Kesmas

Volume 19
Issue 5 *Special Issue 1, July*

Article 2

7-31-2024

The Correlation of Age with Thrombocytes and D-Dimer Values in COVID-19 Patients at Hospital X in Jakarta, Indonesia

Nanik Prasetyoningsih
Universitas Indonesia, Depok, prasetyoningsihnanik@gmail.com

Ascobat Gani
Universitas Indonesia, Depok, ascobatgani@yahoo.com

Recommended Citation

Prasetyoningsih N , Gani A . The Correlation of Age with Thrombocytes and D-Dimer Values in COVID-19 Patients at Hospital X in Jakarta, Indonesia. *Kesmas*. 2024; 19(5): 10-14
DOI: 10.21109/kesmas.v19isp1.1627
Available at: https://scholarhub.ui.ac.id/kesmas/vol19/iss5/2

Prasetyoningsih *et al. Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)*. 2024; 19 (Special Issue 1): 10-14
DOI: 10.21109/kesmas.v19isp1.1627

Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)

The Correlation of Age with Thrombocytes and D-Dimer Values in COVID-19 Patients at Hospital X in Jakarta, Indonesia

Nanik Prasetyoningsih[1,2]*, Ascobat Gani[1]

[1]Department of Health Policy and Administration, Faculty of Public Health, Universitas Indonesia, Depok, Indonesia
[2]Salak Hospital, Bogor, Indonesia

Abstract

Coronavirus disease (COVID-19), caused by the SARS-CoV-2 virus, spread globally, with research indicating that prognosis severity can be assessed by thrombocyte and D-dimer levels; while, patient age serves as a mortality predictor. This study aimed to analyze the relationship between age with thrombocytes and D-dimer in COVID-19 patients. This cross-sectional study used laboratory testing samples from 667 COVID-19 patients at Hospital X in Jakarta, Indonesia, collected from August 2020 until May 2021. The data was collected using cluster random sampling and analyzed using descriptive statistics and the Chi-square test (95% CI). The results showed that age and thrombocytes positively correlated with the D-dimer levels in COVID-19 patients (p-value <0.001). Age ≥48 and thrombocytes below normal (<150.000/mm^3) could increase the normal D-dimer levels in COVID-19 patients. This study could enrich hospital management to prevent and reduce the severity and mortality of COVID-19 patients being treated at hospitals.

Keywords: age, COVID-19, D-dimer, thrombocyte

Introduction

Coronavirus disease 2019 (COVID-19) caused by a virus infection called Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) is a global pandemic with various risks. The virus was first reported in Wuhan, China, in December 2019 and spread rapidly to almost all countries in the world. COVID-19 has spread in 213 countries and infected millions of people worldwide.[1,2] As of October 13, 2021, the number of global COVID-19 cases had reached more than 219 million cases with more than 4.5 million mortality.[2] The first case of COVID-19 in Indonesia was reported on March 2, 2020, in Depok City, West Java Province. The number of new cases reported continued to increase until it reached 43,925 new cases per day on July 15, 2021. As of October 18, 2021, the total number of COVID-19 cases reached 4,235,384, with 142,999 mortality. The Indonesian Government carried out testing, tracing, and treatment (3T) in the context of controlling and breaking the chain of transmission of COVID-19. Of all the provinces in Indonesia, Jakarta has the highest total cases, with 860,146 cases, or around 20.3% of national cases.[3]

People infected with SARS-CoV-2, both symptomatic and asymptomatic, can infect others via droplets.[4] Objects and surfaces contaminated with droplets can also be a medium for transmitting COVID-19 despite small risks. After 3-14 days of being infected with the virus, a person may experience asymptomatic, mild, moderate or severe symptoms. Mild symptoms include fever, cough, sore throat, nasal congestion, headache, muscle aches, and anosmia. Moderate symptoms are accompanied by dyspnea or shortness of breath. While the symptoms are severe, acute respiratory infections begin to occur, characterized by a decrease in oxygen saturation to <90% in the room air.[5-7] Age is related to levels of immunity and metabolism of the human body. The older a person gets, the more the body's immunity decreases. Countries with large elderly populations have been shown to have higher death rates.[1]

