first-time patients hospitalized) and history of contact with COVID-19 confirmed patients. The radiological parameters studied are the presence of pneumonia sign-on chest-X ray or Thoracic CT-Scan. The parameter laboratories used are the number of leukocytes, platelet count, number of neutrophils, number of lymphocytes, and the ratio of neutrophils and lymphocytes (NLR). Data in this study were analyzed using SPSS. The data is presented in a descriptive table.

### 3. RESULTS AND DISCUSSIONS

70 subjects met the inclusion criteria and conducted an analysis, of which 36 subjects suffered from COVID-

19 based on rt-PCR results and 34 people had negative rt-PCR results. The characteristics of the research subjects can be seen in Table 2.

**Table 2.** Basic Characteristics of Research Subjects

Variable	n (%)	mean	Deviation standard (DS)
Gender			
• Male	35 (50)		
• Female	35 (50)		
Age (Years)		50,9	
Rt-PCR COVID-19			
• Positive	36 (51,43)		
• Negative	34 (48,57)		
History of close contact with covid 19 patients			
• Yes	24 (34,29)		
• No	46 (65,71)		
Clinical Symptoms			
• Fever	48 (68,57)		
• Cough	48 (68,57)		
• Dyspnea	40 (57,14)		
• Sore throat	2 (2,86)		
• Abdominal pain	0		
• Nausea and vomiting	7 (10)		
• Diarrhea	1 (1,43)		
• Muscle Pain	0		
• Anosmia	0		
• Fatigue	13 (18,57)		
• Skin manifestations	0		
COVID-19 EWS		7,37	
Laboratory			
• Platelet Count		242142,86	105524,40
• Number of Leukocytes		9152,71	5138,60
• Number of Neutrophils		6790	4669,10
• Number of lymphocytes		1656,39	1054,55
• NLR		6,30	7,18
Radiological Imaging			
• Pneumonia	51 (72,9)		
• Not pneumonia.	19 (27,1)		
Chest X-ray findings			
• Normal	23 (32,9)		
• Pneumonia	46 (65,7)		
• Other (bronchitis)	1 (1,4)		
Thoracic CT-Scan findings			
• Pneumonia	6 (75)		
• Others (bronchitis)	2 (25)		

There was no difference between the number of male and female patients in this study. Some studies show the number of men who suffered from COVID-19 more than women [1,7,9]. Men are more likely to suffer from COVID-19 than women because they have higher mobility than women and related to the type of work that has been done, many men have professions work in outdoors places and have high mobility [1,9]. Genetic factors considered have a role in the susceptibility man easier suffered from COVID-19 than women but its need further research to concluded [8].

The average age of subjects in this study was 50.9 years. Analysis from several studies showed COVID-19 is more often experienced by older people, the occurrence of COVID-19 more common in old age related to immune system and comorbidity. Older people have more comorbidity. Subjects who had older ages had worse clinical outcomes [2-4,8,9]. Further analysis of this study found no significant correlation between the patient's age and the incidence of COVID-19 which was enforced based on rt-PCR examination. In previous studies, age was very influential in the incidence of

COVID-19 related to comorbidities suffered by patients. Elderly patients have more comorbidities thus increasing the risk of severity of COVID-19 [1,8,9].

The correlation between sex, age, close contact history, pneumonia as radiological findings, and clinical

symptoms in subjects was assessed with correlation tests based on the coefficient of contingency and found a significant result between close contact history with COVID-19 events but the strength of the correlation was weak ( $r=0,270$ ). Correlations between variables are shown in Table 3.

**Table 3.** Variable correlation of age, gender, history of close contact, and clinical symptoms

Variable		rt-PCR positive		rt-PCR negative		p-value	r value
		n	(%)	n	(%)		
Gender	Male	20	55,6	15	44,1	0,339	0,114
	Female	16	44,4	19	55,9		
History of close contact	No	19	52,8	27	79,4	0,019	0,270
	Yes	17	47,2	7	20,6		
Age Group	Adult	23	63,9	27	79,4	0,151	0,169
	Elderly	13	36,1	7	20,6		
Clinical Symptoms							
Fever	No	13	36,1	9	26,5	0,385	0,103
	Yes	23	63,9	25	73,5		
Dyspnea	No	14	38,9	16	47,1	0,490	0,082
	Yes	22	61,1	18	52,9		
Cough	No	10	27,8	12	35,3	0,498	0,081
	Yes	26	72,2	22	64,7		
Cold	No	31	86,1	32	94,1	0,263	0,132
	Yes	5	13,9	2	5,9		
Sore throat	No	36	100	32	94,1	0,140	0,174
	Yes	0	0	2	5,9		
Nausea and vomiting	No	30	83,3	33	97,1	0,056	0,223
	Yes	6	16,7	1	2,9		
Diarrhea	No	35	97,2	34	100	0,328	0,116
	Yes	1	2,8	0	0		
Fatigue	Yes	29	80,6	28	82,4	0,847	0,023
	No	7	19,4	6	17,6		
Pneumonia	Not Pneumonia	11	30,6	8	23,5	0,509	0,079
	Pneumonia	25	69,4	26	76,5		