***Correspondence**:* *Nanik Prasetyoningsih, Department of Health Policy and Administration, Faculty of Public Health, Universitas Indonesia, Depok, Indonesia. Email: prasetyoningsihnanik@gmail.com; Phone: +62 815-7872-9391*

Received: April 24, 2024
Accepted: July 8, 2024
Published: July 31, 2024

Patients with moderate to severe symptoms are at risk of experiencing blood clots, cytokine storms, and even mortality; therefore, they need intensive care at the hospital. From admission to the hospital until completion of treatment, patients must be closely monitored for oxygen saturation (SpO2), anemia, leukocytosis, chest x-rays, increased NLR, thrombocytopenia, D-dimer levels, and CRP.[7] Previous studies have shown that high levels of D-dimer can be found in COVID-19 patients with severe to critical symptoms. Examination of D-dimer levels can also be used as a parameter to determine the risk of blood clots, as well as detecting infection or inflammation in the body.[8-9] In addition, increasing D-dimer levels can be a predictor of disease progression (prognosis) to mortality.[8-10] In Sharp and Ghodke's study, there was a significant relationship between age and D-dimer r(151) = 0.244 [p=0.02(<0.05)]. The variation in D-dimer levels with age in women was 0.0869, and in men was 0.0454. The variation in D-dimer levels after menopause was 0.0659; in premenopausal women, it was -0.027. Negative values in the premenopausal age group indicate the presence of factors that are not present in the postmenopausal age group of women.[11]

Among the laboratory parameters examined, there is the highest risk of mortality, which includes routine blood tests (lymphocytes, leukocytes, number of neutrophils and platelets, and hemoglobin), coagulation indicators (D-dimer and prothrombin time), liver function and markers of aggression (albumin, total bilirubin, aspartate, and alanine transaminase), markers of kidney function (urea nitrogen and creatinine), and inflammatory factors (CRP, IL-6, LDH, procalcitonin, ferritin, and cardiac troponin).[12] In patients with low levels of platelet, this condition may indicate thrombocytopenia, a condition that is prone to causing bleeding. In people with thrombocytopenia, platelet levels are less than 150,000/mm3.[7] On average, thrombocytopenia occurs in the second week, so the number needs to be monitored as it is a predictor of worsening condition and mortality of COVID-19 patients.[13,14] Thrombocytopenia is a hematological disorder often encountered in older adults. The general causes are immune thrombocytopenia purpura (ITP), drug induction, bone marrow failure, or infection. Age-related changes in the organs and vascular system also increase the risk of thrombocytopenia.[15]

Based on such situation and condition, it is necessary to carry out a more in-depth study regarding predictors of mortality due to COVID-19, one of which is to determine the relationship between age, platelets, and D-dimer in COVID-19 patients. Even though the COVID-19 pandemic has ended and continues to evolve, a study aimed at optimizing treatment measures for relevant patients is still very significant. The study is expected to provide some valuable reference materials that can inform current and future healthcare strategies, contributing to improved patient outcomes and potentially reducing the overall impact of the disease. This study is crucial for developing effective treatments, managing outbreaks, and enhancing global preparedness for similar future health crises.

Method

This study was a non-experimental study using a cross-sectional study. Data was obtained from the medical records of COVID-19 patients at Hospital X in Jakarta, Indonesia, from August 2020 to May 2021, with a total of 667 patients after selecting criteria and completeness of the data. The data was carried out using cluster random sampling, which means the cluster is a small representation of the entire population. The inclusion criteria for research subjects were patients aged >18 years, confirmed positive for COVID-19 via the RT-PCR test, and hospitalized. The confidentiality, integrity, and availability of medical records were ensured to protect the patients' privacy and comply with regulatory standards in health care. In comparison, patients aged <18 years and with incomplete medical records were excluded from this study. The medical record data collected included general characteristics of the patient (age and sex) and laboratory tests (D-dimer and thrombocyte).

General characteristics and laboratory test results were summarized and presented as categorical data, showing the frequency (n) and percentage (%) of each category. This data was then analyzed using the Chi-square test to determine any significant association between different categories. To determine the level of significance, this study used an α of 0.05 with a confidence level of 95%. The p-value was used to examine conclusions from bivariate analysis. If the resulting p-value was small, the events were concluded as unrelated, independent, or interdependent.

Results

Out of a total of 667 patients, the results of the descriptive analysis showed that the proportion of COVID-19 patients

was dominated by the age group of 18–47 years (50.2%), while the proportion of the age group of ≥48 years was 49.8%. Males dominated in this study at 57.7% compared to females at 42.3%. Laboratory results of thrombocytes showed that 67.8% of COVID-19 patients had normal outcomes (≥150.000/mm^3), and 32.2% were below normal (<150.000/mm^3). On D-dimer laboratory results, the proportion of patients with normal (≤500 ng/mL) results was 94.2%, and 5.2% had D-dimer laboratory results above normal (>500 ng/mL) (Table 1).

Table 1. The Description of Patient Characteristics and Laboratory Test

Variable	Frequency (n = 667)	Percentage (%)	95% CI (Lower–Upper)
Age			
18–47 years	335	50.2%	(46.5–54)
≥48 years	332	49.8%	(46–53.5)
Sex			
Male	385	57.7%	(53.8–61.6)
Female	282	42.3%	(38.4–46.2)
Thrombocyte			
Normal (≥150.000/mm^3)	452	67.8%	(64.2–71.5)
Below normal (<150.000/mm^3)	215	32.2%	(28.5–35.8)
D-dimer			
Normal (≤500 ng/mL)	628	94.2%	(92.2–96)
Above normal (>500 ng/mL)	39	5.8%	(4–7.8)

Note: CI = confidence interval

Table 2 shows the correlation between the age groups and thrombocyte levels (p-value = 0.624). The result of the odds ratio (OR) value was 1.19, meaning that patients aged ≥48 years had a 1.19 higher likelihood of getting thrombocyte output below normal (≥150.000/mm^3). Table 3 shows the positive correlation between the age groups and D-dimer levels (p-value <0.001). The result of the OR value was 2.85, which means that patients aged ≥48 years had a 2.85 higher likelihood of getting above normal D-dimer output. Table 4 shows the positive correlation between the age groups and D-dimer levels (p-value = 0.004). The result of the OR value was 2.61, which means that patients with thrombocytes below normal (<150.000/mm^3) had a 2.61 higher likelihood of getting above normal D-dimer output.

Table 2. Correlation Between Age and Thrombocyte of Patients

Variable	Thrombocyte		p-value	95% CI (Lower–Upper)
	Normal n (%)	Below normal n (%)		
Age				
18–47 years	317 (94.6%)	18 (5.4%)	0.624	*1 1.19 (0.62–2.27)
≥48 years	311 (93.7%)	21 (6.3%)		

Table 3. Correlation Between Age and D-Dimer of Patients

Variable	D-Dimer		p-value	95% CI (Lower–Upper)
	Normal n (%)	Below normal n (%)		
Age				
18–47 years	264 (78.8%)	71 (21.2%)	<0.001	*1 2.85 (2.03 – 4.00)
≥48 years	188 (67.8%)	144 (43.4%)		

Table 4. Correlation Between Thrombocyte and D-Dimer of Patients

Variable	D-Dimer		p-value	95% CI (Lower–Upper)
	Normal n (%)	Below normal n (%)		
Thrombocyte				
Normal (≥150.000/mm^3)	434 (69.1%)	194 (30.9%)	0.004	*1 2.61 (1.36–5.01)
Below of normal (<150.000/mm^3)	18 (46.2%)	21 (53.8%)		

Notes: CI = confidence interval, *Chi square, p-value <0.05

Discussion

A low thrombocyte level may indicate a condition susceptible to thrombocytopenia, which causes bleeding.[16,17] The normal number of thrombocytes ranges from 150,000 to 400,000/mm^3, strongly influenced by the way they are counted.[17] This study showed that age was not significantly correlated to thrombocyte levels. However, patients aged ≥48 years had a 1.19 higher likelihood of getting thrombocyte output below normal ($\geq$150.000/mm3), indicating that many below-normal thrombocytes were found in elderly patients.