The most common clinical symptoms suffered by subjects in this study were fever, cough, and tightness. Gastrointestinal symptoms are less common. Similar results were obtained in previous studies, fever is the most common symptom found followed by cough, fatigue, and shortness of breath [1-9]. Gastrointestinal symptoms, skin manifestations, and neurology are less common [1-9]. However, the analysis in this study did not find a significant result between clinical symptoms and the incidence of COVID-19. A history of close contact with confirmed COVID-19 sufferers is one of the risk factors for COVID-19 infection. In this study, 24 subjects (34.29%) who had a history of contact with COVID-19 patients were confirmed and after analysis, we found a significant result between the history of close contact with the incidence of COVID-19 but the strength of the correlation was weak ( $r = 0,27$ ). COVID-19 patients are the main source of transmission. The largest transmission is through droplet inhalation mechanisms.

This study found a significance result between COVID-19 EWS and COVID-19 incidence with strong correlation ( $p=0,00$ ,  $r= 0,783$ ) and a correlation of

platelet count with COVID-19 incidence but the relationship is weak ( $p=0,00$ ,  $r=0,337$ ). While a variable number of lymphocytes, neutrophils, lymphocytes, NLR, and age did not show a significant result. The results of the statistical test are shown in Table 4.

**Table 4.** Correlation of laboratory variables, EWS, and age with rt-PCR.

Variable	p-value	r value
Platelet count	0,00	0,337
Number of Leukocytes	0,756	0,38
Number of neutrophils	0,537	0,75
Number of lymphocytes	0,784	-0,33
NLR	0,818	0,028
COVID-19 EWS	0,00	0,783
Age	0,522	0,078

The use of COVID-19 EWS for screening patients suspected of COVID-19 is needed especially when receiving patients in ER because it takes a quick decision to determine the patient is in an isolation room or not and to shorten contact between health workers who do not use complete personal protective equipment so that the risk

of transmission to health workers personnel can be reduced. In this study, there are modifications of EWS in the radiology section. This study did not entirely use Thoracic CT-Scans for assessment, all subjects were examined by chest X-ray. there were only 8 subjects who performed CT-Scan thoracic examination. This condition is due to the limited CT-Scan availability. In this study, the average of COVID-19 EWS was 7.37 and the cut point for the COVID-19 EWS value used in the previous study was >10. Although the average value of COVID-19 EWS obtained is lower than the COVID-19 EWS cut point value, the correlation test showed a significant result between COVID-19 EWS and the incidence of COVID-19 with a very strong correlation strength ( $r = 0.783$ ).

In the laboratory, examinations found a significant result between platelet count and the incidence of COVID-19 but the strength of the correlation was weak ( $r = 0.337$ ). A small decrease in platelet count in COVID-19 subjects is obtained. People with COVID-19 often get thrombocytopenia because of coagulation disorders [1-4,7,9]. Sars Cov-2 virus can cause endothelial vascular damage directly because its receptors are also found in blood vessels or through cytokine storm mechanisms that cause the release of inflammatory mediators that cause coagulation disorders. In this study, the average platelet count of subjects was 242142.86 which showed normal platelet values. Number leukocytes, neutrophils, and neutrophils showed no significant result to the incidence of COVID-19. In this study, other laboratory parameters such as LDH, Albumin, CRP, and PaO<sub>2</sub> / FiO<sub>2</sub> ratio were not analyzed because these parameters were not routinely done on patients.

Further in this study, there was no correlation between pneumonia and not pneumonia in radiological findings with the incidence of COVID-19. This study did not analyze the specific radiological picture towards pneumonia caused by COVID-19. In other studies, abnormalities were found in the patient's thoracic CT-Scan picture, abnormalities even appeared in patients who had not shown clinical symptoms. The characteristics of the abnormality in the form of ground-glass opacity or consolidation that often affected both lungs and its location are often on the peripheral and also often occurred in the lower lobe of the lung [1-10,12,13]. In this study, most radiological examinations were conducted using thoracic x-rays and 32.9% showed a normal picture.

#### 4. CONCLUSION

There was a significant result in COVID-19 EWS with the incidence of COVID-19 with a strong correlation strength ( $r = 0.783$ ) but there was no significant result between the number of leukocytes, neutrophils, NLR, radiological images of COVID-19 events. The gender and age of the subjects in this study

also did not show a significant result in the incidence of COVID-19. There is a significant result in platelet count with the incidence of COVID-19 with weak correlation strength ( $r = 0.337$ ) this can be associated with coagulation disorders that occur in COVID-19 patients.