D-dimers are fragments of proteins that give an idea of whether or not there is a clot in the blood.[18] This study found a correlation between a group of COVID-19 patients aged ≥48 years with D-dimer levels above normal (>500 ng/mL). The results revealed that patients aged ≥48 years were more likely to have higher than normal levels of D-dimer (> 500 ng/ml) (p-value <0.001). Excessively high levels of D-dimer increased the risk of blood clots. Changes in the D-dimer level need to be monitored on a regular basis as an increase indicates a possible poor prognosis, even a risk of death.[19] Until now, D-dimer examination has become a parameter for symptom severity, especially in elderly patients in the early COVID-19.[20]

This study's results showed that the thrombocyte levels positively correlated with the increase of D-dimer value (p-value <0.004). The abnormal thrombocyte levels can increase blood clotting in the body so that the D-dimer level increases.[21] This study agreed with a previous study that correlation analysis showed the mean thrombocyte volume had a weak positive correlation with D-dimer (r-value = 0.269, p-value = 0.013).[22] This is also in line with several previous studies which found that age, low platelet levels, and increased D-dimer levels can be an indication of the risk of death in COVID-19 patients, as well as predicting the level of severity in COVID-19 patients.[21,22]

There are several research constraints which could affect the results of the study. The limitation of this study was that it was done only in one hospital; hence, the results could not be generalized to a wider population. Further clinical studies with larger sample sizes conducted at some hospitals need to be conducted to confirm this study's results.

Conclusion

In conclusion, age group, D-dimer value, and thrombocyte levels are significantly affected by COVID-19 disease. Older patients of COVID-19 are likely to have higher D-dimer values above normal. There is a positive correlation between age and elevated D-dimer levels. These findings highlight the importance of considering age when assessing COVID-19 patients. This study is expected to help doctors and policymakers adapt managerial strategies for relevant patients to reduce the risk of mortality.

Abbreviations

COVID-19: coronavirus disease 2019; SARS-CoV-2: severe acute respiratory syndrome coronavirus-2; CI: confidence interval.

Ethics Approval and Consent to Participate

This study has been approved by the Ethics Committee of the Education Installation Section of TK. II Moh Ridwan Meuraksa Hospital, Number Sket/321/VIII/2021.

Competing Interest

The authors declared no competing interests in this study.

Availability of Data and Materials

The participants of this study did not give written consent for their data to be shared publicly, so due to the research's sensitive nature, supporting data is unavailable.

Authors' Contribution

NP: conceptualization, data curation, formal analysis, methodology, supervision, writing – original draft, writing – review & editing. AG: supervision and review.

Acknowledgment

The authors would like to thank the participants involved in this study. Also, the laboratory team of Ridwan Meuraksa Hospital, who have helped provide medical record data for patients and other parties that the author cannot specifically mention.

References

1. Hu B, Guo H, Zhou P, et al. Characteristics of SARS-CoV-2 and COVID-19. Nat Rev Microbiol. 2021; 19: 141–154. DOI: 10.1038/s41579-020-00459-7.
2. World Health Organization. Timeline: Who's COVID-19 response. Geneva: World Health Organization.
3. Satuan Tugas Penanganan COVID-19. Peta Sebaran COVID-19. Jakarta: Kementerian Kesehatan Republik Indonesia.
4. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and Surface Stability of SARS- CoV-2 as Compared with SARS-CoV-1. N Engl J Med. 2020; 382 (16): 1564-1567. DOI: 10.1056/NEJMc2004973.
5. Liu YC, Kuo RL, Shih SR. COVID-19: The First Documented Coronavirus Pandemic in History. Biomed J. 2020; 43 (4): 328–333. DOI: 10.1016/j.bj.2020.04.007.
6. Yang, Y, Xiao, Z, Ye, K, et al. SARS-CoV-2: Characteristics and Current Advances in Research. Virol J. 2020; 17: 117. DOI: 10.1186/s12985-020-01369-z.
7. Zhou F. Clinical Course And Risk Factors For Mortality Of Adult In Patients With COVID-19 In Wuhan, China: A Retrospective Cohort Study. J Med Stud Res. 2020; 3: 015. DOI: 10.24966/msr-5657/100015.
8. Chen B, Gu HQ, Liu Y, et al. A Model to Predict the Risk of Mortality in Severely Ill COVID-19 Patients. Comput Struct Biotechnol J. 2021; 19: 1694–1700. DOI: 10.1016/j.csbj.2021.03.012.
9. Li J, Yang L, Zeng Q, et al. Determinants of mortality of patients with COVID-19 in Wuhan, China: A case-control study. Ann Palliat Med. 2021; 10 (4): 3937-3950. DOI: 10.21037/apm-20-2107.
10. Poudel A, Poudel Y, Adhikari A, et al. D-dimer as a biomarker for assessment of COVID-19 prognosis: D-dimer levels on admission and its role in predicting disease outcome in hospitalized patients with COVID-19. PLoS One. 2021; 16 (8): e0256744. DOI: 10.1371/journal.pone.0256744.
11. Sharp K, Ghodke B. D-Dimer levels in COVID-19 patients and its correlation with age and gender: A retrospective analysis. Int J Res Rev. 2020; 7 (7): 339-347.
12. Mesas AE, Cavero-Redondo I, Álvarez-Bueno C, et al. Predictors of in-hospital COVID-19 mortality: A comprehensive systematic review and meta-analysis exploring differences by age, sex and health conditions. PLoS One. 2020; 15 (11): e0241742. DOI: 10.1371/journal.pone.0241742.
13. Lippi G, Plebani M, Henry BM. Thrombocytopenia is associated with severe coronavirus disease 2019 (COVID-19) infections: A meta-analysis. Clin Chim Acta. 2020; 506: 145-148. DOI: 10.1016/j.cca.2020.03.022.
14. Xu P, Zhou Q, Xu J. Mechanism of thrombocytopenia in COVID-19 patients. Ann Hematol. 2020; 99 (6): 1205-1208. DOI: 10.1007/s00277-020-04019-0.
15. Loh M. Thrombocytopenia in Older adults. Rochester, NY: University of Rochester Medical Center; 2019.
16. Setiabudy RD. Hemostasis dan Trombosis. 6th ed. Jakarta, Indonesia: Balai Penerbit Fakultas Kedokteran Universitas Indonesia; 2009.
17. Setiawan B, Budianto W, Sukarnowati TW, et al. Correlation of Inflammation and Coagulation Markers with the Incidence of Deep Vein Thrombosis in Cancer Patients with High Risk of Thrombosis. Int J Gen Med. 2022; 15: 6215-6226. DOI: 10.2147/IJGM.S372038.
18. Bounds EJ, Kok SJ. D Dimer. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2023.
19. He X, Yao F, Chen J, et al. The poor prognosis and influencing factors of high D-dimer levels for COVID-19 patients. Sci Rep. 2021; 11 (1): 1830. DOI: 10.1038/s41598-021-81300-w.
20. Esmailian M, Vakili Z, Nasr-Esfahani M, et al. D-dimer Levels in Predicting Severity of Infection and Outcome in Patients with COVID-19. Tanaffos. 2022; 21 (4): 419-433.
21. Elkhalifa AME. D-dimer as a predictive and prognostic marker among COVID-19 patients. Saudi Med J. 2022; 43 (7): 723-729. DOI: 10.15537/smj.2022.43.7.20220213.
22. Sari AF, Rikarni R. Desywar, D. Correlation of Mean Platelet Volume with D-dimer in Patients with COVID-2019. Indonesian J. Clin. Pathol. Med. Lab. 2023; 29 (1): 1–5. DOI: 10.24293/ijcpml.v29i1.2030.