#### REFERENCES

- [1] Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia in Wuhan, China. *J Am Med Assoc.* 2020;323(11):1061-9. doi:10.1001/jama.2020.1585.
- [2] Wang Z, Yang B, Li Q, Wen L, Zhang R. Clinical features of 69 cases with coronavirus disease 2019 in Wuhan, China. *Clin Infect Dis.* 2020;71:769-77. doi:10.1093/cid/ciaa272.
- [3] Zhang G, Hu C, Luo L, Fang F, Chen Y, Li J, et al. Clinical features and short-term outcomes of 221 patients with COVID-19 in Wuhan, China. *J Clin Virol.* 2020;127:104364. Doi: <https://doi.org/10.1016/j.jcv.2020.104364>.
- [4] Zhang J-J, Dong X, Cao Y-Y, Yuan YD, Yang YB, Yan YQ, et al. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China. *Allergy.* 2020;75:1730-41. doi:10.1111/all.14238.
- [5] Tu H, Tu S, Gao S, Shao A, Shenga J. Current epidemiological and clinical features of COVID-19; a global perspective from China. *J. Infect Dis.* 2020;81:1-9. DOI: <https://doi.org/10.1016/j.jinf.2020.04.011>.
- [6] Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *Int J Surg.* 2020;76:71-6. Doi: <https://doi.org/10.1016/j.ijsu.2020.02.034>.
- [7] Guan W-J, Ni Z-Y, Hu Y, Liang WH, Ou CQ, He JX, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med.* 2020;382:1708-20. doi:10.1056/NEJMoa2002032.
- [8] Fu L, Wang B, Yuan T, Chen X, Ao Y, Fitzpatrick T. et al. Clinical characteristics of coronavirus disease 2019 (COVID-19) in China: A systematic review and meta-analysis. *J. Infect.* 2020;80:856-65. Doi: <https://doi.org/10.1016/j.jinf.2020.03.041>.
- [9] Du Y, Tu L, Zhu P, Mu M, Wang R, Yang P. Clinical features of 85 fatal cases of COVID-19 from Wuhan a retrospective observational study. *Am J Respir Crit Care Med.* 2020;201:1372-9.

- [10] Wu Z, McGoogan JM. Characteristics of and Important lessons from the corona viruses disease (COVID-19) outbreak in China Summary of report of 72314 cases from the Chinese center for disease control and prevention. *J Am Med Assoc.* 2020;323(13):1239-42. doi:10.1001/jama.2020.2648.
- [11] Liu J, Liu Y, Xiang P, Pu L, Xiong H, Li C. et al. Neutrophil-to-lymphocyte ratio predicts critical illness patients with 2019 coronavirus disease in the early stage. *J Transl Med.* 2020;18:206. DOI: 10.1186/s12967-020-02374-0.
- [12] Shi H, Han X, Jiang N, Cao Y, Alwalid O, Gu J et al. Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. *Lancet Infect Dis.* 2020;20:425-34. DOI: <https://doi.org/10.1016/>.
- [13] Zu ZY, Jiang MD, Xu PP, Chen W, Ni QQ, Lu GM et al. Coronavirus Disease 2019 (COVID-19): A Perspective from China. *Radiology.* 2020;296:E15-25. Doi: <https://doi.org/10.1148/radiol.2020200490>.
- [14] Ng YM, Lee EYP, Yang J, Yang F, Li X, Wang H. Imaging Profile of the COVID-19 Infection: Radiologic Findings and Literature Review. *Radiology: Cardiothoracic imaging.* 2020;2:e20034. <https://doi.org/10.1148/ryct.2020200034> (accessed December 2021).
- [15] Fatima S, Ratnani I, Husain M, Surani S. Radiological findings in patients with COVID-19. *Cureus.* 2020;12:e7651. DOI 10.7759/cureus.7651.
- [16] Ruan Q, Yang K, Wang W, Jiang L, Song J. Clinical predictors of mortality due to COVID-19 based on an analysis of data of 150 patients from Wuhan, China. *Intensive Care Med* 2020. doi:10.1007/s00134-020-05991-x.
- [17] Song CY, Xu J, He JQ, Lu YQ. COVID-19 early warning score: a multi parameter screening tool to identify highly suspected patients. *MedRxiv.* 2020. DOI: <https://doi.org/10.1101/2020.03.05.20031906>.
- [18] Lippi G, Plebani M, Henry BM. Thrombocytopenia is associated with severe coronavirus disease 2019 (COVID-19) infections: a meta-analysis. *Clin Chim Acta* 2020. doi:10.1016/j.cca.2020.03.022.